

Food Culture in the Home Environment: Family Meal Practices and Values Can Support Healthy Eating and Self-Regulation in Young People in Four European Countries

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Background: Overweight epidemics, including among children and adolescents, are fuelled by contemporary obesogenic environments. Recent research and theory highlight the importance of socio-cultural factors in mitigating adverse impacts of the abundance of food in high-income countries. The current study examines whether family meal culture shapes young people's eating behaviors and self-regulation. **Methods:** Young people aged 10–17 years were recruited through schools in four European countries: the Netherlands, Poland, Portugal and the United Kingdom. A total of 2,764 participants (mean age 13.2 years; 49.1% girls) completed a self-report questionnaire in class, providing information on healthy and unhealthy eating, joint family meals and communal meal values and use of eating-related self-regulation strategies. **Results:** Path analysis found that family meal culture variables were significantly associated with young people's eating behaviors, as was self-regulation. Significant indirect effects of family meal culture were also found, through self-regulation. **Conclusions:** Results confirm that family meal culture, encompassing values as well as practices, shapes young people's eating behaviors. Findings extend and link previously separate lines of enquiry by showing how food cultures can play out in the home environment. Importantly, the study contributes novel evidence suggesting that self-regulation is shaped by the home environment and mediates its influence.

Keywords: eating behaviors, family food environment, overweight, self-regulation, young people

INTRODUCTION

Excess body weight poses a major public health threat (Kelly, Yang, Chen, Reynolds, & He, 2008; Rokholm, Baker, & Sørensen, 2010), resulting in, *inter alia*, an increased risk of cardiovascular diseases, metabolic disorders, respiratory problems and some malignancies (e.g. Lean, 2010). Rates of overweight in young people are of particular concern (Rokholm et al., 2010; Wang & Lobstein, 2006), as childhood overweight increases the risk of health problems (Reilly, Houston-Callaghan, Donaghey, & Hammed, 2010), including in later life (Reilly & Kelly, 2011), and tracks into adulthood (Singh, Mulder, Twisk, van Mechelen, & Chinapaw, 2008).

The family environment is increasingly recognised as a critical source of influence on young people's weight-related behaviors and outcomes, and as an important site of intervention (Cislak, Safron, Pratt, Gaspar, & Luszczynska, 2012; Pinard et al., 2012). Extending recent research highlighting the importance of food cultures for overweight epidemics (e.g. Rozin, Remick, & Fischler, 2011), this study is the first to investigate the role of family meal cultures, including practices as well as values, on young people's healthy and unhealthy eating behaviors. The study uniquely examines if family meal cultures shape young people's self-regulation of eating, and whether eating-related self-regulation may mediate cultural influences on eating behaviors.

Overweight Prevalence and Socio-Cultural Differences

Since the 1970s, the prevalence of childhood overweight has increased worldwide (Wang & Lobstein, 2006), with possibly some leveling off in recent years (Rokholm et al., 2010). Importantly, childhood overweight and obesity have increased more strongly in economically developed, “high-income” countries (Wang & Lobstein, 2006). Socioeconomic development is thought to contribute to the emergence of “obesogenic environments” (Egger & Swinburn, 1997), characterised by little physical activity, sedentary lifestyles, and an abundance of easily accessible, energy-rich foods and drinks (Lobstein & Frelut, 2003), and overweight epidemics more dramatically impact high-income countries (Wang & Lobstein, 2006). Substantial differences in childhood overweight prevalence are nevertheless noted between countries in Western Europe with comparable, high levels of development (Lobstein & Frelut, 2003).

In their recent conceptual analysis, De Ridder, de Vet, Stok, Adriaanse, and de Wit (2013) point out that the overweight epidemics among young people worldwide are also shaped by, often overlooked, social aspects of the “toxic food environment” (Brownell & Horgen, 2004). Drawing on an analysis of country differences in attitudes to food, in particular between the United States (US) and Western Europe, Rozin and Fischler posit that a communal food culture, exemplified by the French, in which eating is an important social experience guided by culinary traditions that celebrate the enjoyment of quality food and the virtue of moderation, may be beneficial for people’s health (e.g. Rozin, 2005; Rozin, Fischler, Imada, Sarubin, & Wrzesniewski, 1999; Rozin et al., 2011). Extending their seminal research documenting differences in food culture throughout society (Rozin, Fischler, Shields, & Masson, 2006; Rozin, Kabnick, Pete, Fischler, & Shields 2003), we propose that eating-related cultural values and practices are also reflected in the home environment, which critically shapes young people’s eating behaviors and outcomes.

