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Association Between Marijuana Use and Cardiovascular Diseases in an Adult Population in the United States in 2023

Asociación entre el consumo de marihuana y las enfermedades cardiovasculares en una población adulta en Estados Unidos en 2023

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ABSTRACT

Background: Given the importance of cardiovascular disease in global morbidity and mortality and its impact on public health, this study was conducted to evaluate the association between marijuana use and cardiovascular disease in a United States population. Methodology: The study employed an observational, cross sectional study design utilizing 2023 Behavioral Risk Factor Surveillance System (BRFSS) database as the data source. Results: The study revealed that marijuana users aged 45-54 years (OR=12.40, CI=6.38-24.07), American Indian individuals (OR=1.74, CI=1.49-2.03), and tobacco users (OR=1.48, CI=1.39-1.57) have a higher risk of cardiovascular disease. After reviewing this study, it is clear that further research is needed to


clarify the association between marijuana use and cardiovascular pathology. Conclusion: This study highlights the link between marijuana use and cardiovascular health but calls for further research to clarify its impacts. Findings support targeted public health efforts for at-risk groups.

Keywords: cannabis, cardiovascular diseases, heart attack, stroke

RESUMEN

Antecedentes: Dada la importancia de las enfermedades cardiovasculares en la morbilidad y mortalidad mundial y su impacto en la salud pública, este estudio se realizó para evaluar la asociación entre el consumo de marihuana y las enfermedades cardiovasculares en una población de los Estados Unidos. **Metodología:** El estudio empleó un diseño de estudio observacional transversal utilizando la base de datos del Sistema de Vigilancia de Factores de Riesgo Conductuales (BRFSS) de 2023 como fuente de datos. **Resultados:** El estudio reveló que los consumidores de marihuana de 45-54 años (OR=12,40, IC=6,38-24,07), los indios americanos (OR=1,74, IC=1,49-2,03) y los consumidores de tabaco (OR=1,48, IC=1,39-1,57) tienen un mayor riesgo de enfermedad cardiovascular. Después de revisar este estudio, está claro que se necesita más investigación para aclarar la asociación entre el consumo de marihuana y la patología cardiovascular. **Conclusión:** Este estudio destaca la relación entre el consumo de marihuana y la salud cardiovascular, pero requiere más investigación para aclarar sus impactos. Los hallazgos respaldan los esfuerzos de salud pública dirigidos a los grupos en riesgo.

Palabras clave: cannabis, enfermedades cardiovasculares, infarto, ictus

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INTRODUCTION

Cannabis, also referred to as marijuana, is the most widely utilized drug worldwide, with approximately 183 million consumers by the conclusion of 2014, succeeded by amphetamines (United Nations Office on Drugs and Crime, 2018). Between 2002 and 2019, the annual prevalence of cannabis use among US adults rose from 10.4% to 18.0%, while daily or nearly daily usage (300+ days per year) escalated from 1.3% to 3.9%. The increasing diagnosis of cannabis use disorder indicates that the rise in usage extends beyond mere self-reported consumption (Han et al., 2020; Hasin et al., 2019). Simultaneously, opinions regarding the detrimental effects of cannabis are diminishing. National surveys indicated that the percentage of adults perceiving a significant risk associated with weekly cannabis usage declined from 50% in 2002 to 28.6% in 2019 (Center for Behavioral Health Statistics and Quality, 2020). Despite its prevalent usage, there is less understanding of the hazards associated with cannabis consumption, particularly with cardiovascular disease. Cardiovascular-related mortality is the primary cause of death, and cannabis consumption may represent a significant, under-recognized risk factor contributing to numerous needless fatalities (CDC, 2020).

By early 2018, 34 U.S. states have enacted legislation permitting the use of cannabis for medicinal and recreational uses, with expectations for this number to rise in alignment with worldwide trends (Nargis et al., 2024). Despite substantial advancements in the management of cardiovascular disease in the United States over the past decade, it remains the foremost cause of morbidity and mortality among many racial, ethnic, and cultural groups. The government projects an annual expenditure over 200 billion dollars on professional services, medications, and diminished productivity. This significant expense mostly indicates a deficiency in enthusiasm for executing a thorough array of strategies aimed at the primary prevention of cardiovascular disease (Raj et al., 2023). Information about the correlation between marijuana consumption and cardiovascular illnesses in the U.S., particularly in relation to Myocardial Infarction (MI) and Cerebrovascular Disease (CVD), is scarce. This study will focus on both disorders, which are categorized under cardiovascular diseases. This study aims to ascertain the relationship between marijuana use and cardiovascular disease prevalence among adults in the United States in 2023, considering its significant implications for public health and the worldwide setting.

