

A Content Analysis of Social Media Discussions on THC-O-Acetate

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**Daniel J. Kruger¹, Amila Karahmet^{2,3},
Sydney M. Kaplan^{2,3}, John Redfield^{2,3}, Taylor Stacy^{2,3},
Vitush Agarwal^{2,3}, Mutaz Faqqouseh³, Carlton CB Bone⁴**

¹Institute for Social Research, University of Michigan, Ann Arbor, MI

²College of Literature, Sciences, and the Arts, University of Michigan, Ann Arbor, MI

³Undergraduate Research Opportunities Program, University of Michigan, Ann Arbor, MI

⁴Department of Anthropology, Portland State University, Portland, OR

ABSTRACT

Novel cannabinoids require systematic research to inform policies and practices. There is a growing interest in semi-synthetic cannabinoids by consumers, manufacturers, and regulators. However, there is a scarcity of research on these substances. Online discussion forums can provide guidance for research questions when current knowledge is scarce. The current project investigates the topics and issues covered in a social media forum devoted to THC-O-acetate (THCO), a semi-synthetic cannabinoid with rapidly rising popularity. Reddit comments posted on the THCO subreddit from June 2021 through November 2021 were coded for major and minor themes by a team of five coders and a supervisor. Major themes were established and clarified through group discussions. A second round of coding confirmed major themes and identified minor themes. The analysis identified several future research topics for THC-O-acetate, including the extent of variation in product composition, the characteristics of user experiences and comparisons with other substances, whether THC-O-acetate produces psychedelic effects, concerns and adverse experiences, and user harm reduction practices. As an acetate ester, THC-O-acetate may break down when heated and release toxic ketene gas. Although several users expressed safety concerns regarding THC-O-acetate, some explicitly mentioning ketene risk, the most common administration method reported was heated inhalation.

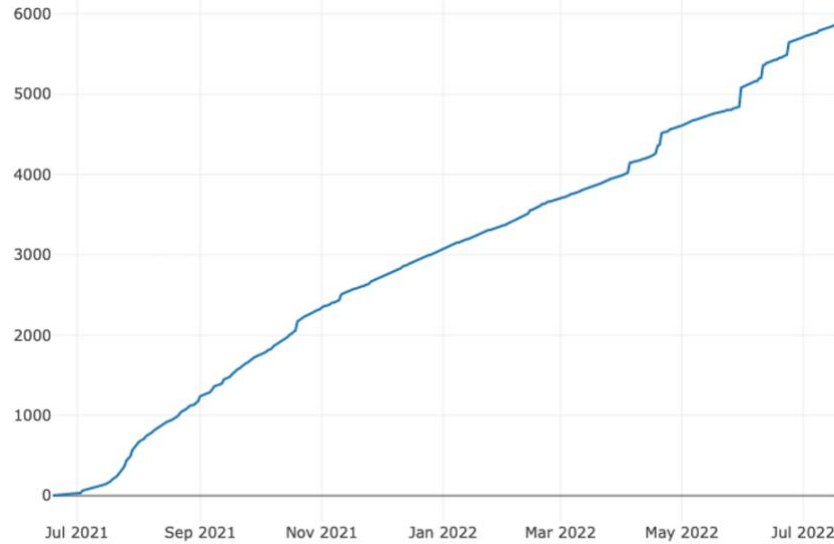
Key words: = THC-O-acetate; ketene; qualitative analysis; social media; Reddit

There is a growing interest among consumers, manufacturers, and regulators of hemp and cannabis derived goods in semi-synthetic cannabinoids (Caulkins, 2021). The term semi-synthetic cannabinoids refers to the growing category of cannabinoids synthesized from hemp extracts being sold as psychoactive substances (Devitt et al., 2022). The passage of the 2018 Farm Bill has increased the interest in and availability of new psychoactive cannabinoids, spawning several consumer networks and online communities (Bone et al., 2022). Researchers are beginning to document use patterns and experiences with recently marketed psychoactive cannabinoids, such as with the stereoisomer

delta-8-THC (Kruger & Kruger, 2021), one of the most prevalent semi-synthetic cannabinoids in this emergent niche (Szczypka et al., 2022). THC-O-acetate appears to be the latest semi-synthetic cannabinoid gaining in popularity, participation in the r/THCO subreddit (Reddit online discussion board) rose from nearly zero participants in July of 2021 to almost 6,000 one year later (Figure 1). The steadily increasing participation in r/THCO reflects the increasing interest in THC-O-acetate by consumers and the popularization of the slang term “THCO.”