Home Food Environment and Young People’s Weight

There is substantial resemblance in the weight status of parents and children, reflecting the interrelated influences of genes and the family environment (Davison & Birch, 2001). The family food environment encompasses a range of potential influences on young people’s eating behaviors, with supportive evidence found for the home availability of foods, parental modeling behaviors, and parental support and encouragement (Bauer, Berge, & Neumark-Sztainer, 2011; Pearson, Biddle, & Gorely, 2009). Interest in the role of joint family meals on young people’s eating behaviors is increasing (Bauer et al., 2011), and evidence suggests that frequency of joint family

breakfast and/or dinner is associated with more healthy and less unhealthy eating and lower risk of overweight (Hammons & Fiese, 2011; Larson et al., 2013).

In addition to direct control and modeling of the type and amounts of food consumed, parents may also shape their children's eating-related behaviors by influencing their dietary beliefs (Lazarou, Kalavana, & Matalas, 2008). Furthermore, it has been suggested that the family environment may influence young people's self-regulation of energy intake (Kral & Rauh, 2010). Self-regulation broadly refers to the capability of people to set and achieve goals (Carver & Scheier, 1998; Vohs & Baumeister, 2011). Self-regulation includes the many cognitive, affective, and behavioral strategies people may use to get started, monitor progress, persist in their efforts, and overcome difficulties, and intentional self-regulation capacities largely develop in adolescence (Gestsdottir, Urban, Bowers, Lerner, & Lerner, 2011).

As Rozin and colleagues (2011) note, some food cultures are characterised by a valuing of moderation. We posit that enacting such dietary moderation requires self-regulation skills, which are acquired through social learning (e.g. Bandura, 1995, 2006). As the family environment provides a critical context for the socialisation of self-regulation (Eisenberg, Smith, & Spinrad, 2011), we further expect the family food environment to play a role in shaping young people's eating-related self-regulation. Consequently, we hypothesise that to the extent that the family food environment shapes both young people's self-regulation and their eating behaviors, self-regulation should mediate the association between the family food environment and young people's eating-related behaviors. We obtained initial support for this mediation hypothesis in a recent study showing that the relationship between young people's eating behaviors and social pressure from their parents, as well as their peers, is mediated by their use of eating-related self-regulation strategies (Luszczynska et al., 2013).

In other previous research we have found that self-regulation may moderate potential adverse impacts of young people's responsiveness to foods (Stok et al., 2013) and of access to snacks and soft drinks on young people's eating behavior (De Vet et al., 2013b; Luszczynska et al., 2013). These differing roles of self-regulation can be explained by differences in the extent to which the source of learning of self-regulation and the source of influence on eating behavior overlap. Based on theory and evidence synthesised by Eisenberg et al. (2011), we expect that young people's eating-related self-regulation is strongly shaped by the family food environment. While the use of self-regulation strategies hence is expected to *mediate* the influence of the family food environment on eating behaviors, it should *moderate* influence external to the family food environment on eating behaviors. Testing this hypothesis is, however, beyond the scope of this study.

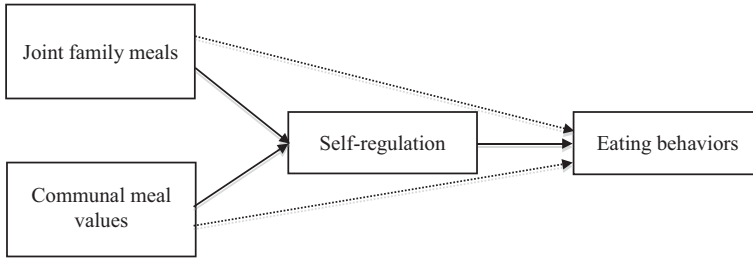


FIGURE 1. Theoretical model of direct and indirect associations between eating behaviors, family meal culture, and self-regulation among children and adolescents.

Note: Dashed connectors between family meal culture variables and eating behaviors reflect theoretical expectations that these associations are mediated by self-regulation of eating.

The Present Study

The aim of this study was to increase understanding of the role of the home food environment in young people's eating behaviors. Informed by theorising of the benefits of communal food cultures, the study investigates associations between young people's healthy and unhealthy eating and family meal cultures, encompassing practices as well as values. The study extends previous research by assessing self-regulation as a mediator of associations between family meal culture and young people's eating behaviors. The conceptual model guiding the current study is graphically represented in Figure 1. We hypothesise (1) that more frequent joint family meals and stronger communal meal values are associated with more healthy eating and less unhealthy eating in young people, and (2) that family meal cultures are associated with young people's use of eating-related self-regulation strategies, which, at least in part, mediates associations between family meal culture and young people's eating behaviors.

