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Associations between Body Weight Status and Substance Use among African American Women in Baltimore, Maryland: The CHAT Study

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Abstract

Background—Studies on associations between body weight status and specific substance use have provided conflicting findings.

Objectives—This paper investigated the association between substance use and body weight status among African American women.

Methods—We analyzed the data from 328 African American women who were enrolled in a HIV prevention intervention in Baltimore, MD, USA in order to investigate the association between substance use and their body weight status. Participants' anthropometry was measured by trained research staff. Substance use information was collected via self-administered and interviewer-administered questionnaires.

Results—About 33.4% were classified as normal/under-weight, 24.2% overweight and 42.4% obese. Compared to overweight (38.5%) and obese (29.2%) participants, the normal/under-weight women had significantly higher prevalence of drug use (52.8%) ($\chi^2=14.11$, $p<0.05$). BMI was significantly negatively associated with current heroin use ($t=-2.21$, $p<0.05$). The risk of being overweight and obesity was lower among active marijuana ($z=-2.05$, $p<0.05$) and heroin users ($z=-1.91$, $p<0.10$) than among non-marijuana/non-heroin users. Heroin smokers had lower body weight ($t=-3.02$, $p<0.05$) and BMI ($t=-2.47$, $p<0.05$) than non-heroin smokers. The decrease in BMI appeared to be greater among more frequent (once/day) heroin users ($t=-2.39$, $p<0.05$) as compared to the less frequent heroin users (<once/day) ($t=-1.71$, $p<0.10$), but this difference was not statistically significant.

Conclusions—The results are comparable to existing findings. Active marijuana and heroin users were less likely to be overweight and obese compared to their counterparts. The impact of substance use on body weight status differed by the frequency and route of administration.

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Declaration of Interest

All authors declare that they have no conflicts of interests. The authors alone are responsible for the content and writing of the article.

INTRODUCTION

Currently, about two thirds of American adults are overweight or obese, and more than one third of American children and adolescents are at risk of overweight (Flegal, Carroll, Kit, & Ogden, 2012; Ogden, Carroll, Kit, & Flegal, 2012). Overweight and obesity has become a major public health problem in the United States, while health disparity among ethnicity minority women is particularly significant. The 2009–2010 National Health and Nutrition Examination Survey (NHANES) showed that the prevalence of overweight and obesity was 59.5% among Caucasian women, 82.1% for African American women, and 75.7% for Hispanic women, respectively (Flegal, et al., 2012).

Despite stringent anti-drug policies, illicit substance use remains a significant public health problem in the United States, with the highest levels of illicit substance use in the world (Degenhardt, et al., 2008). The 2007 National Survey on Drug Use and Health data estimated 46.1% of Americans at age of 12 and older have used an illicit substance at least once in their lifetime (Substance Abuse and Mental Health Services Administration, 2008).

Illicit substance use has disproportionately affected African Americans (Fryar, Hirsch, et al., 2007; Fryar, Merino, Hirsch, & Porter, 2007; Fryar, Merino, Hirsch, & Porter, 2009; Turner & Wallace, 2003). African Americans age 12 and older have significantly higher rate of illicit substance use than white counterparts (Fryar, Merino, et al., 2007; Fryar, et al., 2009; Turner & Wallace, 2003). In addition, more than one third of current illicit substance users in the U.S. are women (Compton, Thomas, Stinson, & Grant, 2007; Greenfield, Manwani, & Nargiso, 2003). Compared to men, women tended to initiate drug use at younger age, have more rapid development of addiction, function worse in social and occupational activities, be in a relationship with an addicted partner, and recover more slowly from depression after cessation (Greenfield, Back, Lawson, & Brady, 2010; Greenfield, et al., 2007; Griffin, Weiss, Mirin, & Lange, 1989; Hernandez-Avila, Rounsaville, & Kranzler, 2004).

Substance use may have various physical effects, including body weight. The relationship between substance use and body weight status has been examined by both basic biomedical and population-based epidemiologic studies. Substances including alcohol, nicotine, marijuana, and cocaine have been known to affect appetite differently (Abel, 1975; Grunberg, 1982; Hetherington, Cameron, Wallis, & Pirie, 2001). Neurobiological and neuroimaging studies hypothesized that food and drug intake share common neural substrates and therefore compete for the same brain reward sites (Trinko, Sears, Guarnieri, & DiLeone, 2007; Volkow, Wang, Fowler, & Telang, 2008). Reduced dopamine D2 receptors were found in both obese patients (Wang, et al., 2001) and drug-addicted individuals (Volkow, Fowler, Wang, & Swanson, 2004). Hormones that regulate energy balance, leptin and ghrelin, also influence the ventral tegmental area which is related to addictive behaviors (Kiefer & Wiedemann, 2004; Trinko, et al., 2007). News coverage on crack cocaine and heroin associated with weight loss may also promote use among those who want to lose weight.

