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Brief Report: Impulsivity and Decision Making in Older and Younger Cocaine-Dependent Participants: A Preliminary Study

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Abstract

Background and Objectives: Substance misuse is increasing in the older population, which may have differing effects on behavior compared to younger substance participants. Differences in trait and state impulsivity were assessed in younger and older cocaine-dependent participants.

Methods: Thirty-one younger cocaine-dependent participants ($n = 31$) and twenty-one older cocaine-dependent participants ($n = 21$) were assessed using the Barrett Impulsiveness Scale-11 and the Immediate Memory Task..

Results: Younger participants showed higher trait impulsivity than older participants ($p = .027$). However, older participants demonstrated higher state impulsivity than younger participants ($p = .018$).

Conclusion: Higher state impulsivity in older cocaine participants suggests that cocaine use may have accelerating effects on the aging brain.

Scientific Significance: This preliminary study adds the limited research on how cocaine use affects normal aging. Current treatments are based on younger adults, therefore the needs of older adults should be taken into consideration and studied more.

INTRODUCTION

Drug addiction is a chronic medical disorder that is typically associated with the younger population. However, it has become a growing problem in the aging population (Wu & Blazer, 2011)¹. According to the National Survey on Drug Use and Health, individuals aged 50 and older with a substance use disorder (SUD) are projected to increase from 2.8 million in 2002–2006 to 5.7 million by 2020 (Wu and Blazer, 2011)¹. Illicit drug use, has also increased in the aging population, particularly with cocaine. (Wu and Blazer, 2011)¹. Cocaine use has been linked to cognitive deficits in working memory and attention (Kjome et al., 2010)². Aging also has been linked to the same deficits such as older adults

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DECLARATION OF INTEREST

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this paper.

demonstrating greater impairment in tasks requiring a prepotent response (Butler and Zacks, 2006)³. Use of cocaine in the aging population may accelerate these impairments.

One cognitive measure associated with addiction is impulsivity, which has been defined as the “predisposition toward rapid and unplanned actions to internal or external stimuli without considering the possible negative consequences to yourself and others” (Moeller et al., 2001)⁴. Impulsivity has been conceptualized as having a “trait” component, commonly measured by questionnaires, and a “state” component usually measured by behavioral laboratory tasks (reviewed in Hamilton et al., 2015Ha)⁵. One commonly used trait measure of impulsivity is the Barrett Impulsiveness Scale (BIS-11) (Patton et al., 1995)⁶ that assesses impulsivity through questions focused on long-term behavior patterns on how a person thinks or acts. State impulsivity is commonly measured using behavioral laboratory measures such as the Immediate Memory Task (IMT) (Dougherty et al., 2000)⁷. The IMT is a continuous performance task that is designed to measure a subject’s ability to retain and subsequently identify a stimulus kept in memory as well as the ability to inhibit impulsive responding. Cocaine-dependent participants as a group, when compared with controls, have demonstrated higher impulsivity on both the BIS-11 and the IMT suggesting they have difficulties in impulsivity and inhibitory control (Kjome et al., 2010)². However, the effect of aging on impulsivity in cocaine-dependent participants has not been previously examined. The purpose of this study was to compare performance on state (IMT) and trait (BIS-11) impulsivity in older and younger cocaine-dependent participants. Aging would likely produce an effect on state impulsivity, but have less of an effect on trait impulsivity. Based on this, we hypothesized that after controlling for years of cocaine use 1) older cocaine-dependent participants will have higher state impulsivity by demonstrating greater commission errors on the IMT compared to younger cocaine-dependent participants and 2) older cocaine-dependent participants will not differ in trait impulsivity as assessed by the BIS-11.

METHODS

Participants

A total of 52 cocaine-dependent participants were recruited for the present study. Participants were divided into older (mean age 53.6 (range 50–60), $n = 21$) and younger (mean age 41.71 (range 20–49), $n = 31$) groups based on a median split for age (median age 49). Participants were recruited via the local newspaper, internet, and flyer advertisements. Participants completed a brief phone interview to determine initial eligibility. Following the phone screen, eligible participants attended an in-person intake assessment session as done in previous studies (Kjome et al., 2010)², which included the Structured Clinical Interview for the DSM-IV (SCID) to screen for psychiatric disorders and the Addiction Severity Index for lifetime drug and alcohol use. All participants also underwent a physical examination and medical history. Each subject’s urine was tested for cocaine, tetrahydrocannabinol (THC), opiates, amphetamine, methamphetamine, and benzodiazepines (Syva Company, Deerfield, IL). Eligible cocaine-dependent participants met DSM-IV criteria for cocaine dependence; did not meet DSM-IV current dependence criteria for abused drugs other than cocaine, marijuana, nicotine or alcohol; and did not have a current axis I disorders other than

substance abuse or dependence. Individuals were excluded if they did not meet DSM-IV criteria for current cocaine dependence, had an Axis I disorder other than substance-induced mood disorder, or significant medical conditions, including self-reported history of moderate or severe traumatic brain injury

Impulsivity Measures

Barrett Impulsiveness Scale Version 11 (BIS-11)—The BIS-11 is a 30-item questionnaire that consists of three factors: non-planning impulsivity, attentional impulsivity, and motor impulsivity (Patton et al., 1995)⁶. Non-planning impulsivity is associated with the tendency to think about behaviors and plans before acting (i.e., “I plan tasks carefully”). Attentional impulsivity is associated with sustaining attention on a given task (i.e., “I concentrate easily”). Motor impulsivity is associated with the inability to withhold responding (i.e., “I do things without thinking”).

