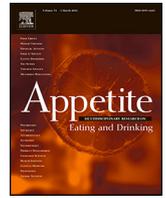




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Research report

Health behaviours and their facilitation under depletion conditions: The case of snacking [☆]

Dilan A. Sellahewa ^a, Barbara Mullan ^{a,b,*}^a School of Psychology, The University of Sydney, Sydney, Australia^b School of Psychology and Speech Pathology, Curtin University, Perth, Australia

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ABSTRACT

Introduction: Previous research suggests that depletion (the state ensuing from self-control exertion) engenders lapses in health behaviours. The present study tested for that effect in relation to the health behaviour of limiting snacking, and investigated whether health goal-priming might facilitate such health behaviours even under depletion conditions. **Method:** A laboratory study was conducted involving an analytic sample of 85 undergraduates (mean age = 20.08, *SD* = 3.96; female: *n* = 63). Depletion was manipulated by having participants watch a humorous video while suppressing their responses (depletion condition) or remaining natural (non-depletion condition). The activation of participants' health goals was then manipulated by subtly exposing (goal-priming condition) or not exposing (non-priming condition) participants to health-related words in a Scrambled Sentence Task. Finally, snacking was measured using a bogus taste-test. **Results and discussion:** Controlling for initial hunger, snacking was higher among depleted compared to non-depleted participants. Snacking was lower among primed compared to non-primed participants. The interaction between depletion and goal-priming was not significant. These findings suggest that depletion should be recognised as a risk factor for lapses in health behaviours, and that health goal-priming may be a useful technique for facilitating such behaviours even when individuals are depleted.

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Introduction

The majority of deaths globally are due to non-communicable diseases such as diabetes and cardiovascular disease, which are largely attributable to behavioural risk factors (World Health Organization, 2011). It is therefore important to identify factors associated with lapses in health behaviours and to develop techniques for addressing such lapses, where health behaviours include the performance of health-promoting behaviours (e.g., exercise) and the avoidance of health-compromising behaviours (e.g., smoking).

Health behaviours often involve self-control: the process of overriding competing internal reactions and behavioural tendencies in order to bring thoughts, feelings and behaviour in line with long-term goals and behavioural standards (Baumeister, Vohs, & Tice, 2007; de Ridder & de Wit, 2006; Muraven, 2012). This is especially true of healthy eating behaviours; in the current 'obesogenic' environment in which palatable but unhealthy foods are highly visible and readily available, it is often necessary to override

temptation to overindulge in such foods in order to maintain a diet that is consistent with long-term health goals (Johnson, Pratt, & Wardle, 2012). Indeed, relatively high dispositional self-control has been associated with healthier eating patterns during a weight-loss programme (Crescioni et al., 2011) and in general (Gerrits et al., 2010; Junger & van Kampen, 2010; Sproesser, Strohbach, Schupp, & Renner, 2011), as well as with concomitant health outcomes such as greater success in a weight-loss programme (Crescioni et al., 2011) and lower body mass index (BMI) in general (Crescioni et al., 2011; Junger & van Kampen, 2010; Keller & Siegrist, 2014). When individuals have recently exerted self-control, they are said to be 'depleted' (Baumeister & Alquist, 2009). Due to the high frequency of everyday self-control demands (Hofmann, Baumeister, Förster, & Vohs, 2012), opportunities to perform health behaviours could often be expected to arise when individuals are already depleted. This raises questions about: (1) whether depletion impedes the exertion of further self-control in implementing health behaviours, such as limiting snacking, and (2) how such health behaviours could be facilitated under depletion conditions.

Health behaviours under depletion conditions

The performance of self-control behaviours under depletion conditions has been widely investigated using Baumeister, Bratslavsky, Muraven, and Tice's (1998) sequential task paradigm.

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* Corresponding author.

E-mail address: barbara.mullan@curtin.edu.au (B. Mullan).

Here, experimental group participants are depleted by completing a task requiring high self-control (e.g., controlling their thoughts), while control participants instead complete a task that requires minimal self-control (e.g., free thought). Subsequently, all participants undertake a second, ostensibly unrelated task designed to measure performance of self-control behaviours. Typically, a 'depletion effect' is observed such that performance on the dependent self-control task is poorer among depleted compared to non-depleted participants. In a meta-analysis of 83 sequential task studies, Hagger, Wood, Stiff, and Chatzisarantis (2010) found a significant medium-to-large depletion effect across a wide range of self-control outcomes. Regarding health behaviours, depletion has been associated with fewer repetitions on exercise tasks (Dorris, Power, & Kenefick, 2012), increased likelihood of smoking (Shmueli & Prochaska, 2009), increased ad-lib alcohol consumption (Christiansen, Cole, & Field, 2012; Muraven, Collins, & Neinhaus, 2002), and increased snacking among restrained eaters (Kahan, Polivy, & Herman, 2003; Vohs & Heatherton, 2000; studies 1 and 3) and individuals with high BMI (Hagger et al., 2013), where 'snacking' refers to consumption of energy-dense foods of low nutritional value between meals.