Several large-scale epidemiologic surveys indicated an inverse relationship between body mass index (BMI) and alcohol (Duncan, Grant, Bucholz, Madden, & Heath, 2009; Kleiner,

et al., 2004) and illicit drug use disorders (McIntyre, et al., 2007; Simon, et al., 2006). However, the studies on the association between BMI and specific substance among different population samples provide conflicting findings. For example, a survey conducted in thirteen countries reported lower likelihood of alcohol use disorders among obese participants in the U.S. but not in the other twelve countries (Scott, et al., 2008). One cross-sectional study among 40,364 U.S. adults suggested that overweight and obesity were not associated with illicit drug use disorders, such as marijuana, cocaine and opiate, after adjusting for sociodemographic background (Barry & Petry, 2009). A longitudinal study conducted in Sweden indicated that an increase in the prevalence of overweight was comparable among illicit drug addicts and the general population (Rajs, et al., 2004), indicating that there was no association between BMI and illicit drug use, e.g., heroin, methadone, and amphetamine. Unlike cocaine and heroin, marijuana is a widely known appetite stimulant. Medicines based on the main psychoactive constituent of marijuana, tetrahydrocannabinol (THC), have been used for patients with cancer or AIDS-related wasting to relieve vomiting, improve appetite, and gain weight (Wilkins, 2006).

It has been suggested that women are more susceptible than men to substance-related health-related consequences in terms of morbidity and mortality (Greenfield, et al., 2003). Despite the severity of health issues and medical and social consequences related to body weight status and substance use, very few studies have focused on urban African American women. None have examined the influence of route or frequency of substance use on body weight status. The purpose of the current study was to investigate the association between substance use and body weight status (BMI and overweight/obesity) among a sample of African American women that were enrolled in a HIV prevention intervention trial in Baltimore, MD, USA. This trial provided detailed data on substance use, including the types, frequency of use, administration route, and objective anthropometric measures. It was hypothesized that body weight status was inversely associated with substance use such as alcohol, nicotine, crack, cocaine and heroin, while marijuana intake was positively related to body weight status.

METHODS

Sampling and recruitment

The CHAT study was a social-network based HIV prevention intervention trial for heterosexual women in Baltimore, MD, USA (Davey-Rothwell, Tobin, Yang, Sun, & Latkin, 2011). CHAT represents four aspects of the intervention strategy: (1) *Choose the right time and place*; (2) *Hear what the person is saying*; (3) *Ask questions*; and (4) *Talk with respect*. The majority participants were African American (97.2%). Overall, 746 participants completed the baseline visit, and 672 completed the 18 month visit, of whom 492 were African American women. The final sample for the present study consisted of 328 African American females with body weight information at 18-month follow up.

The sample consisted of women (i.e., index participants) and their social network members. Index participants were recruited through street outreach as well as at health clinics, and other local community agencies. Eligibility criteria for the index participants included: 1) female, 2) age 18–55 years old, 3) did not inject drugs in the past 6 months, 4) self-reported

sex with at least 1 male partner in the past 6 months, and 5) had at least one sexual risk factor including any of the following: a) more than 2 sex partners in the past 6 months, b) STD diagnosis in the past 6 months, and c) having a high risk sex partner in the past 90 days, e.g., injected heroin or cocaine, smoked crack, HIV seropositive, or man who has sex with men.

At the baseline visit, eligible index participants were asked to complete a personal social network inventory, which included questions about the people they interacted with. Based on this network inventory, eligible network members were identified. Eligibility for social network members were: 1) 18 years and older, 2) someone who injected drugs, 3) sex partner of index, or 4) social network members who the index participants felt comfortable talking to about HIV or STDs. These social network members were called “network participants”. Index participants were requested to recruit those eligible network members to the study.

Participants completed baseline, 6, 12, and 18-month follow-up visits. Data collection at the study visits were the same for index and network participants, while only index participants were eligible to be randomized for the intervention. The present study focused on the 18-month follow-up assessment data for both index and network African American female participants (n=492). All protocols were approved by the Johns Hopkins Bloomberg School of Public Health IRB.

Measurements on substance use behaviors

The section on substance use behaviors in the 18-month follow-up questionnaire contained 37 questions about the history and frequency of substance use during the past 6 months. The substance abuse questions were both self-administered and interviewer-administered. Items were from the Addiction Severity Index (ASI) (McLellan, Luborsky, Woody, & O'Brien, 1980) and the Risk Assessment Battery (RAB) (Metzger, et al., 1991). Both of these instruments have been widely validated (Diaz Mesa, et al., 2010; Metzger, 1993; Navaline, et al., 1994; Rikoon, Cacciola, Carise, Alterman, & McLellan, 2006; Sun, et al., 2012; Zanis, McLellan, Cnaan, & Randall, 1994). The substances evaluated in the study included alcohol, marijuana, cocaine, crack, heroin, opiates other than heroin, buprenorphine, speedball (a combination of heroin and cocaine), sleeping pills, and stimulants. For example, to assess marijuana use, the first question was “When was the last time you smoked marijuana to get high?” on a nine-categorical response “Never”, “More than 5 years ago”, “2–5 years ago”, “Between 1 and 2 years ago”, “In the past year”, “In the past 9 months”, “In the past 6 months”, “In the past 3 months”, “In the past month”. A dichotomized variable was created to indicate participants’ marijuana use in the past 6 months (referred to as “active marijuana user”) versus marijuana use more than 6 months ago (referred as “non active marijuana user”). As the study focused on hard drug use, “active drug user” was defined if a participant used speedball, crack, cocaine or heroin within the past 6 months. Only active substance users were asked for the frequency of their drug use. We dichotomized drug use variables in order to provide the findings comparable and combinable with those of the existing literature (Nolan, 2013; Vera-Villarroel, Piqueras, Kuhne, Cuijpers, & van Straten, 2014). A dichotomized variable was created to indicate higher versus lower frequency of substance