Cannabis consumption is believed to be related with atherosclerotic heart disease. Endocannabinoid receptors are pervasive within the cardiovascular system (Pacher et al., 2018). Tetrahydrocannabinol, the active constituent of cannabis, exerts hemodynamic effects and may lead to syncope, stroke, and myocardial infarction (Page et al., 2020; Ghasemiesfe et al., 2020; Richards et al., 2020). Smoking, the primary mode of cannabis consumption, may present heightened cardiovascular risks due to the inhalation of particulate matter. Moreover, research with rodents has shown that exposure to secondhand cannabis smoke is linked to endothelial

dysfunction, which is a precursor to cardiovascular disease (Khoj et al., 2023). Previous research on the relationship between cannabis consumption and cardiovascular outcomes has been constrained by the scarcity of people who use cannabis often. Seven, twelve, thirteen Furthermore, the majority of research have focused on younger people with a low risk of cardiovascular disease, therefore lacking the statistical power to identify a correlation between cannabis usage and atherosclerotic heart disease outcomes (Jeffers et al., 2024; Page et al., 2024).

Most published studies related to our research do not account for various variables that may affect the study, such as whether participants are exclusively marijuana users or engage in poly substance use. Another factor limiting these studies is that the literature often describes outcomes like hospitalizations or recurrences; however, the association remains weak due to the lack of detailed data on consumption patterns, such as dose, frequency, potency, and genetic susceptibility (Desai et al., 2020).

Theoretical framework

The Social-Ecological Model (SEM) was utilized to outline the various levels of factors influencing health behaviors and their outcomes. The decision to pursue health is influenced by individual, dyadic, community, and policy factors. At this level, individual characteristics include personal health behaviors, physical activity, knowledge, and beliefs that influence the situation. The use of tobacco or marijuana likely affects an individual's cardiovascular health. The interpersonal level encompasses U constructs, including families, friends, and peers, who either support or discourage risky behaviors. Individuals who have friends or family members using tobacco products may be at an increased risk of adopting similar behaviors. At the community level, resource availability, community standards, and the physical environment can either facilitate or obstruct Healthy Asset models. Due to limited access to healthcare and essential resources for a healthy lifestyle, individuals in low SES communities are at increased risk for diseases. The policy level is the final tier, encompassing both the structural and evidential aspects of policy within the community. Legislation and regulations regarding substances such as tobacco and marijuana can greatly impact the likelihood of chronic disease development, including cardiovascular conditions. Additionally, healthcare initiatives, including public health campaigns and preventive screenings, play a significant role in this domain. The integrated levels in this SEM illustrate the impact of various factors on health and provide insights for potential improvements in population health.

The rationale for this study is to continue the development of literature in examining the relationship between marijuana and MI and CVD among US adults. More specifically, the current investigation compared exclusive marijuana users to non-users, rather than extending the comparison to poly-substance users. Besides meaningful variables, it also look into account format of consumption, how often it takes place and how potent a variable it is.

Aim of study

The purpose of this study is to enhance and expand knowledge on the presence of Myocardial Infarction (MI) and Cerebrovascular Disease (CVD) related to marijuana use (exclusively marijuana). This study will consider variables such as the form of consumption and include a sufficiently representative sample size.

MATERIALS AND METHODS

Study design and setting

This research utilized a cross-sectional design through secondary data analysis from the Behavioral Risk Factor Surveillance System (BRFSS), a significant health-related telephone survey in the United States. The BRFSS gathers state-specific data regarding health risk behaviors, chronic health issues, and the use of preventive health services. Data were collected utilizing a randomized, multistage, clustered sampling methodology (Behavioral Risk Factor Surveillance System, 2024).