METHOD

Procedure and Participants

Data were collected through a school-based survey conducted between September 2010 and March 2011 in four European countries—the Netherlands, Poland, Portugal and the United Kingdom (UK). That survey and the present study are part of the "Temptations to Eat Moderated by Personal and Environmental Self-regulatory Tools" (TEMPEST) project undertaken in nine European countries (www.tempestproject.eu), further including

Belgium (Flanders), Denmark, Finland, Germany, and Romania (also see De Vet et al., 2013b; Luszczynska et al., 2013). The countries included in the current study represent distinct macro-level configurations of childhood overweight and socioeconomic development. Specifically, overweight prevalence is lower in the Netherlands and Poland than in Portugal and the UK (Branca, Nikogosian, & Lobstein, 2007), and the Netherlands and the UK are more socioeconomically developed than Poland and Portugal (World Bank, 2013).

Young people 10 to 17 years old were eligible and country research teams purposively selected primary and secondary schools to ensure representation from urban and rural areas and from higher and lower SES areas. Schools agreed that self-report questionnaires could be completed during a class session in the presence of at least one member of the research team to provide information about the study and answer any questions. Data collection procedures complied with human research ethics regulations in each of the countries. Depending on national regulations, active (opt-in) or passive (opt-out) parental informed consent was obtained; participants' informed assent was ensured in all countries before commencing the survey.

A total of 2,764 young people were recruited from 24 schools in the Netherlands ($n = 586$, 10 schools), Poland ($n = 832$, seven schools), Portugal ($n = 517$, three schools), and the UK ($n = 829$, four schools). Participants were from urban (49.1%) and rural (50.9%) parts of the countries and attended schools in lower (31.4%) and higher (68.6%) SES areas. Participants on average were 13.17 years old ($SD = 1.92$), and girls (49.1%) and boys (50.9%) were equally represented. Of the participants (81.2%) for whom height and weight data were available, 16.6% (girls: 12.4%, boys: 20.5%, chi-square (1, $N = 2,245$) = 26.65, $p < .001$) were overweight or obese, according to age- and gender-specific definitions (Cole, Bellizzi, Flegal, & Dietz, 2000).

Measures

The questionnaire took about 30 minutes to complete and was identical in all four countries. To ensure consistency, items were developed in English, discussed in the international research team, translated into the country's (main) language, and back-translated into English; any issues were resolved through discussion. Items used in the reported analyses are described; the full questionnaire is available from the authors.

Eating Behavior. We assessed two healthy eating behaviors (fruit and vegetable consumption) and two unhealthy eating behaviors (snack and soft drink consumption), which are commonly examined in eating-related research with children and adolescents (see Lally, Bartle, & Wardle, 2011).

Using separate items for each behavior, participants were asked to indicate, for an average day, how many servings of fruit they ate and how many serving spoons of cooked or raw vegetables they ate (it was explained that one serving / serving spoon is about one handful), as well as how many snacks they ate (with examples provided appropriate to the country), and how many glasses of soft drinks, lemonade, or energy drinks they drank (excluding diet/light soft drinks and mineral water). Response options ranged from 0 (less than 1/none) to 5 (more than 4). Healthy eating item scores were averaged, reflecting participants' average daily intake of fruit and vegetables (score range 0–5). Unhealthy eating item scores were also averaged, reflecting participants' average daily intake of soft drinks and snacks (score range 0–5).

Family Meal Culture. The assessment of family meal culture included two questions regarding joint family meals and two questions regarding communal meal values. Regarding joint family meals, participants indicated the frequency with which they had breakfast and the frequency with which they had dinner with all (or most) family members (see Larson et al., 2013). Responses ranged from 0 (less than once a week) to 4 (every day of the week). Joint family meal item scores were averaged, reflecting the average weekly frequency with which participants had joint family meals (score range 0–4).

Communal meal values were equally measured with two items. Informed by the theorising of Rozin and colleagues (Rozin, 2005; Rozin et al., 1999, 2003, 2006, 2011), items assessed the extent to which meals are considered communal, social occasions for the family: “My family enjoys having our meal together” and “In my family having our meal together is an opportunity to catch up (like about what happened during the day)”. Responses were given on a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). Communal meal value item scores were strongly correlated ($r = .66, p < .001$), and averaged to indicate communal meal values (score range 1–5).

Self-Regulation. Participants' use of eating-related self-regulation strategies was assessed with the 24-item TESQ-E, an instrument to assess six primary types of dietary self-regulation strategies (each measured with four items) that reflect three higher-order categories, each consisting of two strategies (De Vet et al., 2013a). The TESQ-E assesses a wide range of self-regulation strategies, encompassing actions directed at food temptations (i.e. control and avoidance), strategies to change the meaning of food temptations (i.e. distraction and suppression), and strategies pertaining to actions with respect to healthy eating goals (i.e. goal and rule setting, and goal deliberation). Responses are given on a 5-point Likert-type scale, ranging from 1

(never) to 5 (always). Internal consistency of the TESQ-E was high ($\alpha = .93$), and items score were averaged to reflect eating self-regulation (score range 1–5).