use using median as a cut-off point. Information on route of drug administration was collected for crack, cocaine and heroin. Routes of drug administration were categorized into three subgroups: injecting, snorting/stiffing, and smoking.

A dichotomous variable of current cigarette smoking was created according to participant's answer (Yes/No) to the question -- "Do you currently smoke cigarettes?".

Anthropometric measurements

Participants' weight and height were measured by trained research staff following standard protocols (Rose & Blackburn, 1968; Willett, 1998) at the 12-month and 18-month visits (not at the baseline). The present study focused on the 18-month follow-up data and was conducted as secondary analysis. Barefoot height (in inch to nearest 0.1) was measured using a wall-mounted stadiometer. Participants were weighed without shoes and with light clothes to the nearest 0.25 pound using a digital scale. BMI (kg/m^2) was calculated as weight (pound) $\times 703/\text{height (inch)}^2$. Weight data were missing on 169 women (169/492=34.3%). Sensitivity analysis based on t-test and chi-square tests showed that women with or without weight information did not significantly differ in age, employment status, income, marital status, pregnancy status, depressive symptoms, HIV status, and substance use ($p>0.05$).

According to their BMI, participants were categorized into three groups (National Heart Lung and Blood Institute. & National Institute of Diabetes and Digestive and Kidney Diseases (U.S.), 1998): (1) BMI less than 25: normal weight; (2) BMI greater than or equal to 25: overweight; and (3) BMI greater than or equal to 30: obesity. In our sample, the number of underweight individuals with BMI less than 18.5 ($n=11$, 3.4%) was very small. Among them, 18.2% were HIV positive and 63.6% were active drug users. Due to the small sample size, underweight women were combined with normal weight group.

Covariates

The questionnaire collected data on participants' demographic and socioeconomic variables, including age, employment in the past month, income in the past 30 days, and marital status. The research staff who administered the questionnaire were properly trained and certified. Specifically, all project staff members, including interviewers, were required to complete the Johns Hopkins Bloomberg School of Public Health Protection of Human Subjects Computer-based Training and Education program, which was designed in response to the National Institutes of Health (NIH) directive requiring training on Human Subjects Protection. In addition, all interviewers attended the Maryland AIDS Administration HIV testing and counseling training and received a certificate. Depending on the experience of each interviewer, our in-house training includes reviewing protocols and taking a knowledge exam on the protocols, observing 2–3 interviews conducted by trained interviewers, completing 2–3 mock interviews with staff and a supervisor as the participant, and completing 2 interviews with a supervisor observing. Extensive quality assurance protocols are in place to monitor adherence to all interviewer protocols. Finally, project staff signed a pledge of confidentiality. Information on participants' pregnancy status was also included. A dichotomous variable of HIV status was created to indicate whether the participant had

human immunodeficiency virus (HIV) infection based on participant's self report and antibody tests (positive/negative) collected at baseline. Depressive symptoms were measured using the Center for Epidemiologic Studies Depression Scale (CES-D scale) (Radloff, 1977). The CES-D scale is self-reported and contains 20 items. The alpha coefficient of scale reliability was 0.85 in the general population and 0.90 in the patient samples. The correlations of CES-D scale with other valid self-report depression scales (i.e., the Lubin Depression Adjective Checklist, Bradburn Negative Affect and Bradburn Balance) were located at acceptable levels of concurrent validity, ranging between 0.40s and 0.70s. Having high levels of depressive symptoms was defined by a CES-D score over 20.

Statistic analysis

The final sample included 328 African American females who had body weight information at 18-month follow up. Among them, 323 had complete data on BMI. Demographic characteristics of female participants were compared across body weight status by using ANOVA for continuous variables and chi-square tests for categorical variables. Separate linear and logistic regression analyses were conducted using (1) body weight, (2) BMI, (3) overweight, and obesity as outcome variables. The primary independent variable of interest was substance use. All models were controlled for the abovementioned covariates, including age, employment status, income, marital status, pregnancy status, depressive symptoms and HIV status, as well as intra-cluster correlations between index and network participants. HIV status was also assessed as effect modifier. Approximately 67.1% of these participants were polysubstance users. Therefore, substances, including marijuana, opiate, crack/cocaine, heroin, stimulants, smoking, alcohol, etc., were controlled simultaneously in regression models. We conducted the regression analysis for multicollinearity and the tolerance values (i.e., 1/VIF) ranged between 0.30s and 0.90s. The adjusted R-squared for the regression analyses were located between 0.10–0.15.

