CLINICAL RESEARCH STUDY

Metabolic Syndrome Among Marijuana Users in the United States: An Analysis of National Health and Nutrition Examination Survey Data

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ABSTRACT

BACKGROUND: Research on the health effects of marijuana use in light of its increased medical use and the current obesity epidemic is needed. Our objective was to explore the relationship between marijuana use and metabolic syndrome across stages of adulthood.

METHODS: An analysis of 20- to 59-year-olds (n = 8478) who completed the 2005-2010 National Health and Nutrition Examination Surveys was conducted. Marijuana use was categorized as: never used, past use (used previously but not within the last 30 days), and current use ($\geq$1 day in the last 30 days). Metabolic syndrome was defined as $\geq$3 of the following: elevated fasting glucose, high triglycerides, low high-density-lipoprotein cholesterol, elevated systolic/diastolic blood pressure, and increased waist circumference. An age-stratified analysis was conducted to examine the relationship between marijuana use and metabolic syndrome among emerging adults (20-30 years), adults (31-44 years), and middle-aged adults (45-59 years).

RESULTS: Fourteen percent (13.8%) of current marijuana users and 17.5% of past marijuana users presented with metabolic syndrome, compared with 19.5% of never users (P = .0003 and P = .03, respectively). Current marijuana users had lower odds of presenting with metabolic syndrome than never users (adjusted odds ratio [AOR] 0.69; 95% confidence interval [CI], 0.47-1.00; P = .05). Among emerging adults, current marijuana users were 54% less likely than never users to present with metabolic syndrome. Current (AOR 0.49; 95% CI, 0.25-0.97) and past (AOR 0.61; 95% CI, 0.40-0.91) middle-aged adult marijuana users were less likely to have metabolic syndrome than never users.

CONCLUSIONS: Current marijuana use is associated with lower odds of metabolic syndrome across emerging and middle-aged US adults. Future studies should examine the biological pathways of this relationship.

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KEYWORDS: Cardiovascular diseases; Marijuana; Metabolic syndrome; NHANES

Marijuana is the most commonly used drug in the US.[1] In 2013, 19.1% of emerging adults (18-25 years old) reported current marijuana use, a rate considerably higher than what is reported for youth (7.1%) and adults (>25 years) (5.6%) combined. An overwhelming majority (80.6%) of current illicit drug users reported the use of marijuana.[1] Recent legalization of recreational and medical use across the US makes it unlikely that the prevalence and frequency of marijuana use will decline in the near future.

Despite record high support (58%) for legalizing marijuana use in the US,[2] there is a gap in clinical research

literature of its use.[3] Health risks of marijuana use are a growing concern due to the increasing levels of the main psychoactive ingredient of marijuana, tetrahydrocannabinol, which has increased over the past two decades.[4,5] The impact of increased tetrahydrocannabinol levels on cardiometabolic health is poorly understood; yet, concurrently, the nation is facing epidemic levels of obesity, diabetes, and cardiovascular disease.[6]

Metabolic syndrome, a significant risk factor for type 2 diabetes and cardiovascular disease,[7-14] is defined as the presence of a cluster of ≥3 of the following risk factors: elevated waist circumference, systolic or diastolic blood pressure (or both), triglycerides, fasting glucose, and low high-density lipoprotein (HDL) cholesterol. Some studies have reported an association between marijuana use and individual metabolic syndrome factors, while others have found no relationship.[15-17] This association has been understudied,[17] across stages of adulthood in particular. The objective of this study was to evaluate the relationship between marijuana use and metabolic syndrome in a US population-based sample. Given the differences in the prevalence of marijuana use and obesity by age, the secondary objective was to assess these relationships by stages of adulthood.

CLINICAL SIGNIFICANCE

- Current and past marijuana users have lower odds of presenting with metabolic syndrome than those with no history of marijuana use, depending on the age group.

- There was a lower prevalence of metabolic syndrome among current and past marijuana users when compared with never users.

- Individual metabolic syndrome component mean estimates varied across use categories but were generally lower among marijuana users compared with never users, with the exception of blood pressure.

METHODS

Study Population

An analysis of 20- to 59-year-olds (N = 8478) from combined 2005-2010 National Health and Nutrition Examination Survey (NHANES) cycles were included to increase statistical reliability.[18] The age group was determined based on respondents for key variables used in the study. NHANES is a continuous survey administered by the Centers for Disease Control and Prevention's National Center for Health Statistics that uses a stratified, multistage probability sampling design. In-home questionnaire, laboratory, and physical examination data were collected.[18] Participants provided informed consent, and protocols were approved by the National Center for Health Statistics' Institutional Review Board.

Participants were excluded from the study sample if they did not complete the drug questionnaire (n = 1509), reported current use of heroin, cocaine, or methamphetamines along with marijuana use (n = 234), reported current use of insulin (n = 220) or blood sugar-lowering medication (n = 453), or self-reported or tested positive for pregnancy via urine test (n = 450).

Marijuana Use

Marijuana use was defined using the following questions: 1) "Have you ever, even once, used marijuana or hashish?" (yes, no, refused, don't know); 2) "How long has it been since you last used marijuana or hashish?" (number of days, weeks, months, years, refused, don't know); and 3) "During the past 30 days, on how many days did you use marijuana or hashish?" (number of days 1 to 30 reported).[19] Degree of use was then categorized using the Addiction Severity Index 5th Edition[20] as a guide into the following categories: past marijuana users (lifetime use at least once, but not in last 30 days), current marijuana users (≥1 day in the last 30 days). The reference group was defined as participants who reported no lifetime marijuana use (never users). Audio Computer-Assisted Self-Interview (ACASI) software was used to administer the drug use questionnaire.[19] Validity of responses were verified by ACASI software programming that alerted participants of potential errors and checks for valid responses.[19]

Metabolic Syndrome

The primary outcome was metabolic syndrome, a cluster of ≥3 of the following risk factors: waist circumference, systolic/diastolic blood pressure, HDL cholesterol, triglycerides, and fasting glucose.[9] Protocol, standardization, and reliability of data collection information and procedures are described elsewhere.[21-23] Standardized[9] abnormal/elevated cut-off values were as follows: 1) waist circumference ≥102 cm (40 in) for men, waist circumference ≥88 cm (35 in) for women; 2) systolic blood pressure ≥130 mm Hg, or diastolic blood pressure ≥85 mm Hg (or the report of current hypertensive medication use); 3) HDL cholesterol ≤40 mg/dL for men, ≤50 mg/dL for women; 4) triglycerides ≥150 mg/dL; and 5) fasting glucose ≥100 mg/dL.

Covariates

Sex, age, race/ethnicity, poverty-to-income ratio, and cigarette use were considered covariates a priori. NHANES captured sex as male/female, age in years, and race/ethnicity as Non-Hispanic White, Non-Hispanic Black, Mexican American, Other Hispanic, and Other (which includes Asian Americans, Multi-Race, etc.). Mexican American and Other Hispanic categories were combined to create a "Hispanic" classification for analyses. Poverty-to-income ratio was calculated by dividing family income by the poverty