Statistical Analysis

Descriptive statistics and inter-item correlations were calculated in IBM SPSS Statistics 21. Associations between eating behaviors, family meal culture, and self-regulation of eating (see Figure 1) were simultaneously assessed for healthy and unhealthy eating through path modeling using robust maximum likelihood estimation in Mplus, Version 5.1. A full information maximum likelihood approach was used to account for missing data (Enders & Bandalos, 2001), and a cluster term representing the schools through which participants were recruited was included in the estimation of standard errors. The specified recursive model encompassed three observed dependent (endogenous) variables (healthy and unhealthy eating behaviors, and self-regulation of eating, the hypothesised mediator variable), and two observed independent (exogenous) variables (joint family meals and communal meal values). Participants' age and gender were included as observed control variables. Total effects were calculated separately in an unmediated path model.

Multiple group analysis was undertaken to examine invariance in regression coefficients across countries. Fit of this constrained model was examined using a range of indicators (cut-off values for acceptable fit are given in parentheses; for a discussion of guidelines see Hooper, Coughlan, & Mullen, 2008): chi-square ($p > .05$), Tucker Lewis Index ($TLI > 0.95$), Comparative Fit Index ($CFI > 0.95$), Root Mean Square Error of Approximation ($RMSEA < 0.05$), and Standardised Root Mean Square Residual ($SRMR < 0.08$). Mediation is reflected in the strength of the indirect effect component of the total associations between family meal culture variables and eating behaviors, via self-regulation (cf. MacKinnon, 2008). Asymptotic confidence intervals of the mediated effects were estimated in the program PRODCLIN (MacKinnon, Fritz, Williams, & Lockwood, 2007).

RESULTS

Descriptive Statistics and Bivariate Correlations

Participants' mean scores regarding healthy eating, unhealthy eating, joint family meals, communal meal values, and self-regulation of eating are shown in Table 1. As can be seen, participants on average reported a consumption of healthy and unhealthy foods that was well below the mid-point of the score

TABLE 1
Descriptive Statistics and Correlations for Eating Behaviors, Family Meal Culture, Self-Regulation, and Socio-Demographic Characteristics

	Mean (SD), range	2	3	4	5	6	7
1. Healthy eating	1.99 (1.14), 0–5	.01 <i>ns</i>	.16***	.16***	.26***	-.14***	-.01 <i>ns</i>
2. Unhealthy eating	1.95 (1.19), 0–5		.02 <i>ns</i>	-.05**	-.27***	.06**	-.12***
3. Joint family meals	2.44 (1.27), 0–5			.37***	.18***	-.26***	-.06**
4. Communal meal values	3.96 (0.96), 1–5				.22***	-.18***	.05**
5. Self-regulation	2.29 (0.80), 1–5					-.29***	.09***
6. Age	13.17 (1.92), 10–17						.00 <i>ns</i>
7. Gender (Female)	49.1%						

Note: Pearson’s coefficient was calculated for all combinations of continuous variables; Spearman’s coefficient was calculated for all associations with gender; * $p < .05$; ** $p < .01$; *** $p < .001$; *ns* = nonsignificant.

range, reflecting a mean daily consumption of approximately two servings of fruit and two servings of vegetables, as well as two snack items and two glasses of soft drinks.

Participants on average reported a frequency of joint family meals that was just above the mid-point of the range, indicating that they typically had joint family breakfast and dinner on over half of the days of the week. Participants’ mean score for communal meal values was well above the mid-point of the scale, illustrating that meals on average were important social occasions for the family. Mean reported use of self-regulation was below the mid-point of the scale, indicating that participants on average sometimes to regularly used self-regulation strategies.

Table 1 also presents bivariate correlations between young people’s self-reported eating behaviors, family meal culture, self-regulation of eating, and age and gender. Healthy and unhealthy eating behaviors were not significantly associated. Healthy eating was more likely when joint family meals were more frequent and communal meal values were stronger. Healthy eating was more likely among participants who made more use of eating-related self-regulation strategies. Gender was unrelated to healthy eating, and healthy eating was less likely among older participants.

Unhealthy eating, in contrast, was more likely among older participants and less likely among girls than boys. Unhealthy eating was also less likely when participants reported stronger communal meal values and when participants made more use of self-regulation strategies. Frequency of joint

family meals was unrelated to unhealthy eating. Frequency of joint family meals, communal meal values, and use of eating-related self-regulation were significantly and positively related and were lower among older participants. Communal meal values and self-regulation were significantly higher among girls than boys, while frequency of joint family meals was significantly lower among girls.

Modeling Total Effects of Family Meal Culture on Eating Behaviors

A multiple-group analysis of an unmediated path model, excluding self-regulation, was conducted to estimate regression coefficients for the total effects associations between family meal culture variables and eating behaviors, controlling for participants' age and gender. The constrained model, with regression coefficients invariant across the countries, had excellent fit (chi-square (12, $N = 2,764$) = 12.33, $p = .42$; TLI = 0.99; CFI = 1.00; RMSEA = 0.01, 95% CI 0.00, 0.04; SRMR = 0.01).

