



SHORT REPORT

Correct Recognition and Appeal Ratings of Copycat Cannabis Edible Packaging: Evidence from an Online Experiment

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Abstract

Introduction: Despite prohibitions against youth-appealing packages, deceptive “copycat” cannabis edible packages have been commonly seen in U.S. states that legalized recreational cannabis. Copycat packages mimic the branding features of popular food products, posing a high risk for accidental ingestion, particularly for the younger population.

Materials and Methods: An online experiment was conducted among a representative sample of young adults aged 18–29 ($N = 2,523$). Participants were asked in timed trials to identify whether each package in a series of images contained cannabis content. Regression analysis was conducted to analyze the association between package type and correct identification and the association between correct identification and appeal ratings.

Results: Copycat cannabis packages were associated with lower odds of correct identification of cannabis content (odds ratio = 0.35, 95% CI = [0.31, 0.40]) compared with the non-copycat branded cannabis package. Correct identification of cannabis content was associated with lower appeal ratings (odds ratio = 0.75, 95% CI = [0.69, 0.81]).

Discussion: Copycat cannabis packages were associated with elevated risk of misidentification of cannabis content, making them a public health risk for accidental ingestion. Package features that make a package easily identifiable were less appealing, underscoring the need of requiring salient features to indicate cannabis content on cannabis packages.

Keywords: cannabis; cannabis edible; copycat; packaging; package regulation; youth appeal

Introduction

With the rapid expansion of recreational cannabis legalization to over 20 U.S. states, cannabis edible products have grown in popularity to become the second most popular mode of administration after smoking.¹ Although most states regulate tetrahydrocannabinol (THC) content (typically limiting edibles to 5–10 mg per piece and 100 mg per package), some products contain far higher doses, such as 100 mg in a single cookie or brownie and up to 600 mg in illicit, unregulated items.^{2–4} Because edibles have a delayed onset and prolonged psyc-

hoactive effect, inexperienced users may consume excessive THC before feeling the intended high. Cannabis overdose can lead to serious medical outcomes, including central nervous system depression, respiratory compromise, and tachycardia, sometimes requiring intensive care or intubation in young children.^{3,4} Edible use has been frequently documented in poison center calls and health care visits for acute cannabis intoxication.^{5–9} Youth-appealing packaging of edible products has also exacerbated the risk of accidental ingestion, particularly among the younger population.^{6,10,11}

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Youth-appealing features on cannabis packaging are banned by state or local regulations, but at varying levels of strictness and clarity, ranging from vague bans on youth-appealing designs to specific language banning bubble fonts, neon colors, or words such as “candy.”^{12,13} Audit studies of cannabis products sold online and in dispensaries have documented the frequent use of youth-appealing packaging in practice.^{2,14–16} One type of packaging of special concern is “copycat” (also called “lookalike” or “knockoff”) cannabis edible packaging, which replicates branding features of popular, non-cannabis food products. These products pose a particularly high risk of accidental ingestion because the deceptive packaging may cause people to believe it is a non-cannabis food product, especially if people do not examine them thoroughly before consumption. Recent studies have collected images of cannabis products or discarded cannabis packages to assess the prevalence of copycat products. One study found that 15% of the 256 cannabis products were copycats.¹⁶ One study found 35 discarded cannabis packages containing a nationally recognized food brand, representing 31% of packages in the study sample.¹⁴ One study identified 13 unique copycat products from the 267 cannabis edible packages.²

In this study, we conducted an online experiment to examine the risks of copycat cannabis edible packaging among young adults. Specifically, participants viewed package images with various styles, including branded cannabis, copycat cannabis, plain cannabis, and food product counterpart packages, in timed trials to identify whether each package contained cannabis content. We analyzed the association between package type and correct identification of cannabis products and the association between correct identification of cannabis products and appeal ratings. This study provides implications for cannabis regulation and enforcement regarding the potential of using packaging policies to reduce the public health risks of accidental consumption of cannabis products.

Materials and Methods

Participants

We recruited 2,523 participants through the Qualtrics survey platform between December 2023 and January 2024. The inclusion criteria were being 18–29 years old and residing in one of the 23 states (or Washington, D.C.) that had legalized recreational cannabis at the time of the study. We implemented demographic

quotas based on a national probabilistic sample (the 2021 National Survey on Drug Use and Health) to increase representativeness. Full details about participant recruitment are provided in Supplementary Appendix A1.

The study was approved by the Institutional Review Board at the University of California San Diego.