All data analyses were conducted using SAS (9.2). Although various regression models were used, we did not make multiple comparisons adjustments (e.g., modify p values or widen confidence intervals). The reason is that Type 1 error is based on truly zero effects (not “small” effects) (Johnstone & Silverman, 2004; Krantz, 1999). Such truly zero effects may exist in genetic research (Efron & Tibshirani, 2002) but less likely in social science (Gelman, Hill, & Yajima, 2012). Statistical significance for the parameter coefficients was set at $p < 0.05$; $p < 0.10$ was defined as marginal significance.

RESULTS

Sociodemographic characteristics

Among 323 African American women who had complete data on BMI, 108 women (33.4%) were classified as under-/normal weight (Only 3.4% were under weight), 78 (24.2%) were overweight and 137 participants (42.4%) were obese (Table 1). Normal/under weight, overweight and obese women did not significantly differ in terms of their age, height, unemployment status, income level, and marital status. About 18.5% of normal/underweight women lived with HIV/AIDS and the proportion of HIV infection was significantly lower among overweight (14.1%) and obese (5.1%) women ($\chi^2 = 11.00$, $p < 0.05$). The effect size

was small with a phi coefficient of 0.19. In addition, normal/underweight women (52.8%) were significantly more likely to be active drug users than those who were overweight (38.5%) and obese (29.2%) ($\chi^2=14.11$, $p<0.05$). The effect size was moderate with a phi coefficient of 0.23.

Association between body weight status and different category of substance use

In adjusted linear regression models, neither weight nor BMI was associated with use of marijuana, opiate and other drugs such as stimulants, sleeping pills and buprenorphine (Table 2). Body weight was marginally significantly inversely associated with current heroin use ($\beta=-6.539$, Standard Error of Estimate (SEE)=3.344, $p<0.10$). Only heroin use was found to be significantly negatively associated with BMI ($\beta=-2.642$, SEE=1.198, $p<0.05$).

Several adjusted logistic regression models were conducted using (1) overweight, (2) obesity or (3) overweight and obesity as outcomes. The reference group was normal weight women. Active marijuana users were significantly less likely to be overweight (OR=0.386, 95% CI: 0.184–0.809, $p<0.05$) (Table 3). The risk of being overweight and obesity was lower among active marijuana (OR=0.537, 95% CI: 0.296–0.974, $p<0.05$) and heroin users (OR=0.505, 95% CI: 0.250–1.020, $p<0.10$) than among their counterparts.

Association between body weight status and routes of crack/cocaine/heroin use

In linear regression models after adjustment for crack/cocaine use and other routes of heroin use, both body weight ($\beta=-15.344$, SEE=5.079, $p<0.01$) and BMI ($\beta=-5.303$, SEE=2.148, $p<0.05$) were significantly lower among heroin smokers (Table 4).

In logistic regression models, as compared to non-snorting/sniffing-heroin users and non-heroin users, active snorting/sniffing heroin users were at a marginally significantly lower risk of overweight and obesity (OR=0.495, 95% CI: 0.232–1.056, $p<0.10$) (Table 5). No other significant associations were found between body weight status and routes of crack/cocaine/heroin use (all z-scores >-1.60 , $p>0.10$).

Association between body weight status and substance use frequency

In linear regression models, BMI was inversely associated with higher frequency of crack/cocaine and heroin use (Table 4). The decrease in BMI was greater among more frequent users (once a day) ($\beta=-3.291$, SEE=1.767, $p<0.10$ for speedball, crack or cocaine; $\beta=-4.499$, SEE=1.885, $p<0.05$ for heroin) than less frequent users (< once a day) ($\beta=-1.403$, SEE=1.269, $p>0.10$ for speedball, crack or cocaine; and $\beta=-2.343$, SEE=1.368, $p<0.10$ for heroin).

In logistic regression models, overweight was significantly inversely associated with active marijuana use, whether frequent or less frequent (Table 5). The contribution of marijuana to obesity as well as overweight and obesity tended to be stronger among frequent marijuana users (OR=0.523, 95% CI: 0.240–1.141, $p>0.10$ for obesity; OR=0.459, 95% CI: 0.230–0.916, $p<0.05$ for overweight and obesity). As compared to non-heroin use, using heroin less than once a day was marginally significantly less likely to be overweight and obesity (OR=0.518, 95% CI: 0.242–1.109, $p<0.10$). Using heroin more than once a day seemed to

have an even lower risk of obesity (OR=0.193, 95% CI: 0.033–1.129, $p<0.10$) than non-heroin use, however the difference was only marginally significant.