Regression coefficients are shown in Table 2 and reflect that, across countries, more frequent joint family meals and stronger communal meal values were significantly associated with more healthy eating. Stronger communal meal values were also significantly associated with less unhealthy eating, while frequency of joint family meals was not. Country-specific regression coefficients are also shown in Table 2; associations are largely similar to the multiple-group model.

Modeling Direct and Indirect Effects of Family Meal Culture on Eating Behaviors

The fit of the constrained multiple group path model estimating invariant direct and indirect effects of family meal culture values on eating behavior (controlling for participants' age and gender) was excellent (chi-square (24, $N = 2,764$) = 35.57, $p = .06$; TLI = 1.00; CFI = 0.99; RMSEA = 0.03, 95% CI 0.00, 0.04; SRMR = 0.02). Regression coefficients are depicted in Table 3; patterns of associations for the multiple-group and country-specific models are largely similar. Across countries, family meal culture variables were significantly and positively associated with self-regulation (Table 3), reflecting more use of self-regulation among participants who reported more frequent joint family meals and stronger communal meal values.

Across countries, more self-regulation was significantly associated with more healthy eating and less unhealthy eating. All indirect associations between family meal culture variables and eating behaviors, through self-regulation, were significant across countries. Direct associations between family meal culture variables and healthy eating remained significant, and

TABLE 2
Regression Coefficient Estimates of the Total Effects Associations between Family Meal Culture and Eating Behaviors, from Single-Group and Constrained Multiple-Group Path Models

<i>Antecedent variables</i>	<i>Healthy eating^a b (95% CI)</i>	<i>Unhealthy eating^a b (95% CI)</i>
<i>Multiple group^b</i>		
Joint family meals	0.18 (0.13, 0.22)***	0.01 (-0.12, 0.11) <i>ns</i>
Communal meal values	0.12 (0.08, 0.16)***	-0.07 (-0.11, -0.03)**
<i>The Netherlands</i>		
Joint family meals	0.11 (0.02, 0.19)*	-0.02 (-0.13, 0.10) <i>ns</i>
Communal meal values	0.07 (-0.04, 0.18) <i>ns</i>	-0.04 (-0.12, 0.05) <i>ns</i>
<i>Poland</i>		
Joint family meals	0.15 (0.07, 0.23)***	-0.01 (-0.08, 0.07) <i>ns</i>
Communal meal values	0.15 (0.09, 0.21)***	-0.04 (-0.13, 0.06) <i>ns</i>
<i>Portugal</i>		
Joint family meals	0.24 (0.18, 0.30)***	0.01 (-0.02, 0.03) <i>ns</i>
Communal meal values	0.09 (-0.05, 0.22) <i>ns</i>	-0.17 (-0.23, -0.10)***
<i>United Kingdom</i>		
Joint family meals	0.20 (0.18, 0.22)***	-0.00 (-0.05, 0.05) <i>ns</i>
Communal meal values	0.11 (0.08, 0.15)***	-0.08 (-0.11, -0.05)***

Note: CI = confidence interval; * $p < .05$; ** $p < .01$; *** $p < .001$; *ns* = nonsignificant; ^a Model adjusted for participants' age and gender; ^b Regression coefficients constrained to equality between the four countries.

these associations were partially mediated by self-regulation. The direct effect between communal meal values and unhealthy eating was not significant, suggesting full mediation of this association.

While the total effect of the association between joint family meals and unhealthy eating was not significant across countries (see Table 2), the composite direct and indirect effects were both significant and of similar magnitude, albeit in opposite directions (see Table 3). As noted by Kenny (2013), this reflects an instance of inconsistent mediation (MacKinnon, Fairchild, & Fritz, 2007), whereby a mediator acts as a suppressor variable, in this case of a potential adverse direct influence of more frequent joint family meals on increased unhealthy eating.

TABLE 3
Regression Coefficient Estimates of the Direct and Indirect Effects Associations between Family Meal Culture and Eating Behaviors, from Single-Group and Constrained Multiple-Group Path Models