THC-O-acetate is a THC analogue made through the acetylation of THC that first appeared as a consumer product during cannabis

Figure 1. Number of Subscribers to the r/THCO Subreddit on Reddit



Note. From <https://subredditstats.com/r/THCO>

prohibition and has evolved alongside the commercialization of cannabinoid markets (Bone, 2021). As an acetate ester (the dominant form of commercial acetates, with the general formula $\text{CH}_3\text{CO}_2\text{R}$, where R is an organyl group, THC-O-acetate may break down when heated at or above 340°C (644°F) and release ketene, a toxic gas that is potentially lethal at 5 parts per million (Munger, 2022). Ketene gas was implicated in the thousands of hospitalizations and at least 60 deaths that occurred in 2019 from e-cigarette or vaping-associated lung injury (EVALI; Blagev, 2019). The highly toxic ketene gas was released when vitamin E acetate, used as a cutting or cheap diluting agent in THC cartridges, was heated (Li, 2022).

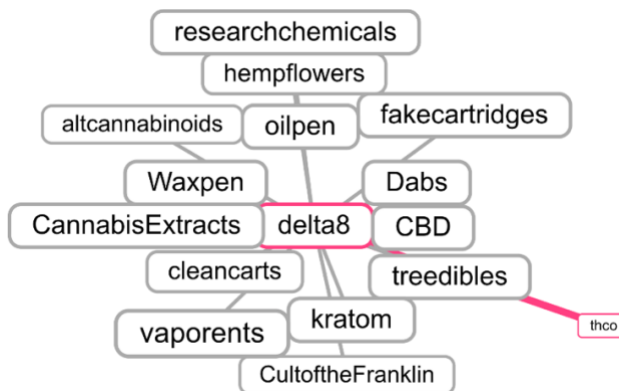
All policies and practices regarding cannabis and its products should be informed by empirical evidence from systematic research. The rapid emergence of novel cannabinoids in cannabis consumption markets outpaces the systematic research necessary to inform policies, regulations, and practices that minimize the costs, risks, and harms and maximize the benefits to individuals and society. THC-related cannabinoids may have divergent profiles of properties and effects, and thus full understandings of specific cannabinoids are more complex than comparisons of the intensity of experiences (Kruger & Kruger, 2021).

Given the scarcity of knowledge of the properties and effects of these cannabinoids, the naturalistic social media commentary in online user forums such as r/THCO can be utilized to

identify themes and issues discussed by users. Scientists, from psychologists to chemists, have relied on online communities to develop informed lexicons and derive experimental conditions for analysis (Anderson et al., 2018; Meacham et al., 2018; Meehan-Atrash et al., 2017). Social science research into online communities has utilized structured approaches such as Netnography to ground research methods and questions (Frude et al., 2020). Researchers have conducted qualitative analysis of discussions on online forums related to substance use to identify themes and promote understanding of the use of these substances (Holm et al., 2023). These analyses identify specific themes and quantify their prevalence in online discourse.

Reddit is an on-line social media platform where users submit content such as text, images, and links to news stories and other websites in posts. Users can vote posts up or down, determining the prominence of the post's placement on the site. Posts are organized thematically into user-created boards called "communities" or "subreddits." The r/THCO community on Reddit represents a component of a larger ecosystem of online communities that intersect with other drug using communities (Figure 2). Well known substance related subreddits like "Research Chemicals," a subreddit that involves extensive discussion of Synthetic Cannabinoids, are juxtaposed with other emerging communities like "CultoftheFranklin," a subreddit dedicated to hemp with high levels of

Figure 2. Graph of Cannabis-specific subreddits related to r/THCO on Reddit



Note. From <https://anvaka.github.io/sayit/?query=thco>. Overlap is measured through a Jaccard Similarity, whereby the relationship is determined by a metric "users who posted to this subreddit also post to..."

Tetrahydrocannabinolic acid (THCA); providing a web of connection that situates semi-synthetic cannabinoids throughout the broader online ecosystem for psychoactive substances.