HIV status was significantly negatively associated with body weight, BMI, and obesity among these women (all t-scores <-2.00 and z-scores <-4.00 , $p<0.05$) (data not shown). However, none of the interaction terms between HIV status and drug use were statistically significant (all t-scores >-0.60 and z-scores >-0.50 , $p>0.10$), which suggested absence of effect modification by HIV status.

DISCUSSION

The present study examined the relationship between substance use and body weight status among a sample of urban African American women. Active marijuana and heroin users were less likely to be overweight and obese as compared to non-marijuana or heroin users. Body weight and BMI were found to be lower among more frequent heroin users, particularly heroin smokers.

We found that the impact of substance use on body weight status differed by the frequency and route of administration. An inverse association between frequent heroin use and body weight status were observed in this sample, particularly among heroin smokers. Substances such as heroin may compete for foods in brain reward sites and therefore suppress appetite (Kiefer & Wiedemann, 2004; Trinko, et al., 2007; Volkow, et al., 2004; Volkow, et al., 2008; Wang, et al., 2001). The significant negative contribution of smoked heroin to body weight and BMI may be due to faster rate of brain delivery by smoking than by injecting, snorting or other routes (Cutter, 2010; Volkow, 2006). Our findings also suggest that the inverse association was enhanced if heroin was administered more frequently, i.e., greater than once a day, which were consistent with previous research. Frequent use of heroin indicates a higher level of addiction and longer history of drug use (Fox, et al., 2005; Gfroerer & Brodsky, 1993; Gossop, Griffiths, Powis, & Strang, 1992).

A multitude of previous studies have examined nutritional status among drug use populations (Aylett, 1978; Forrester, Tucker, & Gorbach, 2004, 2005; Forrester, et al., 2000; Himmelgreen, et al., 1998; McCombie, et al., 1995; Nazrul Islam, Jahangir Hossain, Ahmed, & Ahsan, 2002; Quach, et al., 2008; Santolariafernandez, et al., 1995; Tang, et al., 2010; Varela, et al., 1990). Clinical results have indicated that heroin use disorder is associated with poor nutrition and lower body mass among women (Cofrancesco, et al., 2007). One study in the UK showed that prevalence of underweight was significantly greater among female drug users at younger group (i.e., 20–24 years old) than among the UK population (McCombie, et al., 1995). Another study conducted among male drug addicts in Dhaka, Bangladesh reported significantly lower BMI, hemoglobin, and serum total protein and albumin levels among addicts as compared to non-addicted controls (Nazrul Islam, et al., 2002). Some studies found negative association between BMI and drug use solely among women but not among men (Forrester, et al., 2000; Santolariafernandez, et al., 1995).

Contrary to our hypothesis, our analysis indicated a negative association between body weight status and marijuana use. Similar results were reported by several recent

epidemiological studies. One study among young males found an inverse relationship between BMI and recent illicit drug use including cannabinoids (Bluml, et al., 2012). Another study based on the U.S. representative data reported non-significant relationship between marijuana and body weight (Barry & Petry, 2009). A potential explanation is despite high caloric diet in marijuana users, they may also have higher metabolic rates (Rodondi, et al., 2006).

Our data did not find significant associations between alcohol or nicotine use and body weight status. Previous studies on alcohol use have provided conflicting results. Although cross-sectional studies conducted in non-clinical populations reported inverse relationships between alcohol consumption and BMI among women (Hellerstedt, Jeffery, & Murray, 1990; Wannamethee, Shaper, & Whincup, 2005), other studies failed to find a relationship between alcohol abuse and obesity (Bluml, et al., 2012; Scott, et al., 2008). Some studies showed that number of cigarettes per day increased risk of obesity among both male and female smokers (Chiolero, Jacot-Sadowski, Faeh, Paccaud, & Cornuz, 2007; Zimlichman, et al., 2005), while one study reported that overweight women were at higher risk for lifetime nicotine dependence and obese women were at lower risk for past-year nicotine dependence (Barry & Petry, 2009). These mixed results may be due to different populations.

The current study has the following strengths: 1) participants' weight and height were measured by trained research staff following standard protocols, which were more accurate than self-reported values; 2) we have studied an often understudied but at risk population; 3) a variety of substances including nicotine, alcohol, marijuana, cocaine, crack, heroin, opiates other than heroin, buprenorphine, speedball, sleeping pills, and stimulants were screened using the survey questionnaire; 4) both the frequency and route of substance consumption were evaluated; 5) body weight status was examined as both continuous outcome variables (i.e., body weight and BMI) and categorical outcome variables (i.e., overweight and obesity). The contribution of substance use to various forms of body weight status was able to be estimated by using linear and logistic regression models; and 6) compared to previous research on drug use and body weight status (Quach, et al., 2008; Tang, et al., 2010), our study collected detailed demographic information. A number of potential confounders were adjusted in our models, including participants' age, employment status, income, marital status, pregnancy status, depressive symptoms, and HIV infection status.

