



Navigating the obesogenic environment: How psychological sensitivity to the food environment and self-regulatory competence are associated with adolescent unhealthy snacking



F. Marijn Stok^{a,b,*}, Emely De Vet^c, Jane Wardle^d, Maria T. Chu^{d,e}, John De Wit^f, Denise T.D. De Ridder^a

^a Clinical and Health Psychology, Utrecht University, The Netherlands

^b Psychological Assessment and Health Psychology, University of Konstanz, Germany

^c Communication, Philosophy and Technology, Centre for Integrative Development, Wageningen University and Research Centre, The Netherlands

^d Health Behaviour Research Centre, Department of Epidemiology and Public Health, University College London, UK

^e School of Health Sciences, City University London, UK

^f National Centre in HIV Social Research, University of New South Wales, Australia

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ABSTRACT

Purpose: Living in an obesogenic environment may not affect all adolescents to the same extent, depending on their psychological sensitivity to the food environment and their self-regulatory competence. The purpose of the current study was to examine associations of these two factors with unhealthy snacking among adolescents. We also investigated whether self-regulatory competence could attenuate the negative effects of being sensitive to the food environment.

Methods: A survey was completed by 11,392 European adolescents (10–17 years old). The survey measured psychological sensitivity to the food environment, self-regulatory competence and self-reported unhealthy snack intake.

Results: Higher food environment sensitivity and lower self-regulatory competence were associated with more unhealthy snacking. The two factors also interacted, with self-regulatory competence attenuating the influence of high food environment sensitivity.

Discussion: Adolescents who are sensitive to the food environment reported higher unhealthy snack intake. More frequent use of self-regulation strategies on the other hand was associated with lower unhealthy snack intake. Moreover, self-regulatory competence was found to moderate the influence of psychological sensitivity to the food environment on unhealthy snacking, although the effect size was small. Fostering adolescents' self-regulatory competence can help enable them to better navigate the obesogenic environment.

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1. Introduction

About one-third of European school-aged children are now overweight (Wang & Lobstein, 2006). A large body of evidence shows that the omnipresence and easy accessibility of palatable energy-dense foods, often referred to as the *obesogenic environment* (Swinburn, Egger, & Raza, 1999), contributes substantially to this trend (Booth, Pinkston, & Carlos Poston, 2005). Living in the obesogenic environment is especially challenging for adolescents, who are just beginning to learn to handle increased autonomy regarding eating choices (Basset, Chapman, & Beagan, 2008; Stok, De Ridder, Adriaanse, et al., 2010). Additionally, their reward sensitivity is heightened whereas inhibitory control is not yet fully developed (Steinberg, 2007). However, the effects of the obesogenic environment on individuals are not universal, with a proportion of the population remaining slim despite

environmental pressures (Lowe & Butryn, 2009; Wardle & Boniface, 2008). The current study investigates if differences in the extent to which adolescents are sensitive to the obesogenic environment can explain differences in unhealthy snacking, and if self-regulatory competence can attenuate the negative effects of being sensitive to the obesogenic environment on unhealthy snacking.

1.1. The psychological power of food and self-regulatory competence

Studies with adults have shown that individuals differ in their psychological sensitivity to the food environment (Cappelleri, Bushmakin, Gerber, et al., 2009; Lowe, Butryn, Didie, et al., 2009), and that these individual differences are associated with eating-related outcomes. Obese participants reported higher sensitivity than non-obese participants (Lowe et al., 2009), and sensitivity was shown to predict frequency and intensity of chocolate craving and to negatively predict success in abstaining from eating chocolate (Levitsky & Shen, 2008). The obesogenic environment thus affects some individuals

* Corresponding author at: Postbox 80140, 3508 TC Utrecht, The Netherlands.
E-mail address: F.M.Stok@uu.nl (F.M. Stok).

more than others, raising the question of whether adolescents who experience high psychological sensitivity to the food environment would inevitably overeat as long as they are in an obesogenic environment. We believe that this may not necessarily be the case and that there may be factors, such as self-regulatory competence, that can buffer the negative effects of the food environment on eating behavior.

Self-regulatory competence is the ability to resist an immediate temptation in the service of attaining a long-term desired goal (Baumeister & Vohs, 2004; Metcalfe & Mischel, 1999). Adolescents have been shown to know various self-regulation strategies in the food domain (Stok, De Vet, De Ridder, et al., 2012), and higher use of these strategies has been shown to be associated with healthier eating behaviors (De Vet, De Ridder, Stok, et al., 2014). Self-regulatory competence thus has a direct correlation with healthier intake. We propose that self-regulatory competence may have another benefit, namely, that it may also serve as a moderator of the negative impact of being sensitive to the food environment on eating behavior.