Inclusion exclusion criteria

The conclusive sample for this investigation comprised 45,359 people. The inclusion criteria comprised adults aged 18 to 55 who reported their marijuana usage and history of Myocardial Infarction (MI). Participants who expressed uncertainty ("unsure") or declined to respond to pertinent questions were omitted from the study.

Study variables

The principal independent variable was marijuana consumption, while the dependent variables were the occurrence of cardiovascular illnesses, namely Myocardial Infarction (MI) and Cerebrovascular Disease (CVD). Confounding variables encompassed age, sex, race, tobacco consumption, and body mass index (BMI).

Statistical analysis

Statistical analyses were conducted with R software. Descriptive statistics, bivariate analysis, and logistic regression models were utilized. The chi-squared test was employed for categorical variables, and associations were analyzed using odds ratios (ORs) with 95% confidence intervals (CIs).

RESULTS AND DISCUSSION

The BRFSS 2023 database has 437,436 entries, with 434,626 individuals responding to both the inquiries regarding a prior diagnosis of acute myocardial infarction and the occurrence of a cerebrovascular stroke. Approximately 112,942 individuals within this population responded to the inquiry concerning the number of days they consumed marijuana in the preceding 30 days. Ultimately, respondents who answered 'unsure' or declined to respond were eliminated, yielding a sample size of 45,359 persons, which is optimal for our study.

Approximately 6.98% of the population indicated having using marijuana within the past 30 days. Table 1 indicates that the prevalence of marijuana usage was markedly greater among those aged 25 to 34 (21.71% compared to 8.38%), among males (60.53% versus 43.21%), and among Black individuals (11.12% versus 8.92%). Marijuana users had a higher prevalence of current tobacco use (57.2% compared to 30.83%). Individuals with a body mass index classified as normal weight had more marijuana consumption (37.77% compared to 28.85%). The prevalence of cardiovascular disease was lower in marijuana users (8.27% compared to 9.92%).

Table 1
Association Between Marijuana Use and Cardiovascular Disease

Characteristics	Marijuana Use		P value
	Yes (n=7871) N (%)	No (n=105071) N (%)	
MI or CVD			0,001*
Yes	648 (8,27)	10373 (9,92)	
No	7191 (91,73)	94170 (90,08)	
Age (years)			0,001*
18-24	1152 (14,64)	4708 (4,48)	
25-34	1709 (21,71)	8806 (8,38)	
35-44	1274 (16,19)	11536 (10,98)	
45-54	1153 (14,65)	16062 (15,29)	
Sex			0,001*
Masculine	4758 (60,53)	45361 (43,21)	
Feminine	3103 (39,47)	59606 (56,79)	
Race			0,001*
White	5986 (77,37)	85056 (82,41)	
Blacks or African Americans	860 (11,12)	9210 (8,92)	
American Indians or Alaska Natives	303 (3,92)	1837 (1,78)	
Asians	126 (1,63)	2249 (2,18)	
Native Hawaiians	84 (1,09)	847 (0,82)	
Other	322 (4,16)	3724 (3,61)	
No preferred race	56 (0,72)	286 (0,28)	
Tobacco Use			0,001*
Use	3055 (57,20)	13302 (30,83)	
Does't use	2286 (42,80)	29840 (69,17)	

Body mass index		0,001*
Underweight	211 (2,75)	1493 (1,52)
Normal weight	2899 (37,77)	28422 (28,85)
Overweight	2550 (33,22)	35943 (36,49)
Obesity	2016 (26,26)	32649 (33,14)
MI: Myocardial Infarction		
CVD: Cerebrovascular Disease		
*: Due to rounding to zero		

Taking non-users as a reference, individuals who used marijuana (within the last 30 days) had an unadjusted odds ratio of 0.81 (0.75-0.88). After adjusting for confounding factors among marijuana users who developed cardiovascular diseases, we obtained an odds ratio of 1.08 (CI=0.98-1.20), indicating that there is no significant association between marijuana use and cardiovascular diseases (Table 2).