Immediate Memory Task (IMT)—The Immediate Memory Task is a continuous performance task that is designed to measure a subject’s ability to retain and subsequently identify a stimulus kept in memory as well as the ability to inhibit impulsive responding (Dougherty et al., 2000)⁷. The task is computer driven and takes approximately 10 minutes to complete. A series of 5-digit numbers (e.g., 73021) display on the monitor for the 0.5s blackout period. Participants are instructed to respond to when a target stimulus (five-digit number) appears that matches the previous stimulus. If the response is made while the target stimulus is on the screen or before the next stimulus appears, it is recorded as a correct detection. Correct detections are considered to assess sustained attention. If the participant fails to respond to the target stimulus, it is recorded as an omission error. The task also includes catch stimuli, which differ from the previous number by one digit. Responses to catch stimuli are recorded as commission errors, which are considered impulsive responses. Filler errors are new stimuli that are neither target or catch and assess whether or not the participant understands the task.

DATA ANALYSIS

Demographic differences between groups were assessed with independent sample t-tests and chi-square tests. Means scores were determined for each subscale of the BIS-11 and IMT. An analysis of covariance (ANCOVA) was used to compare group means on variables and control for years of cocaine use and years of alcohol use.

RESULTS

A total of 52 cocaine-dependent participants met the inclusion criteria for the study. All participants completed the IMT and BIS-11. Demographic variables and means for the BIS-11 and IMT can be found listed in Table 1. There was no significant difference in education, years of cocaine use, years of alcohol use, and gender between groups. As shown in Table 1, younger cocaine-dependent participants had significantly higher motor impulsivity scores compared to older cocaine-dependent participants ($p = .027$). Whereas, older cocaine-dependent participants had significantly higher commission errors on the IMT ($p = .018$). There was a significant effect of age on IMT commission errors, $F(1,47) = 8.10$,

$p=.007$ (Spearman $r=0.390$) and the BIS-11 score for motor impulsivity, $F(1,47)=4.12$, $p=.048$ (Spearman $r=-.045$) after controlling for years of cocaine use, years of alcohol use, and gender.

DISCUSSION

The current study examined the effects of age on state and trait impulsivity in cocaine-dependent participants using the BIS-11 and IMT. As hypothesized, older cocaine-dependent participants had higher state impulsivity as evident through significantly higher commission errors on the IMT. This may suggest that the older brain may be more sensitive to cocaine use. Although there was no difference in non-planning impulsivity, attentional impulsivity, and total scores on the BIS-11, younger cocaine-dependent participants scored higher than the older cocaine-dependent participants on motor impulsivity. Older adults have been known to show less impulsivity on the BIS-11 when compared to younger adults (Patton et al., 1995)⁶.

Although limited studies are examining how substance abuse affects the aging population, the studies that been published suggest that there may be differences between older and younger substance participants. Ersche et al. 2013⁸ examined the effects of aging on gray matter volume in cocaine-dependent participants and healthy controls, aged 18–50. Age-related gray matter volume was significantly reduced in cocaine-dependent participants, particularly in the prefrontal and temporal areas. Another study examined the effects of crack-cocaine dependence and aging in 77 female participants. They found that crack-cocaine dependent participants performed the same as healthy older participants, in that they both displayed impairment on the task when compared to healthy young adults (Sanvicente-Vieira et al., 2016)⁹. These findings emphasize the importance of more research on how substance use affects the aging population especially since cocaine use contributes to other comorbidities such as cardiovascular and liver disease; as well as contributing to 40.3% of emergency admissions (Bachi et al., 2017)¹⁰. Much of the research and treatment of substance use is geared towards the younger population, therefore, leaving out a population that may require different needs.

This study should be considered preliminary due to the sample size and some limitations. One limitation of this study is that we did not age match our participants nor use age-matched controls. Bearing these limitations in mind, this study supports future research on effects of substance misuse in aging populations.

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TABLE 1.

Demographics and behaviors results in Younger and Older Cocaine-Dependent Participants

	Younger	Older	<i>p</i> ^{**}
N	31	21	
Age	41.71 (7.38)	53.62 (2.62)	<.001 [*]
Male N (%)	18 (58.1)	16(76.2)	.178
Female N (%)	13 (41.9)	5 (23.8)	
Education	12.26 (2.03)	12.62 (1.50)	.490
Years of Cocaine Use	13.68 (8.37)	18.07 (9.75)	.100
Years of Alcohol Use	13.97 (11.09)	17.29 (14.48)	.390
BIS Non-Planning	24.74 (5.81)	26.62 (6.00)	.265
BIS Attentional	14.77 (3.52)	14.67 (4.18)	.921
BIS Motor	25.23 (4.57)	22.81 (3.06)	.027 [*]
BIS Total Score	64.74 (10.99)	64.10 (11.27)	.838
IMT Correction Detections %	83.37 (11.86)	0.838(11.86)	.976
IMT Commission Errors %	38.34 (14.35)	38.34 (14.35)	.018 [*]

BIS-11, Barrett Impulsiveness Scale version 11; IMT, Immediate Memory Task

^{*}*p* significant at <.05. All values are "mean (standard deviation)" unless otherwise noted.