The r/THCO community provides a reasonable starting point for our examination of the product's ontology. The role of r/THCO, like other online networks focused on cannabinoids, is to facilitate conversation and consumption. This is done through the sharing of images, links, and text comments on a variety of topics from the safety and potency of THC-O-acetate brands to flash product sales. The creation of a subreddit to facilitate product engagement is of interest because it affords unique insights into the role of this substance in the creation of cannabinoid subcultures, as well as a window into the general consumer experience with these products that seems to reflect similarities in composition to how online communities on reddit for other substances – namely "research chemicals" – operate.

The current study documents the content of r/THCO participant entries during the first six months of forum activity, providing insights into the ontology of this community (Sharp, 2017). This content can be used to inform more systematic studies by allowing researchers to identify trends, language, as well as critical structures and stakeholders that enables better engagement with these communities.

METHODS

Reddit entries on the THCO subreddit from June 2021 through November 2021 were

downloaded and copied onto spreadsheets. These include the original forum post and the comments made in reply to the original post or to other comments. A team of five coders and a supervisor coded the content in an iterative process. This timeframe was selected to provide an adequate volume of content and adequate time for completion of coding. First, coders read through at least one month of posts and generated suggestions for major theme coding categories, at least two coders reviewed each month of posts. There was considerable variation in the number of posts per month, so coding assignments were made to balance the volume of posts across posters. Theme coding categories were established and clarified through group discussions. Next, each coder completed an initial round of coding. Each post was categorized as to whether it contained content consistent with the major themes. These themes were: Discussion of THC-O-acetate production; Discussion of THC-O-acetate use; Reasons for THC-O-acetate use; Discussion of chemical/physiological mechanisms; Effects of THC-O-acetate (other than adverse experiences); Adverse Experiences; Concerns; Comparisons with other substances; Mention of other substances (but not comparisons with THC-O-acetate); and comments on specific brands/products. Posts consisting solely of images (including product pictures), emojis, or brief reactions (e.g., "Ha!") without usable content were excluded from coding.

Each coder was then assigned at least two specific major themes for elaboration of content (so there were at least two coders per theme). Posts were re-sorted by theme and coders read through

all posts tagged with their respective major themes. Posts determined not to fit with the major theme on the second review were removed from the theme set. Coders generated suggestions for subtheme categories for each major theme set, subtheme coding categories were established and clarified through group discussions. The following major themes were prioritized for elaboration: Reasons for THC-O-acetate Use, Effects of THC-O-acetate (Other than adverse experiences), Adverse experiences, Concerns, Comparisons with other substances, and Mention of other substances (but not comparisons with THC-O-acetate).

RESULTS

There were 3437 posts coded from 974 unique forum members who made posts. Users made four posts on average (SD = 6, median = 2), with a range from one to 88 posts. About half (49.8%) of users made only one post, 10% made 8 or more posts. The four most common themes were Mention of other substances, Effects of THC-O-acetate, Comments on specific brands/products, and Discussion of THC-O-acetate use - Frequency, Administration methods, Preparation methods (See Table 1).

Table 1. *Compositions of THCO Reddit Forum User's Posted Comments (N = 3437)*

<i>Major Themes</i>	<i>n</i>	<i>% of Total</i>	<i>% of Theme</i>
Mention of other substances	707	20.6	100
Effects of THC-O-acetate	522	15.2	100
Comments on specific brands/products	517	15.0	100
Discussion of THC-O-acetate use (Frequency, Administration methods, Preparation methods)	485	14.1	100
Comparisons with other substances	434	12.6	100
Concerns	333	9.7	100
Discussion of chemical/physiological mechanisms	162	4.7	100
Adverse Experiences	136	4.0	100
Discussion of THC-O-acetate production (how THC-O-acetate) is manufactured	99	2.9	100
Reasons for THC-O-acetate use	34	1.0	100
<i>Themes with elaboration</i>			
Mention of other substances	707	20.6	100
Mention of delta-8-THC	387	11.3	54.7
Mention of delta-9-THC	288	8.4	40.7
Mention of Psychedelics (LSD, DMT, Psilocybin)	32	0.9	4.5
Mention of other substances	258	7.5	36.5
Effects of THC-O-acetate	522	15.2	100
Lack of any effects	95	2.8	18.2
'Standard' THC experiences	92	2.7	17.6
Lengthy onset	53	1.5	10.2
Psychedelic/spiritual experience	48	1.4	9.2
Lengthy duration	39	1.1	7.5
Sedating/calming	37	1.1	7.1
Lack of psychedelic effects (but other effects present)	30	0.9	5.7
Psychedelic hallucinations (visuals, hearing sounds, etc.)	25	0.7	4.8
Physical/body sensation	20	0.6	3.8
Decreased effects from tolerance	19	0.6	3.6
Euphoria	16	0.5	3.1
Medically beneficial for pain relief	11	0.3	2.1
Energizing	9	0.3	1.7
Cross-tolerance between cannabinoids	4	0.1	0.8
Weird dreams	4	0.1	0.8
Increased sexual arousal	4	0.1	0.8
Lots of laughing	4	0.1	0.8
No changes in effects from tolerance reported	3	0.1	0.6
Feeling drunk	2	0.1	0.4
Improved sleep	2	0.1	0.4
Disrupted sleep	2	0.1	0.4