Our study also has several limitations: 1) the present study was based on cross-sectional data and we could not establish their causal relationships; 2) compared to previous studies based on the national representative data, our study had a small sample size recruited from an improvised community setting. The current findings may not be generalizable to other populations. Nevertheless, given the statistical power, we were still able to find significant associations; 3) Part of the information on substance use was collected based on self report which has been demonstrated to have good validity (Darke, 1998), yet it may be subject to social desirability and assessment methods such as drug tests may be considered in the future studies; and 4) we did not collect information on dietary intake and physical activity level. Although it has been well known that drug users have more food insecurity problems and poorer diet (Himmelgreen, et al., 1998), no evidence has shown that dietary intake and physical activity contributed to the observed differences in weight and BMI between HIV-

positive drug users and HIV-positive non-drug users (Forrester, et al., 2004, 2005; Tang, et al., 2010). Therefore, dietary intake and physical activity do not meet the criteria for being potential confounders, and we believe that non-adjustment for dietary intake and physical activity level would not significantly affect the estimates derived from the multivariate models we used.

CONCLUSIONS

We found significant negative associations between various substance use and body weight status (body weight, BMI, overweight and obesity). The associations differed by frequency and route of administration. Further research, e.g., longitudinal studies, is needed to better understand the causal relationship between substance use and body weight status. Chronic diseases and substance abuse are key factors in health disparities in the United States. More studies are in need to improve the understanding of common determinants of those health conditions and inform future behavioral interventions that can address multi-level and multiple behavioral risk factors. Meanwhile, there was no association between using crack and lower weight in this population, and it is important to disseminate this finding to the public to reduce the proclivity of some individuals to use crack to reduce their weight.

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GLOSSARY

Active drug user

A participant used speedball, crack, cocaine or heroin within the past 6 months

Active marijuana user

A participant used marijuana in the past 6 months

ANOVA

Analysis of variance

ASI

Addiction Severity Index

CES-D

Center for Epidemiologic Studies Depression Scale

Non active drug user

A participant used speedball, crack, cocaine or heroin more than 6 months ago

Non active marijuana user

A participant used marijuana more than 6 months ago

Obesity

Body mass index (BMI) of adults greater than or equal to 30

Overweight

Body mass index (BMI) of adults greater than or equal to 25

RAB

Risk Assessment Battery

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Sociodemographic characteristics by body weight status among African American females (n=323)^a

Table 1

	Normal weight (N=108)	Overweight (N=78)	Obesity (N=137)	P value
Mean, SD				
Age (yrs)	43.6	44.0	42.2	8.8 0.218
Weight (kg)	57.9	72.8	98.7	18.9 <0.001
Height (cm)	163.5	163.4	162.3	9.0 0.438
BMI (kg/m ²)	21.5	27.2	37.3	6.1 <0.001
N, %				
Unemployment (the past 6 months)	87	58	102	74.5 0.471
Income (in the past 30 days)				0.943
<\$500	45	30	51	37.2
\$500–\$999	42	32	60	43.8
\$1,000	20	16	26	19.0
Marital status				0.346
Married or in a committed relationship	55	34	54	39.4
Divorced/widowed/separated	9	8	20	14.6
Single	44	36	63	46.0
Current pregnancy	2	0	3	2.2 0.433
Depression (CESD score ≥ 20)	52	29	50	36.5 0.143
HIV infection	20	11	7	5.1 0.004
Current smoker	94	61	110	80.3 0.235
Active alcohol use (in the past 6 months)	76	51	78	56.9 0.088
Active drug use (in the past 6 months)	57	30	40	29.2 0.003

^aDifferences were compared by ANOVA or Chi-square tests.

Table 2Association between body weight, BMI and substance use among African American females^a

		Weight (kg)	BMI (kg/m²)
Active marijuana use (vs. no)	β coefficient	−3.836	−1.038
	SE	(2.916)	(1.105)
	P value	0.190	0.348
Active opiate (other than heroin) use (vs. no)	β coefficient	−5.701	−1.451
	SE	(5.105)	(1.948)
	P value	0.265	0.457
Active speedball, crack or cocaine use (vs. no)	β coefficient	−2.557	−1.573
	SE	(3.184)	(1.180)
	P value	0.423	0.184
Active heroin use (vs. no)	β coefficient	−6.539	−2.642
	SE	(3.344)	(1.198)
	P value	0.052	0.028
Active other drug use (e.g., stimulants, sleeping pills, buprenorphine) (vs. no)	β coefficient	6.582	2.520
	SE	(5.783)	(2.371)
	P value	0.256	0.289
Current smoking (vs. no)	β coefficient	−1.330	−0.996
	SE	(3.289)	(1.221)
	P value	0.686	0.415
Active alcohol use (vs. no)	β coefficient	−3.210	−0.791
	SE	(3.014)	(1.080)
	P value	0.288	0.465

^aLinear regression models were adjusted for age, unemployment, income, marital status, current pregnancy, depression, HIV infection, and different types of substance use other than the substance of interest.