Table 2

Unadjusted and adjusted association between marijuana use and cardiovascular diseases

	Unadjusted	Ajusted ¹
	OR (95% IC)	OR (95% IC)
Marijuana Use		
No	REFERENCE	REFERENCE
Yes	0,81 (0,75-0,88)	1,08 (0,98-1,20)

¹Ajusted: Age, Sex, Race, tobacco use, body mass index

Additionally, it was evidenced among the confounding variables in our study that both the age range of 45-54 years (OR=12.40, CI=6.38-24.07), race of American Indians (OR=1.74, CI=1.49-2.03), and tobacco users (OR=1.48, CI=1.39-1.57) presented a higher risk of developing cardiovascular diseases. Meanwhile, maintaining an adequate weight (OR=0.62, CI=0.51-0.76) and being female (OR=0.61, CI=0.57-0.64) served as protective factors (Table 3).

Table 3

Adjusted association between confounding variables and cardiovascular diseases

	Adjusted ¹
	OR (95% IC)
Age (Years)	
18-24	REFERENCE
25-34	2,61 (1,30-5,24)
35-44	5,73 (2,93-11,22)

45-54	12,40 (6,38-24,07)
Sex	
Masculine	REFERENCE
Feminine	0,61 (0,57-0,64)
Race	
White	REFERENCE
Blacks or African Americans	1,27 (1,15-1,40)
American Indians or Alaska Natives	1,74 (1,49-2,03)
Asians	0,84 (0,61-1,15)
Native Hawaiians	1,06 (0,76-1,46)
Other	0,84 (0,70-1,02)
No preferred race	1,86 (1,16-2,98)
Tobacco use	
Use	1,48 (1,39-1,57)
Does't use	REFERENCE
Body mass index	
Underweight	REFERENCE
Normal weight	0,62 (0,51-0,76)
Overweight	0,67 (0,55-0,81)
Obesity	0,88 (0,72-1,07)

¹ Adjusted: Age, Sex, Race, tobacco use, body mass index

The present study sample data was obtained from the 2023 BRFSS, with the final sample consisting of 45,359 people who met the inclusion requirements. The results indicated that approximately 6.98% of the population utilized marijuana in the preceding month. Significant tendencies were discovered about marijuana users, specifically within the age category of 25-34 years, predominantly male, and of Black ethnicity. Significantly, current tobacco smokers and individuals with a normal BMI exhibited elevated rates of marijuana consumption. It is also significant to note that the prevalence of cardiovascular disease (CVD) was marginally lower among marijuana users compared to non-users. The analysis augmented the unadjusted odds ratio (OR) of 0.81, linked to marijuana users and cardiovascular disease (CVD) risk; however, upon adjustment for variables including age, sex, race, tobacco use, and BMI, the adjusted OR was 1.08, indicating no association between marijuana use and CVD.

Our findings correspond with Alhassan and Howard, who observed that marijuana usage was not substantially linked with traditional atherosclerotic cardiovascular risk factors such as hypertension, dyslipidemia, and diabetes when adjusted for pertinent socio-demographic and

lifestyle variables. In their examination of the NHANES data, they determined that marijuana usage does not significantly influence cardio metabolic profiles, suggesting non-atherosclerotic pathways for marijuana-related cardiovascular disease indicators. The crude odds ratio (OR) of 1.14 (confidence interval [CI] = 1.02–1.27) was statistically significant at $p = 0.028$; however, subsequent adjustments for potential confounders including age, sex, race, and tobacco use were made (Alhassan and Howard, 2022). Conversely, Shah (2021) indicated that present daily and past thirty-day marijuana usage substantially heightened the risk of myocardial infarction and stroke. This discrepancy may stem from varying study samples and definitions of marijuana consumption. Our research was limited to the preceding 30 days of marijuana consumption, whereas Shah's analysis may have included individuals with more extensive cannabis exposure. This suggests that the characteristics and degree of marijuana consumption, as well as the method of use, may influence the cardiovascular outcomes of users (Shah et al., 2021).

Another study revealed that the selective consumption of marijuana correlated with an increased risk of cardiovascular issues in young individuals, It posited that marijuana has numerous effects on the cardiovascular system, including elevated heart rate, alterations in blood pressure, and effects on arterial function (Yang et al., 2022). Nonetheless, present study conducted in the present research did not establish a direct correlation between marijuana use and cardiovascular disease (CVD) after accounting for confounding variables, suggesting that the relationship between marijuana use and cardiovascular outcomes may not be simple and could be influenced by other lifestyle or demographic factors.

