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Research report

The skinny on cocaine: Insights into eating behavior and body weight in cocaine-dependent men ☆,☆☆

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ABSTRACT

There is a general assumption that weight loss associated with cocaine use reflects its appetite suppressing properties. We sought to determine whether this was justified by characterizing, in detail, alterations in dietary food intake and body composition in actively using cocaine-dependent individuals. We conducted a cross-sectional case-control comparison of 65 male volunteers from the local community, half of whom satisfied the DSM-IV-TR criteria for cocaine dependence ($n = 35$) while the other half had no personal or family history of a psychiatric disorder, including substance abuse ($n = 30$). Assessments were made of eating behavior and dietary food intake, estimation of body composition, and measurement of plasma leptin. Although cocaine users reported significantly higher levels of dietary fat and carbohydrates as well as patterns of uncontrolled eating, their fat mass was significantly reduced compared with their non-drug using peers. Levels of leptin were associated with fat mass, and with the duration of stimulant use. Tobacco smoking status or concomitant use of medication did not affect the significance of the results. Weight changes in cocaine users reflect fundamental perturbations in fat regulation. These are likely to be overlooked in clinical practice but may produce significant health problems when cocaine use is discontinued during recovery.

Introduction

There is a wide belief that cocaine use suppresses appetite, thereby reducing body weight (Cochrane, Malcolm, & Brewerton, 1998). This view is supported by observations that problematic weight gain may rapidly emerge on cessation of regular cocaine use (Cowan & Devine, 2008), a distressing phenomenon that can lead to relapse. Many clinical interventions are therefore shaped by the belief that eating habits and weight-related problems are not an issue during cocaine use (VanBuskirk & Potenza, 2010), but rather occur in abstinent users to restore the weight that they previously lost due to a cocaine-induced suppression of appetite (Vanbuskirk & Potenza, 2010). As a consequence, community treatment services try to address drug users' weight problems with educational interventions promoting healthy eating (Cowan & Devine, 2012). However, we argue that a more nuanced view is needed, one that acknowledges a major disturbance in eating behaviors and metabolism accompanying cocaine use.

Research in experimental animals indicates that cocaine's anorexic effects are relatively transient (Balopole, Hansult, & Dorph, 1979), with intake of food delayed but not actually reduced (Cooper & Vanderhoek, 1993), and followed by a compensatory increase in the consumption of fat and carbohydrates (Bane, Mccoy, Stump, & Avery, 1993). Paradoxically, the weight gain generally associated with increased caloric density and fat intake is, however, not seen in cocaine-treated animals (Bane et al., 1993). Similar observations have also been noted in humans: regular cocaine users report eating fewer balanced meals than non-using peers, with an expressed preference for fatty foods, but no corresponding weight gain (Castro, Newcomb, & Cadish, 1987). Given that the significant weight gain following cocaine abstinence is not only a source of

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major personal suffering but also has profound implications for health and recovery, we suggest that there is a pressing need for a more detailed understanding of the effects of cocaine on dietary intake and body composition. This is an important consideration given that by far the most substantial health burden arising from drug addiction lies not in the direct effects of drug intoxication but in the secondary effects on physical health.

In the current study, we characterized key patterns of eating behavior and weight change in cocaine dependence. We measured circulating levels of leptin, body composition and self-reported eating habits in a sample of cocaine-dependent men and compared them to matched healthy non-drug using male volunteers. We hypothesized that chronic cocaine use is associated with changes in eating patterns, specifically with regard to the consumption of fat and carbohydrates that had been observed in cocaine-treated animals. We predicted that changes in dietary food intake are reflected in alterations of body composition.

Methods

Study sample

Sixty-five male volunteers participated in this study. They were recruited within the local community either upon referral from health care professionals, probation officers, advertisements or by word-of-mouth. Drug-using volunteers had to meet the DSM-IV-TR criteria for cocaine dependence (American Psychiatric Association, 2000) whereas control volunteers had to have no personal or family history of substance misuse disorders. Exclusion criteria for all volunteers included a lifetime history of a psychotic disorder; a neurological illness or a traumatic head injury; an autoimmune or a metabolic disorder; and a current infection with HIV. All volunteers consented in writing and were screened for current psychiatric disorders using the Mini-International Neuropsychiatric Inventory (Sheehan et al., 1998). Current and past psychopathology in the drug users was further evaluated using the structured clinical interview for DSM-IV (First, Spitzer, Gibbon, & Williams, 2002). Verbal intelligence was estimated in all volunteers using the National Adult Reading Test (Nelson, 1982). All participants further completed the Barratt Impulsiveness Scale (BIS-11, Patton, Stanford, & Barratt, 1995) and the Obsessive–Compulsive Inventory (OCI-R, Foa et al., 2002) to assess both impulsive and compulsive personality traits. The protocol was approved by the National Research Ethics Committee (NREC10/H0306/69, PI: KD Ersche).