Experimental procedure

The online experiment presented 18 package images to participants, as shown in Supplementary Figure A1, including 1 branded cannabis package, 8 copycat cannabis packages, 1 plain cannabis package, and 8 food product counterpart packages. Package images were drawn from various sources, including cannabis packaging audit studies and image searches of online retailer websites (Supplementary Appendix A1).

Participants viewed each package image under a 10-second timer and quickly identified it as cannabis or not cannabis.¹⁷ After the timed recognition tasks, participants submitted appeal ratings for each of the 10 cannabis packages on a Likert scale from 0 to 10.^{18–21}

Full details of the experimental procedure are provided in Supplementary Appendix A1.

Data analyses

We conducted a logistic regression with the binary outcome variable of correct identification of cannabis content and a set of explanatory variables of package types (branded, copycat, plain, or real food packages). We conducted an ordered logistic regression with the ordered categorical outcome variable of appeal rating and a binary explanatory variable of correct identification of cannabis content (only the 10 cannabis packages were included in this analysis). All regressions controlled for individual race/ethnicity, sex, age, employment status, income level, substance use, state of residence, and trial order. Standard errors were clustered at the participant level.

In addition to the main analysis above, we conducted two robustness checks: (1) omitting participants who incorrectly answered the attention check question “which day of the week” (7% of the sample); (2) omitting observations with the two copycat packages having substantially lower rates of correct identification: Copycat Doritos (67.18% correct identification) and Copycat Rice Krispies (33.69% correct identification).

Data analysis was conducted in Stata SE 18.0.

Results

Sample characteristics

Supplementary Table A1 displays sample characteristics. Demographic quotas were successful, closely matching our sample characteristics with the nationally representative 2021 National Survey on Drug Use and Health on targeted characteristics.

Main results

The rate of correct identification of cannabis content varied by package type: 90.33% for branded cannabis, 79.97% for copycat cannabis, 94.85% for plain cannabis, and 96.01% for real food packages.

Table 1 reports the results of the logistic regression on correct identification of cannabis content. Compared to the branded cannabis package, copycat packages were associated with lower odds of correct identification (odds ratio = 0.35, 95% CI = [0.31, 0.40]), plain cannabis with greater odds of correct identification (odds ratio = 1.99, 95% CI = [1.64, 2.40]), and real food with greater odds of correct identification (odds

ratio = 2.61, 95% CI = [2.19, 3.12]) (all significant at the $p < 0.001$ level).

Table 2 reports the results of the ordered logistic regression on appeal ratings on cannabis packages. Correct identification of cannabis content was associated with lower appeal ratings (odds ratio = 0.75, 95% CI = [0.69, 0.81]).

Robustness checks

The regression coefficient directions and significance levels were not altered in the two robustness checks (detailed results not reported).

Discussion

This study provided evidence on the potential public health harms of copycat cannabis edible products among young adults. It showed an association between copycat packages and lower likelihood of correct identification of cannabis content, suggestive of heightened risk for accidental ingestion. Policy-makers may reduce this risk by implementing and enforcing comprehensive bans on youth-appealing and copycat cannabis products with clear language

Table 1. Logistic Regression on Correct Identification of Cannabis Content

	Odds ratio (95% CI)
Package Type:	
Branded Cannabis	Ref.
Copycat Cannabis	0.35*** (0.31, 0.40)
Plain Cannabis	1.99*** (1.64, 2.40)
Real Food	2.61*** (2.19, 3.12)
Demographics:	
Age 18–20	1.04 (0.91, 1.20)
Age 21–25	0.88 (0.77, 1.00)
Age 26–29	Ref.
Female	Ref.
Male	0.83** (0.75, 0.93)
Non-Hispanic White	Ref.
Non-Hispanic Black	1.17 (0.99, 1.38)
Hispanic	1.19 (1.00, 1.42)
Non-Hispanic Other Minority	0.89 (0.75, 1.07)
Socioeconomic Status:	
Not Employed	Ref.
Employed Part Time	1.02 (0.88, 1.17)
Employed Full Time	0.94 (0.83, 1.07)
Income: \$25k or Lower	Ref.
Income: \$25k to \$50k	1.17* (1.00, 1.37)
Income: \$50k to \$75k	1.10 (0.93, 1.30)
Income: \$75k or Higher	1.02 (0.88, 1.19)
Income: Decline to State	1.10 (0.91, 1.34)
Substance Use:	
Past-Year Cannabis Use	1.39*** (1.22, 1.58)
Past-Month Alcohol Use	1.60*** (1.43, 1.79)
Past-Month Cigarette Use	0.83 (0.68, 1.01)
# Observations	45,414