Antecedent variables	Healthy eating			Unhealthy eating			
	α <i>b</i> (95% CI)	β <i>b</i> (95% CI)	$c\beta^a$ <i>b</i> (95% CI)	τ <i>b</i> (95% CI)	β <i>b</i> (95% CI)	$c\beta^a$ <i>b</i> (95% CI)	τ <i>b</i> (95% CI)
<i>Multiple group^b</i>							
<i>The Netherlands</i>							
Joint family meals	0.09 (0.06, 0.12)***	0.28 (0.22, 0.34)***	0.03 (0.02, 0.04)***	0.17 (0.11, 0.19)***	-0.42 (-0.49, -0.35)***	-0.04 (-0.05, -0.03)***	0.03 (0.00, 0.06)*
Communal meal values	0.11 (0.07, 0.14)***		0.03 (0.02, 0.04)***	0.09 (0.04, 0.13)**		-0.04 (-0.06, -0.03)***	-0.02 (-0.07, 0.02) ns
<i>Poland</i>							
Joint family meals	0.10 (0.05, 0.15)***	0.25 (0.13, 0.37)***	0.03 (0.01, 0.05)**	0.12 (0.04, 0.20)**	-0.37 (-0.45, -0.30)***	-0.04 (-0.06, -0.02)**	0.03 (-0.05, 0.11) ns
Communal meal values	0.10 (0.04, 0.17)**		0.03 (0.01, 0.05)***	0.13 (0.07, 0.18)***		-0.04 (-0.06, -0.01)***	0.00 (-0.07, 0.07) ns

TABLE 3 Continued

	Portugal				United Kingdom			
Joint family meals	0.14 (0.12, 0.16)***	0.35 (0.27, 0.42)***	0.05 (0.04, 0.06)***	0.19 (0.11, 0.27)***	-0.31 (-0.53, -0.09)**	-0.04 (-0.07, -0.01)**	0.05 (0.00, 0.09)*	
Communal meal values	0.14 (0.12, 0.16)***		0.05 (0.04, 0.06)***	0.04 (-0.11, 0.18) ns		-0.04 (-0.07, -0.01)**	-0.12 (-0.18, -0.06)**	
Joint family meals	0.08 (0.04, 0.11)***	0.35 (0.30, 0.39)***	0.03 (0.01, 0.04)***	0.17 (0.15, 0.20)***	-0.40 (-0.43, -0.37)***	-0.03 (-0.05, -0.01)***	0.03 (-0.02, 0.07) ns	
Communal meal values	0.09 (0.07, 0.12)***		0.03 (0.02, 0.04)***	0.08 (0.05, 0.11)***		-0.04 (-0.05, -0.03)***	-0.04 (-0.07, -0.01)*	

Note: Models were adjusted for participants' age and gender; α = regression coefficient for the association between self-regulation and family meal culture variables; β = regression coefficient for the association between eating behaviors and self-regulation; $\alpha\beta$ = product of α and β paths, measuring the indirect association between eating behaviors and family meal culture variables through self-regulation; τ^2 = regression coefficient for the association between eating behaviors and family meal culture variables independent of self-regulation, which measures the direct association between family meal culture and eating behavior; CI = confidence interval; * $p < .05$; ** $p < .01$; *** $p < .001$; ns = nonsignificant; ^a Asymmetric confidence intervals estimated using PRODCLIN software; ^b Regression coefficients constrained to equality between the four countries.

DISCUSSION

This study is part of the TEMPEST project, undertaken in nine European countries, which is the first comprehensive program of research to systematically examine the role of self-regulation in mitigating adverse impacts of the contemporary obesogenic food environment on young people. The present study specifically examined the role of family meal culture in young people's eating behaviors and use of self-regulation, drawing on data provided by 2,764 participants aged 10–17 years from urban and rural parts of the Netherlands, Poland, Portugal and the UK. The sample had comparable numbers of girls and boys, who were recruited from schools in lower as well as higher SES areas.

Participants on average reported consuming around two servings of fruit and two servings of vegetables per day, which compares favorably with findings from the 2005–06 HSBC study that found that less than half of 11–15-year-old participants across 41 countries reported eating fruit or vegetables daily, including in the Netherlands, Poland, Portugal and the UK (Haug et al., 2009). Participants in our study on average reported consuming two snack items and two glasses of soft drinks, which may adversely depart from findings of the 2005–06 HSBC survey, finding that the majority of young people across countries, including countries represented in the current study, did not have soft drinks each day (Haug et al., 2009). Comparability of data on intake of fruit, vegetables, and soft drinks is, however, limited as different response options were used (average consumption per day vs. number of days on which consumed).

Confirming a previous meta-analysis of research concluding that having more frequent joint family meals is associated with better nutritional health in young people (Hammons & Fiese, 2011), we found significant associations between young people's reported frequency of joint family breakfast and/or dinner, and their healthy (i.e. fruit and vegetable consumption), and unhealthy (i.e. snack and soft drink consumption) eating. Of note is that having more frequent joint family meals seemed more strongly associated with young people's healthy eating than with their unhealthy eating, illustrating that fruit and vegetables are likely consumed as part of joint family meals, while snacks and soft drinks are more likely consumed on other occasions.