(table continues)

Comparisons with other substances	434	12.6	100
Comparison with delta-9-THC	241	7.0	55.5
Comparison with delta-8-THC	235	6.8	54.1
Comparison with Psychedelics (LSD, DMT, Psilocybin)	46	1.3	10.6
Comparison with other substances	90	2.3	20.7
Concerns	333	9.7	100
Variation in product composition or effect	63	1.8	18.0
Health	60	1.7	17.1
Safety concerns from novelty of product, lack of research	57	1.7	14.1
Legality	47	1.4	12.9
Safety	43	1.3	8.1
Inconsistencies in product quality	27	0.8	5.7
Safety concerns from impurities	19	0.6	4.2
Shelf life/stability	14	0.4	2.4
Ketene risk	8	0.2	2.1
Smell	7	0.2	1.8
Building tolerance	6	0.2	1.2
Variation in metabolism/effect	4	0.1	1.2
Accessibility	4	0.1	1.2
Concerns with specific brands	4	0.1	18.0
Adverse experiences	136	4.0	100
Physical adverse experience (e.g., coughing)	91	2.6	66.9
Anxiety	14	0.4	10.3
Pain	12	0.3	8.8
Bad trip/unpleasant experience	9	0.3	6.6
Bad taste	6	0.2	4.4
Overconsumption from effect latency	3	0.1	2.2
Unpleasant after-effects	3	0.1	2.2
Poor sleep quality	2	0.1	1.5
Feeling "drunk"	2	0.1	1.5
Reasons for THC-O-acetate use	34	1.0	100
Medical - Pain	8	0.2	23.5
Unspecified Medical/Therapeutic	6	0.2	17.6
Medical - Insomnia/Sleep issues	5	0.1	14.7
Medical - Anxiety	3	0.1	8.8
Substitution for synthetic cannabinoids	3	0.1	8.8
Recreational	2	0.1	5.9
Medical - Arthritis	1	0	2.9

Mention of other substances contained a wide variety of content, as may be expected for an open discussion form related to cannabis products, usually focused on other forms of THC: “My Δ9 cannabis oil survives freezing with no discernable loss in potency, but again, we're talking about a different compound here, and I'm not a chemist.” ; “Yeah even weak Delta 9 flower these days keeps me from being productive.” ; “Seriously, are you unaware Delta-9 isn't hemp derived? Lol”; “I could not care less if it was synthetic or not. Spice wasn't dangerous because it was synthetic, it was just dangerous and synthetic. Correlation does not equal causation.”

Users most frequently compared THC-O-

acetate with delta-9-THC and delta-8-THC: “Overall high feeling was definitely stronger than that of D8 and D9 imo.” “THC-O is not 300% stronger than traditional D9THC. At most 1.5 to 3x.”; “I place it at 1.5 to 3x the strength of d9 depending on dosage.”; “My experience is that it's noticeably stronger than D8, but still weaker than D9, let alone 3x more potent as I've been told.” However, they also often mentioned and made comparisons with psychedelic drugs (e.g., LSD, DMT, Psilocybin) and other substances: “Ya I didn't really believe its strong as LSD but I could see it being as strong as a low dose.”; “Idk man I took a fat dab of THC-O and I actually felt like I was on a low dose of shrooms like 2g's and I had

minor visuals. And it all lasted for like 5-6 hours.”