Table 3Association between body weight status and substance use among African American females^a

		Overweight	Obesity	Overweight and obesity
Active marijuana use (vs. no)	Odds ratio	0.386	0.653	0.537
	95% CI	(0.184, 0.809)	(0.327, 1.304)	(0.296, 0.974)
	P value	0.012	0.227	0.041
Active opiate (other than heroin) use (vs. no)	Odds ratio	0.814	0.914	0.756
	95% CI	(0.204, 3.243)	(0.230, 3.627)	(0.241, 2.369)
	P value	0.770	0.898	0.631
Active speedball, crack or cocaine use (vs. no)	Odds ratio	0.618	0.544	0.631
	95% CI	(0.288, 1.324)	(0.231, 1.278)	(0.330, 1.207)
	P value	0.216	0.162	0.164
Active heroin use (vs. no)	Odds ratio	0.582	0.513	0.505
	95% CI	(0.252, 1.344)	(0.218, 1.207)	(0.250, 1.020)
	P value	0.205	0.126	0.057
Active other drug use (e.g., stimulants, sleeping pills, buprenorphine) (vs. no)	Odds ratio	1.712	1.968	2.008
	95% CI	(0.579, 5.058)	(0.540, 7.176)	(0.656, 6.144)
	P value	0.331	0.305	0.222
Current smoking (vs. no)	Odds ratio	0.547	0.887	0.702
	95% CI	(0.234, 1.279)	(0.393, 2.001)	(0.341, 1.445)
	P value	0.164	0.772	0.337
Active alcohol use (vs. no)	Odds ratio	1.276	0.760	0.887
	95% CI	(0.635, 2.564)	(0.393, 1.470)	(0.488, 1.614)
	P value	0.494	0.415	0.695

^aLogistic regression models were adjusted for age, unemployment, income, marital status, current pregnancy, depression, HIV infection, and different types of substance use other than the substance of interest.

Table 4

Association between body weight, BMI, and route and frequency of substance administration among African American females

		Weight (kg)	BMI (kg/m ²)
Route^a			
Injecting speedball or cocaine (vs. no)	β coefficient	-7.084	1.563
	SE	(7.254)	(3.171)
	P value	0.330	0.622
Injecting heroin (vs. no)	β coefficient	-8.478	-2.800
	SE	(6.533)	(2.871)
	P value	0.196	0.330
Snorting or sniffing cocaine (vs. no)	β coefficient	5.335	2.694
	SE	(5.008)	(1.646)
	P value	0.288	0.103
Snorting or sniffing heroin (vs. no)	β coefficient	-4.201	-2.479
	SE	(3.695)	(1.315)
	P value	0.257	0.061
Smoking crack or cocaine (vs. no)	β coefficient	-2.832	-1.734
	SE	(3.243)	(1.212)
	P value	0.383	0.154
Smoking heroin (vs. no)	β coefficient	-15.344	-5.303
	SE	(5.079)	(2.148)
	P value	0.003	0.014
Frequency^b			
Active marijuana use			
<1/week vs. no	β coefficient	-2.523	-0.945
	SE	(3.702)	(1.354)
	P value	0.496	0.486
1/week vs. no	β coefficient	-5.619	-1.458
	SE	(3.473)	(1.349)
	P value	0.107	0.281
Active opiate (other than heroin) use (vs. no)			
<1/week vs. no	β coefficient	-6.192	-2.724
	SE	(4.573)	(1.756)
	P value	0.177	0.122
1/week vs. no	β coefficient	-6.125	0.772
	SE	(8.500)	(3.261)
	P value	0.472	0.813
Active speedball, crack or cocaine use (vs. no)			
<1/day vs. no	β coefficient	-2.669	-1.403
	SE	(3.448)	(1.269)
	P value	0.439	0.270

		Weight (kg)	BMI (kg/m ²)
1/day vs. no	β coefficient	-5.032	-3.291
	SE	(5.445)	(1.767)
	P value	0.356	0.064
Active heroin use			
<1/day vs. no	β coefficient	-4.685	-2.343
	SE	(3.872)	(1.368)
	P value	0.227	0.088
1/day vs. no	β coefficient	-13.893	-4.499
	SE	(4.634)	(1.885)
	P value	0.003	0.018
Active other drug use (e.g., stimulants, sleeping pills, buprenorphine)			
<1/week vs. no	β coefficient	2.779	-0.251
	SE	(5.853)	(1.860)
	P value	0.635	0.893
1/week vs. no	β coefficient	9.220	4.950
	SE	(7.858)	(3.557)
	P value	0.242	0.165
Active alcohol use			
<2/week vs. no	β coefficient	-4.964	-1.559
	SE	(3.098)	(1.089)
	P value	0.110	0.153
2/week vs. no	β coefficient	-0.403	0.485
	SE	(3.767)	(1.415)
	P value	0.915	0.732

^aLinear regression models were adjusted for age, unemployment, income, marital status, current pregnancy, depression, HIV infection, current smoking, active alcohol use, active marijuana use, active opiate use, active other drug use, and different cocaine/heroin routes other than the route of interest.

