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Research report

Clues to maintaining calorie restriction? Psychosocial profiles of successful long-term restrictors ☆

Angela C. Incollingo Belsky [a], Elissa S. Epel [b] and A. Janet Tomiyama [a,*]

[a] Department of Psychology, University of California, Los Angeles, CA, USA
[b] Department of Psychiatry, University of California, San Francisco, CA, USA

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ABSTRACT

To combat the obesity epidemic, interventions and treatments often recommend low-calorie dieting. Calorie restriction (CR) as a weight intervention, however, is often unsuccessful, as most people cannot sustain the behavior. Yet one small group has maintained extreme CR over years – members of the CR Society and followers of The CR Way. This study examined stable psychosocial characteristics of these individuals to identify traits that may promote success at long-term CR. In 65 participants, we measured diet, eating behaviors, and personality traits comparing calorie restrictors with two age-, gender-, ethnicity-, and education-matched comparison groups (normal weight and overweight/obese). We first tested whether the CR group restricted calories without indications of eating disorder pathology, and second, what crystallized psychosocial characteristics set them apart from their nonrestricting comparisons. Results indicated the CR group averaged 10 years of CR but scored lower than comparison groups on measures of disordered eating ($p < .001$) and psychopathology ($p < .001$). Particularly against overweight/obese participants, CR participants scored lower on neuroticism ($p < .04$) and hostility ($p < .01$), and were stronger in future time orientation ($p < .05$). Overall, CR profiles reflected high self-control and well being, except for having few close relationships. This study suggests a potential predisposition for successful long-term CR without disordered eating. Since modifying trait factors may be unrealistic, there may be psychosocial boundaries to the capacity for sustaining CR. Paralleling a movement toward personalized medicine, this study points toward a personalized *behavioral* medicine model in behavioral nutrition and treatment of overweight/obesity.

Introduction

Overweight and obesity are highly prevalent in the United States (Flegal, Carroll, Kit, & Ogden, 2012), yet weight-loss is an elusive goal and dieting an often ineffective solution. While dieting – defined here as calorie restriction (CR) – does result in initial weight-loss and is a common clinical recommendation for weight-loss (van Dillen, van Binsbergen, Koelen, & Hiddink, 2013), randomized controlled trials of dieting demonstrate average *maintained* weight-loss below 1 kg (2.1 lbs; Tomiyama, Ahlstrom, & Mann, 2013). The real challenge then is maintenance; indeed, dieting research has found that the average man could sustain CR for only 6 weeks and the average woman only 4 weeks (Williamson, Serdula, Anda, Levy, & Byers, 1992). CR adherence has been demonstrated to be strongest in the initial weeks with nonadherence rising in subsequent months (Jeffery et al., 2000), and even staff-supported interventions receive only 25% attendance at treatment sessions after 12 months (Jeffery, Wing, Thorson, & Burton, 1993). This highlights the paradox of dieting: for optimal weight-loss, dieting should continue indefinitely, but dieting failure increases over time. Accordingly, CR maintenance failure has been identified as the strongest basis for modest weight-loss outcomes (Heymsfield et al., 2007). Perhaps then, sustained weight-loss is unobtainable largely because CR is unsustainable.

To understand why CR might be unsustainable for many who are seeking weight-loss, a critical step is identifying individual differ-

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* Corresponding author.
E-mail address: tomiyama@psych.ucla.edu (A.J. Tomiyama).

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ences underlying successful long-term restriction. Although dieting failure is the norm and long-term successes are uncommon, fortunately, there is a small cohort successfully adhering to CR for years to even decades – the Calorie Restriction (CR) Society and followers of The CR Way. Since long-term CR is their hallmark, identifying distinguishing behavioral and psychosocial characteristics of these individuals may help predict which individuals might be successful at CR and when CR might be a recommendable weight-loss intervention.

Of similar attempts to understand dieting success, most notable is the National Weight Control Registry, which studies individuals with self-reported weight-loss of at least 30 pounds and maintenance of at least 1 year. The Registry averages 6.2 years of weight-loss maintenance and has provided valuable information about common practices of weight-loss maintenance such as daily weighing and exercising (Thomas, Bond, Phelan, Hill, & Wing, 2014). Building on these findings, our study sought to answer an upstream question: what type of individuals can maintain calorie-restricted diets over the long-term, and how are these people unique? For comparison, we recruited free-eating non-CR individuals to more clearly understand the distinguishing characteristics of successful long-term restrictors. Furthermore, we sharpened our inclusion criteria to at least 2 years of CR (whenever possible obtaining third-party confirmation), resulting in a CR group that, upon enrollment, already averaged 10 years of CR. Before conducting any comparisons, we verified the CR group's self-report behavior, using objective measures such as fasting glucose levels to confirm that they were indeed restricting calories.