1.2. Current study

In the current study, data were used from an international survey conducted within the scope of the TEMPEST project, in which self-regulation of eating in adolescents in nine European countries was investigated. Unhealthy snacking was chosen as outcome variable because adolescents have more autonomy and choice over the snacks they eat than over main meals (Stok et al., 2010) and because snacking is an important contributor to overweight (Duffey & Popkin, 2011; Zizza, Siega-Riz, & Popkin, 2001). Our hypotheses were that higher psychological sensitivity to the food environment would be associated with more unhealthy snacking, that higher self-regulatory competence would be associated with less unhealthy snacking, and that self-regulatory competence would attenuate the impact of food environment sensitivity on unhealthy snacking

2. Methods

2.1. Participants and procedures

A total of 11,392 adolescents aged 10–17 years took part in the survey. Participants' mean age was 13.2 years ($SD = 2.0$) and 50.5% were girls. Data were collected in 121 schools in nine European countries (The Netherlands, Belgium, UK, Germany, Denmark, Finland, Poland, Romania, and Portugal), selected to represent various geographic locations, socio-economic backgrounds, and overweight prevalences. Moreover, within each country, care was taken to select schools from both urban (58.5%) and rural (41.5%) regions and from both lower (47.8%) and higher (52.2%) socio-economic status areas. Data collection complied with the ethical guidelines applicable in each country; in countries where this was required, ethical approval from the relevant institution was obtained. Active or passive consent from adolescents and their parents was also obtained.

2.2. Measures

The questionnaire was originally prepared in English and was translated and back-translated to each country-specific language. The following measures were included in the current analyses:

Socio-demographic and anthropometric measures: Participants reported their age and gender. BMI was calculated from self-reported height and weight. Using age- and gender-specific cutoff points (Cole, Bellizzi, Flegal, et al., 2000), a dichotomous *weight status* variable (not overweight versus overweight) was computed. *Immigrant status* was assessed by asking participants to indicate the language they usually speak with their parents (Berry, Phinney, Sam, et al.,

2006), from which a dichotomous variable was created (native versus immigrant). *Family socio-economic status* was assessed using the Family Affluence Scale (FAS; Currie, Molcho, Boyce, et al., 2008). Using the protocol described by the developers of the scale, three categories reflecting low, medium and high affluence were computed.

Psychological sensitivity to the food environment was assessed using an abbreviated 11-item version¹ of the Children's Power of Food Scale (C-PFS; unpublished child version of the PFS (Lowe et al., 2009 and Cappelleri et al., 2009), available from lowe@drexel.edu). This scale measures the psychological impact of the food environment. Example items are "I think about food even when I'm not truly hungry" and "I often think about what foods I might eat later in the day." Response options ranged from 1 (strongly disagree) to 5 (strongly agree). The scale had good internal reliability (Cronbach's $\alpha = .86$).

Eating-related self-regulatory competence was measured using the 24-item Tempest Self-Regulation Questionnaire for Eating (TESQ-E; De Vet et al., 2014). Response options ranged from 1 (never) to 5 (always) and example items are "If I want to have a treat, I take a little bit and put the rest out of sight" and "If I have the urge to eat candy, I find something else to do." One average measure was computed (Cronbach's $\alpha = .93$).²

Unhealthy snack intake was assessed using a single item asking for average daily intake (number of snacks); country-specific examples of unhealthy snacks were provided in the questionnaire (e.g. candy bars, crisps and fried snacks). The answering scale ranged from 0 (none or less than 1 per day) to 5 (more than 4 per day).

2.3. Data analyses

A linear regression analysis was conducted. In Step 1, socio-demographic and anthropometric variables (age, gender, overweight status, immigrant status, and family socio-economic status) were entered. In Step 2, the main effect of food environment sensitivity was assessed, and in Step 3, the main effect of self-regulatory competence was added. Step 4 investigated if there was an interaction between these two variables, which was then further decomposed using simple slopes analysis (Aiken & West, 1991). The effect of food environment sensitivity on unhealthy snacking was examined at two levels of self-regulatory competence, low strategy use ($M - 1SD$) and high strategy use ($M + 1SD$).

To correct for a potential clustering effect at country level, the analysis was re-run using complex sample analysis with the nine countries as strata. The square root of the design effects maximally deviated .007 from 1.00, indicating that the design effect was extremely small. Country effects were thus negligible and because results did not differ between the complex samples analysis and the regular analysis, the latter is reported here.

3. Results

3.1. Sample description

Most participants (74.8%) had a normal weight, while 10.5% was underweight, 12.5% was overweight and 2.1% was obese. Most participants spoke the country's national language with their parents (90.7%). Of the

¹ The eight items that were excluded from the original Children's Power of Food Scale were items 2, 5, 8, 9, 11, 12, 14 and 16.

² The TESQ-E in fact consists of three subscales measuring three different categories of self-regulatory competence. All analyses were also run for each of these three categories separately. Results did not differ between the categories and are therefore reported for the overall measure.

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