The present study on adolescent lifestyle profiles reveals several noteworthy findings when compared to existing research on marijuana use and cardiovascular health. In a 2020 study Burt et al. found no significant association between marijuana consumption in young adulthood and CAD when controlling for other risk factors. This suggests that young individuals without other underlying conditions may not face significant cardiovascular risks from marijuana use in the near future. This is significant for adolescent patients, as their clinical choices indicate that, while they may lead to lifestyle-related complications, they do not directly impact cardiovascular diseases. Nonetheless, the other consequences of early marijuana use remain uncertain, necessitating further research in this domain (Burt et al., 2020).

In contrast, A study outline other cardiovascular consequences of marijuana use, including myocardial infarction, arrhythmia among the elderly. There is a focus on the fact that it is important to know the influence of marijuana on the cardiovascular system and the use of which is gradually increasing in all age groups. Although there are less direct effects of marijuana use on cardiovascular system among adolescents, early use of marijuana may result in increased health risks factors over time including those associated with cardiovascular disease where the use is complemented by other unhealthy practices (Latif and Garg, 2020).

Due to the complexity of the findings, further extensive follow-up research is necessary, based on physiological data regarding the effects of marijuana use, as well as studies that account for additional variables that may influence these effects, including the consumption of other substances and various lifestyle factors. This paper underscores the necessity of an interdisciplinary approach to marijuana policy and cardiovascular health, including the total public health advantages and potential hazards associated with medicinal cannabis.

Recommendations for public health policy

Population-based interventions should focus on disseminating information regarding the negative effects of marijuana and tobacco use. Conducting counseling sessions alongside health risk appraisals is advisable to enhance the client's awareness of cardiovascular diseases. Interventions focused on family and peer groups should be developed, as these serve as intermediary goals that necessitate the acquisition of essential behaviors, supported by family and peers in cases of quitting smoking or marijuana use. Improvements must be proposed in health care accessibility, physical activity, and nutrition modifications for the highest risk populations within communities. At the policy level, it is essential to establish regulations that legalize marijuana use globally, while also considering guidelines for its usage. Policies must also focus on expanding health coverage and enhancing preventive healthcare services, such as those for cardiovascular disease and smoking cessation.

CONCLUSIONS

Future implications

Although there was no evidence of substantial association between marijuana use and cardiovascular diseases, the study raised concern to public health. Notably, trends in marijuana usage seemed to be associated with given population type and behavior; areas that seemed amenable to change. For example, designing an exclusively targeted interventional campaign based on the type of using the substance also based on gender and age, for example, young men and current tobacco users, and thus, cardiovascular health could also be targeted. Further, the study means it is suggestive that marijuana had protective effects before adjustment which raises future research interest towards how marijuana affects heart health in more ways than one.

Limitations

There are several limitations that have been observed in the study that needs, therefore, discussion. The use of a cross-sectional design limited the possibility of establishing causality of marijuana use and the development of cardiovascular diseases. Second, the use of self-collected data may have led to recall bias or errors. The failure to capture individuals because of incomplete responses could also have affected the generalisability of the research results. Several inherent limitations of using the BRFSS database can also be viewed as the objective study's limitations: First, patterns of marijuana use, including dosage frequency, and the mode of use, were not

available in the BRFSS database, which could have lessened the study's validity. Second, although BRFSS included states' data of different regions, rural populations with limited telephone access were not considered in the study.

This study demonstrates a higher risk of developing cardiovascular diseases, such as myocardial infarction or cerebrovascular events, in patients who use marijuana belong to the American Indian demographic, or use tobacco. Conversely, normal weight and female sex appear to offer some protection against these diseases. Additionally, it was observed that the rates of marijuana use and cardiovascular disease presence were 6.96% and 9.25%, respectively. Generalizations from the results of this study should be approached with caution due to clear limitations in data organization. The diverse participant sample and consideration of confounding variables enhance result reliability; however, specific limitations warrant investigation in future prospective studies. Examining the effects of marijuana on cardiovascular health will enhance the development of public health objectives and practical healthcare strategies. The findings highlight the necessity for a broader perspective on health promotion and prevention in cardiovascular disease, particularly concerning populations at heightened risk due to substance use.

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