Regression also controlled for trial order and state of residence indicators (not shown in table). Standard errors were clustered at the participant level.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 2. Ordered Logistic Regression on Appeal Ratings (0–10 Scale)

	Odds ratio (95% CI)
Correct Identification of Cannabis Content	0.75*** (0.69, 0.81)
Demographics:	
Age 18–20	0.77*** (0.67, 0.90)
Age 21–25	0.89 (0.79, 1.01)
Age 26–29	Ref.
Female	Ref.
Male	1.14* (1.02, 1.27)
Non-Hispanic White	Ref.
Non-Hispanic Black	1.38*** (1.20, 1.59)
Hispanic	1.31** (1.11, 1.55)
Non-Hispanic Other Minority	0.99 (0.83, 1.18)
Socioeconomic Status:	
Not Employed	Ref.
Employed Part Time	1.10 (0.95, 1.27)
Employed Full Time	1.15* (1.00, 1.31)
Income: \$25k or Lower	Ref.
Income: \$25k to \$50k	0.81** (0.69, 0.94)
Income: \$50k to \$75k	0.78** (0.67, 0.91)
Income: \$75k or Higher	0.84* (0.72, 0.97)
Income: Decline to State	0.97 (0.77, 1.21)
Substance Use:	
Past-Year Cannabis Use	2.74*** (2.45, 3.06)
Past-Month Alcohol Use	1.11 (1.00, 1.24)
Past-Month Cigarette Use	1.56*** (1.30, 1.88)
# Observations	25,230

Regression also controlled for trial order and state of residence indicators (not shown in table). Standard errors were clustered at the participant level. This analysis only included observations on cannabis packages.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

denoting specific prohibited package features.^{12,13} Policymakers may also consider implementing plain packaging requirements, as in Canada, which we found were associated with significantly higher odds of correct identification compared with normal branded packages. However, these regulations on legal markets may have limited effectiveness for copycat packages sold by illicit stores or street dealers. Enforcement against copycat packages and illicit markets in general would be crucial to policy success. Our results also showed associations of being male, cannabis nonusers, and alcohol nonusers with reduced odds of correct identification of cannabis content, suggesting that these populations may especially benefit from regulations on deceptive packaging.

Correctly identifying cannabis content was associated with lower appeal ratings, which we interpreted as evidence that characteristics making packages easily identifiable were not attractive to consumers. To make packages less appealing to the younger population, who are at elevated risk of cannabis use and related consequences, policymakers may consider prohibiting deceptive or unclear cannabis packaging, requiring salient elements on packages indicative of cannabis content, such as larger warning symbols or texts with bigger fonts, or implementing plain packaging.

Two of the copycat packages in our experiment had especially low rates of correct identification. Unlike the other six copycat packages, these two packages had the following features in common: no words indicative of cannabis content, such as “infused” or “medicated”; fewer alterations to the counterpart food branding titles or graphics; smaller sizes of identifying symbols or texts; and no visible front-of-package warning labels. These features may be fruitful for future researchers to explore and policymakers to regulate.

This study had several limitations. Our sample of young adults aged 18–29 omitted children and the elderly, two populations of concern for accidental cannabis ingestion due to their potential unfamiliarity with cannabis products and more vulnerable state of health. We used convenience sampling instead of probability-based sampling due to cost concerns. Despite the use of demographic quotas to match our sample to the national population characteristics, the generalizability of our findings may still be limited for non-matched demographic characteristics or outside

of U.S. states with recreational cannabis legalization. We tested a specific set of package images, and our findings may not apply to packages with different visual characteristics. Our outcomes only included timed recognition and appeal ratings, which may not directly link to real consumption patterns or incidences of accidental ingestion.

Evidence from our experiment suggested that copycat cannabis packages were associated with an elevated risk of misidentification of cannabis content, making them a public health risk for accidental ingestion among the younger population. Package features that make a package easily identifiable were less appealing, underscoring the need of requiring salient features to indicate cannabis content on cannabis packages.

Authors' Contributions

M.C.: Conceived the study, designed the study, collected data, performed data analysis, and drafted the article. Y.S.: Obtained the funding, supervised the study, conceived the study, designed the study, participated in data analysis, and critically edited the article. Both authors approved the final version of the article.

Author Disclosure Statement

No competing financial interests exist.

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Supplementary Material

Supplementary Appendix A1

Supplementary Figure A1

Supplementary Table A1

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Abbreviation Used

THC = tetrahydrocannabinol