There were a mix of effects reported by users, some reported experiences typical for THC: “I experienced no psychedelic effects and instead got to experience a really nice normal THC feeling high.” ; “It is definitely a cannabinoid in the classical sense in how it feels” ; “I personally still prefer smoking really good d9 over THCO but the effects are similar depending on how much puffs you take before you feel it.” ; “Felt like a mild D8 buzz, lasted about half an hour. A tad different, felt a bit more spatial while it lasted.” ; “It felt like a really good indica dominant hybrid high feeling.” Others reported psychedelic or spiritual experiences: “then I took about 4 more rips and it was pretty psychedelic at first but after I ate it died down and it was more mellow.” ; “Very trippy and cerebral high mixed with a body sedation.” ; “Dude i had this for like 6 hours then woke up out of my sleep tripping balls” ; “more spiritual almost psychedelic” ; “The effects were definitely not visual like psychedelics, but the introspection and headspace was pretty psychedelic for sure.” ; “I noticed some stronger CEV's (Closed Eye Visuals) once but I have not taken high doses and I think edibles are more likely to have psychedelic effects.” ; “THC-O will be more visually trippy than normal stuff, just remember to stay grounded and stay safe.”

Some reported mild effects or no effect at all: “Yeah for me the effects are very mild, I am on the fence of I would even call them intoxicating. Just a mild calm, like smoking CBD [cannabidiol] weed.” ; “when I dab my THCO I can feel it almost right away and there is a slight creeping come up but it's nowhere near the strength that people are claiming.” ; “I haven't been feeling it Like, at ALL. I thought it was me and my tolerance. Then I had my girlfriend try it.... She says she got a harder buzz from frigin hookah.” ; “THC-O so far hasn't even gotten me high lol” ; A poster affiliated with a company selling THCO products remarked: “We have noticed this as well, at scale from consumer feedback. I would say it's roughly 4-5% of people that THCO literally does not effect. Then there's the other side of the spectrum in which it effects them drastically like a full blown psychedelic.”

Multiple users reported a relatively lengthy onset of effects and/or a lengthy duration of effects: “Thco also takes ab 45 mins to fully hit you n last considerably longer then thc.” ; “Takes an hour to fully kick in then for me the high lasts several

hours” ; “the high from thc-o lasts SIGNIFICANTLY longer than d8/even d9. like, way longer.”

Variation in product quality, composition, and/or effect was a prominent concern: “I think whatever is going into the products is not THCO or a very low concentration of it.” ; “I'm assuming THCO carts are just like delta 8 and some of them are 75% or 7% THCO, you can never know for sure. Never believe a stupid box anybody can fake lab results.” ; “I think cheaper companies may have residual solvents left over in their batches imo” ; “I strongly caution anybody who vapes or inhales it in any way: please make sure you get a third party source analysis of the contents you hope to ingest.”

Several users explicitly expressed safety concerns regarding ketene formation: “I don't feel comfortable smoking the acetate salt of any compound. Could decompose into ketene when heated like vitamin e acetate” ; “Apparently heating up THC-O-acetate has the same dangers of heating up and vaporizing vitamin-e acetate.” ; “People are saying the acetate group is making this chemical plain dangerous in the lungs. I've been vaping it with no problem, and everyone that's saying not to smoke it isn't explaining. Supposedly the ketene formation?? Vitamin E acetate for sure cause the EVALI problem with lungs, but why does this mean the same for THCO?” Other concerns were more ambiguous but could also refer to ketene risk: “There's a lot of question whether smoking it is even safe” ; “It's highly unlikely that any "acetate ester" is safe to consume quite honestly.” ; “I'm pretty sure THC-O acetate is not meant to be introduced into the lungs.” Some concerns were regarding other types of risks, such as whether inhaling THC-O-acetate was carcinogenic.

Adverse experiences included physical experiences such as coughing: “after about 10 minutes though I began to start coughing because of this weird itch or sensitivity feeling in my lungs and I couldn't stop coughing for 6 minutes or so after the fact” ; “If the voltage is too high I get very very bad coughing attacks” ; “It can make me feel like I'm going to overdose if I huff it the same way I would huff d8 or d9. By overdose I mean nausea and mild jitters and general physical discomfort.” “When I got some THCO I noticed that I've had to go to pee more frequently.” ; “it feels like someone put a taffy puller in my mouth as my mouth starts contorting in extreme ways very slowly.”