Extending previous research on the role of the home food environment in shaping young people's eating behaviors (e.g. Bauer et al., 2011; Cislak et al., 2012), we found significant associations between communal meal values and young people's eating behaviors, over and above associations with joint family meals. This suggests that parents and caretakers not only influence young people's eating behaviors through their control over the accessibility of foods and their modeling and support of specific eating

behaviors, but also by transmitting social standards of appropriate eating (De Ridder et al., 2013). To the extent that meal values at the family level reflect macro-level food cultures that are dominant in society, our study provides novel evidence, based on correlational rather than descriptive data, in support of the theorised beneficial influences of communal food cultures that emphasise moderation (cf. Rozin, 2005; Rozin et al., 1999, 2011).

As hypothesised, the study found that young people's use of eating-related self-regulation strategies was associated with family meal culture, underscoring that the home food environment is an important source of learning and skills acquisition (cf. Kral & Rauh, 2010). Young people's use of self-regulation strategies was not only associated with frequency of joint family meals, but also, and more strongly, with communal meal values. This illustrates that self-regulation skills are not only acquired through direct mastery and vicarious learning, but that social persuasion may also play a role (cf. Bandura, 1995), as well as the verbal and non-verbal transmission of culture across generations. Self-regulation was found to partially mediate the associations between family meal culture and young people's eating behavior, providing further evidence of the important role of effective self-regulation in young people's success in navigating the food environment (see De Vet et al., 2013b; Luszczynska et al., 2013). Self-regulation may be critical to enacting the moderation that Rozin and colleagues (2011) have found characteristic of a communal food culture.

As with any research, this study has several limitations that should be noted when considering the wider implications of the reported findings. Notably, the study had a cross-sectional design, which precludes drawing causal conclusions and is not ideal for ascertaining mediation. In addition, the specific age range and non-random sampling of participants limits generalisability of findings to all young people in the participating countries, albeit that care was taken to recruit diverse samples. Also, the focus on four countries precludes extrapolating findings to other national settings, although countries were selected to reflect distinct combinations of overweight prevalence and socioeconomic development. Furthermore, data were collected via self-report, which may have affected their accuracy, and fruit juices were not included or excluded in the soft drinks measure, resulting in a potential for bias. Importantly, young people's eating behaviors are much broader than reflected in our indicators of healthy and unhealthy eating, and the family food environment is more complex than captured in our assessment of joint family meals and communal meal values. We report an initial assessment of family food culture as consisting of practices and values, and its association with young people's eating behaviors and self-regulation, and conceptualisations and measures should be further developed in future research that we hope to stimulate with this paper.

This study uniquely examined the influence of food culture on young people's eating behaviors as this may play out in the home environment. Extending research that documented positive effects of joint family meals, our findings underscore the importance of the home food environment and provide novel evidence regarding the important role of communal meal values in young people's healthy and unhealthy eating. Communal meal values are found to be of particular importance to young people's eating-related self-regulation, which may reflect that moderation and self-control are enshrined and promoted more in some food cultures than others. Together with our previous research on the important role of self-regulation, findings highlight that young people need not inevitably become victims of their obesogenic food environments. They can and do use effective cognitive, affective, and behavioral strategies to mitigate the possible adverse affects of food abundance, and their social environments can support them in developing their critical self-regulation skills.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflict of interest to disclose.

REFERENCES

- Bandura, A. (1995). Exercise of personal and collective efficacy in changing societies. In A. Bandura (Ed.), *Self-efficacy in changing societies* (pp. 1–45). Cambridge: Cambridge University Press. doi: 10.1017/CBO9780511527692.003
- Bandura, A. (2006). Toward a psychology of human agency. *Perspectives on Psychological Science*, 1, 164–180. doi: 10.1111/j.1745-6916.2006.00011.x
- Bauer, K.W., Berge, J.M., & Neumark-Sztainer, D. (2011). The importance of families to adolescents' physical activity and dietary intake. *Adolescent Medicine: State of the Art Reviews*, 22, 601–613.
- Branca, F., Nikogosian, H., & Lobstein, T. (Eds.) (2007). *The challenge of obesity in the WHO European region and the strategies for response*. Geneva: World Health Organization. Retrieved 25 November 2013 from: http://www.euro.who.int/_data/assets/pdf_file/0008/98243/E89858.pdf.
- Brownell, K.D., & Horgen, K.B. (2004). *Food fight: The inside story of the food industry, America's obesity crisis, and what we can do about it*. New York: McGraw-Hill.