Based on current evidence however, it remains unclear whether the depletion effect on snacking holds among broader samples (i.e., without subdividing based on dietary restraint or BMI). In one study it was found that depleted participants from a broader sample ate more than non-depleted participants when offered snack foods (Zyphur, Warren, Landis, & Thoresen, 2007; study 1), whereas other studies reported only a marginally significant effect (Friese, Hofmann, & Wänke, 2008; study 2), or no significant depletion effect on snacking (Stillman, Tice, Fincham, & Lambert, 2009; study 3). These divergent findings may be accounted for by the lack of consideration given in these studies to the extent to which participants held long-term health goals and were tempted by the proffered snacks. These are important considerations since only if limiting snacking was consistent with participants' goals, but also required overriding temptation to indulge, would that behaviour involve self-control and hence be susceptible to a depletion effect on self-control behaviour.

Consequently, the first aim of the present study was to extend existing evidence concerning the effects of depletion on health behaviours, by investigating whether limiting snacking is compromised under depletion conditions among members of broader samples when that behaviour more clearly involves self-control.

Facilitating health behaviours under depletion conditions

If depletion impedes the enactment of health behaviours such as limiting snacking, this creates a need to develop effective techniques for facilitating health behaviours under depletion conditions. Many well-established interventions for health behaviours target explicit cognitions (e.g., health beliefs; Jones, Smith, & Llewellyn, 2014). The suitability of these techniques in the context of depletion is challenged however, by evidence that the influence of such explicit cognitions over self-control behaviour is attenuated under depletion conditions (Friese et al., 2008; studies 2 and 3; Hofmann, Rauch, & Gawronski, 2007). Accordingly, implicit techniques may be more useful in this context.

One implicit technique that is receiving increasing attention as a means of promoting healthy eating behaviours is goal-priming (Papies, 2012). This involves subtly exposing individuals to environmental cues (such as words or images) that are semantically related to a particular goal. This exposure is expected to implicitly activate ('prime') the cognitive representation of that goal, such that it proceeds to guide subsequent responses just as if it had been consciously activated (Custers & Aarts, 2010). Goal-priming has been successfully applied in relation to a range of eating behaviours. When

health goals were primed through subtle exposure to goal-related rather than goal-neutral cues, female restrained eaters snacked less while watching a movie (Anschutz, Van Strien, & Engels, 2011), overweight individuals purchased fewer snacks from a grocery store (Papies, Potjes, Keesman, Schwinghammer, & Van Koningsbrugge, 2014), restrained eaters and current dieters made healthier meal choices in a restaurant (Papies & Veling, 2013), and restrained eaters ate fewer product samples in a butcher's shop (Papies & Hamstra, 2010).

Researchers have also begun to test the efficacy of goal-priming in bolstering self-control performance under depletion conditions. Alberts, Martijn, Greb, Merckelbach, and de Vries (2007) reported that participants primed with perseverance cues performed better than non-primed participants on a subsequent physical endurance task, and that the extent of this priming effect either did not differ depending on depletion (study 1), or was even stronger among depleted compared to non-depleted participants (study 2). The authors suggested that their priming technique affected behaviour through activating the behavioural construct of perseverance. In their first study however, Alberts et al. utilised an adapted Scrambled Sentence Task as their priming manipulation, and this paradigm has frequently been interpreted as priming goals (e.g., Bargh, Lee-Chai, Barndollar, Gollwitzer, & Trötschel, 2001; experiment 2; Crone & Beike, 2012; Sheeran et al., 2005; experiment 2). An alternative interpretation of these results might therefore contend that Alberts et al.'s Scrambled Sentence Task affected behaviour through priming perseverance goals. On that interpretation, this study provides preliminary evidence that priming a goal promotes responses consistent with that goal, even under depletion conditions.

In the eating domain, two recent studies have examined the impact of health goal-priming on snacking under depletion conditions. Boland, Connell, and Vallen (2013) found that in the afternoon (but not in the morning), participants exposed to health cues consumed less during an opportunity for snacking than those exposed to indulgence or neutral cues. Boland et al. argued that since self-control demands accrue as the day progresses, individuals are typically depleted by afternoon. Accordingly, they interpreted their findings as demonstrating that health goal-priming affects snacking when individuals are depleted. Yet while this proposed temporal pattern of depletion seems plausible, the time of day variable may have been confounded with several uncontrolled variables (e.g., wakefulness, cognitive load). Using more standard experimental manipulations, Walsh (2014) manipulated depletion and health goal-priming, before having participants choose between a healthy and unhealthy snack option in an imaginary shopping task. While goal-priming led to a higher proportion of participants choosing the healthy option overall, it seemed to have no effect on snack choices in the depletion condition.

Thus, results concerning the efficacy of goal-priming under depletion conditions have been mixed. Since the dependent variable in Walsh's (2014) study was a hypothetical choice, it remains to be seen whether health goal-priming can lead to reduction in actual snack consumption under experimentally induced depletion conditions just as well as under non-depletion conditions. The second aim of the present study was to conduct the first test of that possibility.

The present study

A sequential task design comprising of: (1) a depletion manipulation, (2) a goal-priming manipulation, and (3) a measure of snacking as a prototypical self-control behaviour, was adopted here. Consistent with earlier evidence linking depletion with compromised self-control performance (Hagger et al., 2010), and in view of the current study's measurement of snack consumption as a manifestation of poor self-control performance, it was hypothesised that

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