Adverse experiences also included

psychological effects such as anxiety: “It definitely can cause anxiety on the come up” ; “The high is intense and fun, but not always pleasant. I get sort of a low grade background anxiety that isn't usually present when I'm sober. I've also noticed I'm irritable when the high wears off; I smoke/consume at night and during the day I've got a short fuse and have been generally cranky pants.” ; “last time, it was way too much for me. i felt like my skin was too tight on my bones...i kept stretching my face out trying to loosen it. then i was always paranoid someone was breaking into my house, literally got up and peeked around the corner in horrible fear.”

Post-hoc analyses determined that users reported vaping THC-O-acetate in 130 posts (3.8%), oral consumption of THC-O-acetate (edibles/tinctures/capsules) in 117 posts (3.4%), dabbing THC-O-acetate in 40 posts (1.2%), inhalation of THC-O-acetate from unspecified method in 39 posts (1.1%), smoking THC-O-acetate in 24 posts (0.7%), and boofing THC-O-acetate (suppositories) in 5 posts (0.1%).

DISCUSSION

Reports on cannabinoid use experiences posted on topical online discussion boards can provide guidance for research questions and hypotheses regarding novel substances to consumer markets by grounding exploratory research. Results of this study demonstrate the value of online forums for informing studies and the need for further qualitative and quantitative research. The content analyzed in this study demonstrates the need for research into the properties and effects of THC-O-acetate products used by consumers. Many forum users reported seeking or having psychedelic-like experiences with THC-O-acetate, whereas others reported null or typical THC-like effects. Systematic testing for product composition could help inform on whether variation in product composition may explain variation in reported effects. Only 1% of posts discussed reasons for THC-O-acetate use, most commonly for the treatment of health or medical issues, however the naturalistic nature of these data may underrepresent medicinal use, as users were not specifically asked about their reasons or motivations for use.

Although users reported concerns and adverse experiences, only a small proportion noted the

risk of toxic ketene gas production from the combustion of acetates. Inhaling heated THC-O-acetate was the most popular form of consumption reported. Confirmation of this chemical reaction had not been established and communicated to the public until after the timeframe in which survey responses were collected. However, a recent publication by Benowitz et al. (2023) confirms the findings of Munger et al. (2022) and points to an important role for research engaging with communities who are consuming new hemp-derived psychoactive substances. Future research could engage with a broader section of products, manufacturers, and digital communities for semi and fully synthetic cannabinoids, especially as they compare to those focused on botanical cannabinoids derived from hemp and cannabis (Baumgartner and Pieper, 2017). The use of mixed methodologies and direct community engagement is a complement to the utilization of big data to understand similar trends (Anderson et al., 2018; Meacham et al., 2018).

The current results describe the content of naturalistic posts on a public, online discussion forum. Users are not systematically addressing research questions or providing comprehensive accounts of their experiences. They are sharing information and participating in discussions with other anonymous individuals who share interests in THC-O-acetate. Structured research, such as quantitative and qualitative surveys, focus groups, and clinical trials will be needed to properly address the issues and concerns identified in these analyses. Moreover, the existence of other communities focused on semi-synthetic cannabinoid discourse uncovered during the coding process underscores the complex and expansive online web of connections facilitated by social media platforms like Reddit. A consequence of which is that we cannot say the discourse and topics reflected in this subreddit or community are indicative of broader discourses online.

There are growing on-line communities devoted to discussions of cannabinoids. Although the information provided by these discussions has a very wide range of content and quality, the topics and issues discussed can inform systematic research such as the development of survey instruments, interview questions, and background information for chemical and clinical experimentation. The identification of hypotheses and research questions is especially important for

substances such as THC-O-acetate, where so little is known about its naturalistic use and effects.

We also believe that this approach could be modelled in other adjacent communities to provide a comparative understanding of the variety of new psychoactive substances derived from cannabis. In doing so we hope to set the foundation for a longitudinal perspective on the development of THC-O-acetate and other semi-synthetic cannabinoids and explore how beliefs have changed with the introduction of new information. Such longitudinal approaches may aid in understanding how the discovery of ketene formation from the vaporization of THC-O-acetate (Benowitz et al., 2023) and subsequent discussions amongst online has shaped consumer habits and behaviors.

Empirical evidence from systematic studies is needed to inform policies and practices regarding cannabis. When novel cannabinoids emerge on the market, online discussion forums can provide guidance for research questions. The current study identified several topics for research on THC-O-acetate, including the extent of variation in product composition, the qualia of user experiences and comparisons with other substances, concerns and adverse experiences, user familiarity with ketene risk, and harm reduction practices.

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