^bLinear regression models were adjusted for age, unemployment, income, marital status, current pregnancy, depression, HIV infection, current smoking, active alcohol use, and different types of drug use other than the drug of interest.

Table 5

Association between body weight status and route and frequency of substance administration among AfricanAmerican females

		Overweight	Obesity	Overweight and obesity
Route^a				
Injecting speedball or cocaine (vs. no)	Odds ratio	0.483	1.900	0.846
	95% CI	(0.031, 7.536)	(0.206, 17.53)	(0.095, 7.509)
	P value	0.604	0.571	0.881
Injecting heroin (vs. no)	Odds ratio	1.237	0.688	0.874
	95% CI	(0.097, 15.72)	(0.083, 5.723)	(0.114, 6.716)
	P value	0.870	0.729	0.897
Snorting or sniffing cocaine (vs. no)	Odds ratio	1.845	1.966	2.018
	95% CI	(0.577, 5.905)	(0.661, 5.850)	(0.779, 5.230)
	P value	0.302	0.224	0.148
Snorting or sniffing heroin (vs. no)	Odds ratio	0.504	0.528	0.495
	95% CI	(0.198, 1.286)	(0.213, 1.306)	(0.232, 1.056)
	P value	0.152	0.167	0.069
Smoking crack or cocaine (vs. no)	Odds ratio	0.589	0.493	0.590
	95% CI	(0.265, 1.312)	(0.206, 1.180)	(0.304, 1.146)
	P value	0.195	0.112	0.119
Smoking heroin (vs. no)	Odds ratio	2.373	NA ^b	0.735
	95% CI	(0.218, 25.87)		(0.086, 6.313)
	P value	0.478		0.779
Frequency^c				
Active marijuana use				
<1/week vs. no	Odds ratio	0.345	0.795	0.577
	95% CI	(0.129, 0.920)	(0.328, 1.922)	(0.273, 1.220)
	P value	0.034	0.610	0.150
1/week vs. no	Odds ratio	0.383	0.523	0.459
	95% CI	(0.159, 0.922)	(0.240, 1.141)	(0.230, 0.916)
	P value	0.032	0.103	0.027
Active opiate (other than heroin) use (vs. no)				
<1/week vs. no	Odds ratio	0.886	0.503	0.613
	95% CI	(0.180, 4.353)	(0.079, 3.201)	(0.174, 2.163)
	P value	0.882	0.467	0.447
1/week vs. no	Odds ratio	0.566	2.087	1.101
	95% CI	(0.047, 6.847)	(0.298, 14.62)	(0.192, 6.333)
	P value	0.654	0.459	0.914
Active speedball or cocaine use (vs. no)				
<1/day vs. no	Odds ratio	0.626	0.544	0.649
	95% CI	(0.284, 1.379)	(0.221, 1.338)	(0.329, 1.279)

		Overweight	Obesity	Overweight and obesity
1/day vs. no	P value	0.245	0.185	0.212
	Odds ratio	0.660	0.347	0.490
	95% CI	(0.129, 3.370)	(0.086, 1.400)	(0.145, 1.656)
	P value	0.617	0.137	0.251
Active heroin use				
<1/day vs. no	Odds ratio	0.525	0.588	0.518
	95% CI	(0.215, 1.283)	(0.237, 1.460)	(0.242, 1.109)
	P value	0.158	0.253	0.090
1/day vs. no	Odds ratio	0.755	0.193	0.411
	95% CI	(0.169, 3.385)	(0.033, 1.129)	(0.105, 1.616)
	P value	0.714	0.068	0.203
Active other drug use (e.g., stimulants, sleeping pills, buprenorphine)				
<1/week vs. no	Odds ratio	1.691	0.824	1.195
	95% CI	(0.430, 6.644)	(0.186, 3.640)	(0.343, 4.165)
	P value	0.452	0.798	0.779
1/week vs. no	Odds ratio	1.574	3.927	3.143
	95% CI	(0.360, 6.873)	(0.605, 25.48)	(0.649, 15.220)
	P value	0.547	0.152	0.155
Active alcohol use				
<2/week vs. no	Odds ratio	1.205	0.612	0.785
	95% CI	(0.559, 2.596)	(0.300, 1.250)	(0.415, 1.484)
	P value	0.634	0.178	0.456
2/week vs. no	Odds ratio	1.449	0.989	1.086
	95% CI	(0.619, 3.392)	(0.447, 2.191)	(0.529, 2.232)
	P value	0.393	0.979	0.822

^a Logistic regression models were adjusted for age, unemployment, income, marital status, current pregnancy, depression, HIV infection, current smoking, active alcohol use, active marijuana use, active opiate use, active other drug use, and different cocaine/heroin routes other than the route of interest.

^b None of heroin smokers were obese.

^c Logistic regression models were adjusted for age, unemployment, income, marital status, current pregnancy, depression, HIV infection, current smoking, active alcohol use, and different types of drug use other than the drug of interest.