Our first aim was to determine whether the CR group differed from non-CR comparisons in disordered eating symptomatology to ensure that any observed differences would be attributable to a unique ability to maintain long-term CR rather than psychopathological traits common to anorexia nervosa. We therefore tested for common symptoms of eating disorders such as excessive shape and weight concern (Gowers & Shore, 2001) and psychopathology like depressive symptomology (Ackard, Croll, & Kearney-Cooke, 2002; Cachelin & Regan, 2006; Crow, Eisenberg, Story, & Neumark-Sztainer, 2006; Gillen, Markey, & Markey, 2012) and obsessive compulsive tendencies (Rothenberg, 1986). We also tested differences in behavioral eating patterns such as external food cue sensitivity, emotional eating, and restraint.

Our second aim was to test our hypothesis that, considering dieting failure is the norm, the CR group must possess key personality characteristics or self-regulation abilities, unrelated to eating (more specific to behavior in general rather than uniquely about eating), predisposing them to successful CR. In the context of this cross-sectional design, we focused on relatively stable characteristics in a preliminary attempt to grasp the directionality of correlational findings. Low neuroticism and high conscientiousness have been identified as influential in successful short-term dieting (Heaven, Mulligan, Merrilees, Woods, & Fairooz, 2001). Therefore, we expected the CR group would score lower on neuroticism and higher on conscientiousness than free-eaters. Since compulsive eating, versus controlled eating, is associated with hostility (Kagan & Squires, 1984; van den Bree, Przybeck, & Cloninger, 2006), we also hypothesized that the CR group would demonstrate lower hostility, congruent with their considerable control over eating. CR maintenance also requires delay of gratification (Epstein, Salvy, Carr, Dearing, & Bickel, 2010), and similarly, future time orientations are positively associated with weight management behaviors and negatively associated with obesity (Guthrie, Butler, Lessl, Ochi, & Ward, 2013). Therefore, we predicted that the CR group would show stronger future-oriented and weaker present-focused time perspectives.

Finally, as our calorie restrictors varied widely in the length of time they had practiced CR, our third aim was to determine whether positive characteristics were strongest in those who practiced the longest. This would lead us to infer that the traits may facilitate the maintenance of CR. Thus, there might be a relationship between duration of CR practice and both key psychosocial characteristics and markers of CR behavior. In this vein, we tested for associations between years of CR, calorie consumption, and the above-mentioned stable psychosocial characteristics. We ultimately aimed to determine, at least preliminarily, if these qualities would be related to the ability to better maintain CR over time, although in a cross-sectional manner.

Materials and methods

Subjects

We recruited 30 individuals from the CR Society and followers of The CR Way. We chose this population as they are the largest organization of calorie restrictors with detailed documentation of restriction history. This group also explicitly prioritizes optimal nutrition, which mitigated concerns about malnutrition. Inclusion criteria for the CR group were reporting (1) Body Mass Index (BMI; weight [kg]/height^2 [m]) 24.99 or below and (2) over 2 years of CR. Whenever possible, the President of The CR Way Longevity Center and Vice President for Research of the CR Society International and the Chairman of the Board of the CR Society International and Treasurer and Vice President of The CR Way Longevity Center verified each participant's self-reported duration of CR.

We also recruited two matched comparison groups: (a) normal weight (BMI 18.5–24.99) free-eaters ($n = 16$) and (b) overweight/obese (BMI 25+) free-eaters ($n = 25$) to ensure that the comparisons represented a broad BMI range. Six of these comparisons were siblings of CR participants. We matched the comparison groups on age, gender, ethnicity, and educational attainment. All participants were nonsmokers and none was pregnant. We recruited the CR group in collaboration with the CR Society and The CR Way and then recruited comparison groups from the surrounding community targeting demographics matching CR participants.

Procedure

The University of California, San Francisco (UCSF) Committee on Human Research approved all procedures. Participants completed measures assessing psychosocial characteristics and structured interviews assessing social interactions. A subset ($n = 26$) of local participants ($n = 38$) completed the surveys as outpatients, while all others traveled to the UCSF Clinical and Translational Science Institute Clinical Research Center (CCRC) to participate as inpatients. To minimize confounds from jetlag and unfamiliar settings, participants located over 100 miles away spent an acclimation night at CCRC before completing procedures. To minimize diurnal activity pattern confounds, participants woke up, ate, and slept according to usual schedules. The CCRC metabolic kitchen prepared specialized calorie-restricted meals for CR participants.

All participants also completed food diaries designed by a registered dietitian that reflected all foods and liquids consumed and the time of day consumed on the Sunday, Monday, and Tuesday preceding the CCRC visit to capture weekend/weekday variability. In addition, each participant received a Bayer glucometer and video/phone training for use during the 4 weeks preceding the CCRC visit. On four randomly chosen nights, study staff contacted participants between 17:00 and 20:00 and told them to note time of last meal and then fast from midnight onward. Participants then reported their fasting blood glucose upon awakening.