All drug users satisfied the DSM-IV-TR (American Psychiatric Association, 2000) criteria for cocaine dependence. They were non-treatment seeking and actively using cocaine either in powdered (40%) or in freebase form (60%). They had been using cocaine for an average of 15.3 years (±9.0 SD), starting at the age of 19.2 years (±5.5 SD). On the testing day, urine samples tested positive for stimulants in all except four users, indicating that they consumed either cocaine or amphetamines within the detection window of 72 h (Preston et al., 2002). On the Obsessive-Compulsive Drug Use Scale (OCDUS, Franken, Hendriks, & Van Den Brink, 2002) they indicated moderate levels of cocaine-related compulsivity (mean score = 23.8 ± 10.7 SD). The majority of the drug user sample also met criteria for dependence on another substance (91% nicotine, 43% opiates, 29% alcohol, 20% cannabis, 3% amphetamines) and used other drugs sporadically (68% cannabis, 20% sedatives, 15% opiates, 14% ecstasy, 3% hallucinogens). Participants with co-morbid opiate dependence were either prescribed methadone (31%, mean dose: 55 mg ± 16.2SD) or buprenorphine (9%, mean dose: 3 mg ± 2.6SD), or were using street heroin on a daily basis (3%). A quarter of cocaine users reported taking prescribed medication, including narcotic-like pain relief (11%), antidepressants (9%), benzodiazepines (9%), and d-amphetamine (3%).

The healthy volunteers were screened for drug and alcohol abuse, but none met criteria for abuse or dependence. Thirteen percent were current tobacco smokers and 57% reported past tobacco smoking habits. Half of the healthy volunteer group (53%) reported having had social experiences with cannabis but never had used the drug regularly; none of them reported taking prescribed or illicit drugs on a regular basis and urine sampled on the testing day was negative for illicit substances.

Procedures

Participants were examined in the Wellcome Trust Clinical Research Facility at Addenbrooke's Hospital, Cambridge, U.K. A trained research assistant assessed participants' eating behavior and habitual diets using validated instruments. The Food Frequency Questionnaire (FFQ) determines individuals' habitual dietary food intake by measuring the frequency with which food items have been consumed over the past year (Bingham et al., 2001). The FFQ was initially developed for the European Prospective Investigation to evaluate the role of diet and nutritional status in cancer rates and has been widely used ever since (http://www.srl.cam.ac.uk/epic/nutmethod/FFQ.shtml). It contains a list of 131 food items that are commonly consumed in the U.K. as well as specific questions regarding the fat content of dietary products and the types of fat used for cooking. For each food item, the average consumption per day was estimated on the basis of the reported portion size and the frequency that each food item was consumed using specifically-developed software programs (Welch, Luben, Khaw, & Bingham, 2005; Welch et al., 2001).

The Three-Factor Eating Questionnaire (TFEQ), originally developed by Stunkard and Messick (1985) and revised by Karlsson, Persson, Sjostrom, and Sullivan (2000), consists of 18 items to measure three different aspects of eating behavior: *restrained eating* (deliberate restriction of food intake to control body weight), *uncontrolled eating* (tendency to eat more than intended by losing control over food intake), and *emotional eating* (tendency to eat in response to emotional cues). Participants indicate the extent to which these behaviors reflect their eating pattern on a 4-point scale.

Anthropometric measurements were acquired by a metabolic physiologist using both manual measurements and dual-energy X-ray absorptiometry scans (DXA; GE Lunar Prodigy, Madison, WI) to determine fat mass, non-bone lean mass and bone mineral density. Levels of plasma leptin were measured in light of the hypothesized influence on body composition using an RIA kit (Antibodies & Standards from R&D Systems, Abingdon UK) with an in-house two-site microtitre plate-based DELFIA assay with a between batch imprecision of 7.1% at 2.7 ng/ml, 3.9% at 14.9 ng/ml, 5.7% at 54.9 ng/ml (in-house data).

Statistical analysis

Responses on the FFQ were processed using a modified version of the DINER and CAFE programs (Welch et al., 2001, 2005). All data were analyzed using the Statistical Package for Social Sciences (SPSS.V20; IBM). Group difference in demographics were analyzed using *t*-tests, except for leptin levels, which did not meet parametric requirements, so the Mann–Whitney *U*-test was used. As in 6% of cases anthropometry measures were taken by a different member of staff, analysis of co-variance was used for group comparisons in anthropometry and the categorical variable 'staff' was included as a covariate. Questionnaire data were analyzed using multivariate analysis of variance. To statistically control for significant group differences in energy and alcohol intake in the FFQ analysis, we