- Carver, C.S., & Scheier, M.F. (1998). *On the self-regulation of behavior*. New York: Cambridge University Press.
- Cislak, A., Safron, M., Pratt, M., Gaspar, T., & Luszczynska, A. (2012). Family-related predictors of body weight and weight-related behaviours among children and adolescents: A systematic umbrella review. *Child: Care, Health and Development*, 38, 321–331. doi: 10.1111/j.1365-2214.2011.01285.x
- Cole, T.J., Bellizzi, M.C., Flegal, K.M., & Dietz, W.H. (2000). Establishing a standard definition for child overweight and obesity worldwide: International survey. *British Medical Journal*, 320, 1240–1243. doi: 10.1136/bmj.320.7244.1240
- Davison, K.K., & Birch, L.L. (2001). Childhood overweight: A contextual model and recommendations for future research. *Obesity Reviews*, 2, 159–171. doi: 10.1046/j.1467-789x.2001.00036.x
- De Ridder, D., de Vet, E., Stok, M., Adriaanse, M., & de Wit, J. (2013). Obesity, overconsumption and self-regulation failure: The unsung role of eating appropriateness standards. *Health Psychology Review*, 7, 146–165.
- De Vet, E., de Ridder, D.T.D., Stok, F.M., Brunso, K., Baban, A., & Gaspar, T. (2013a). Assessing self-regulation strategies: Development and validation of the Tempest Self-regulation Questionnaire for Eating (TESQ-E) in adolescents. Manuscript submitted for publication.
- De Vet, E., de Wit, J.B.F., Luszczynska, A., Gaspar, T., Stok, F.M., Wardle, J. et al. (2013b). Access to excess: How do youngsters deal with unhealthy foods in their environment? *European Journal of Public Health*, 23, 752–756. doi: 10.1093/eurpub/cks185
- Egger, G., & Swinburn, B. (1997). An “ecological” approach to the obesity pandemic. *British Medical Journal*, 315, 477–480. doi: <http://dx.doi.org/10.1136/bmj.315.7106.477>
- Eisenberg, N., Smith, C.L., & Spinrad, T.L. (2011). Effortful control: Relations with emotion regulation, adjustment, and socialization in childhood. In K.D. Vohs & R.F. Baumeister (Eds.), *Handbook of self-regulation: Research, theory and applications* (2nd edn.; pp. 263–283). New York: Guilford.
- Enders, C.K., & Bandalos, D.L. (2001). The relative performance of full information maximum likelihood estimation for missing data in structural equation models. *Structural Equation Modeling*, 8, 430–457. doi: 10.1207/S15328007SEM0803_5
- Gestsdottir, S., Urban, J.B., Bowers, E.P., Lerner, J.V., & Lerner, R.M. (2011). Intentional self-regulation, ecological assets, and thriving in adolescence: A developmental systems model. *New Directions for Child and Adolescent Development*, 133, 61–76. doi: 10.1002/cd.304
- Hammons, A.J., & Fiese, B.H. (2011). Is frequency of shared family meals related to the nutritional health of children and adolescents? *Pediatrics*, 127, 1565–1574. doi: 10.1542/peds.2010-1440
- Haug, E., Rasmussen, M., Samdal, O., Iannotti, R., Kelly, C., Borraccino, A. et al. (2009). Overweight in school-aged children and its relationship with demographic and lifestyle factors: Results from the WHO-Collaborative Health Behaviour in School-aged Children (HBSC) study. *International Journal of Public Health*, 54(Suppl. 2), 167–179. doi: 10.1007/s00038-009-5408-6

- Hooper, D., Coughlan, J., & Mullen, M.R. (2008). Structural equation modelling: Guidelines for determining model fit. *Electronic Journal of Business Research Methods*, *6*, 53–60. Retrieved from: <http://www.ejbrm.com/main.html>
- Kelly, T., Yang, W., Chen, C.S., Reynolds, K., & He, J. (2008). Global burden of obesity in 2005 and projections to 2030. *International Journal of Obesity*, *32*, 1431–1437. doi: 10.1038/ijo.2008.102
- Kenny, D.A. (2013). Mediation. Retrieved 10 December 2013 from: <http://davidakenny.net/cm/mediate.htm>
- Kral, T.V., & Rauh, E.M. (2010). Eating behaviors of children in the context of their family environment. *Physiology and Behavior*, *100*, 567–573. doi: 10.1016/j.physbeh.2010.04.031
- Lally, P., Bartle, N., & Wardle, J. (2011). Social norms and diet in adolescents. *Appetite*, *57*, 623–627. doi: 10.1016/j.appet.2011.07.015
- Larson, N., Maclehorse, R., Fulkerson, J.A., Berge, J.M., Story, M., & Neumark-Sztainer, D. (2013). Eating breakfast and dinner together as a family: Associations with sociodemographic characteristics and implications for diet quality and weight status. *Journal of the Academy of Nutrition and Dietetics*, *113*, 1601–1609. doi: 10.1016/j.jand.2013.08.011
- Lazarou, C., Kalavana, T., & Matalas, A.L. (2008). The influence of parents' dietary beliefs and behaviours on children's dietary beliefs and behaviours: The CYKIDS study. *Appetite*, *51*, 690–696. doi: 10.1016/j.appet.2008.06.006
- Lean, M. (2010). Health consequences of overweight and obesity in adults. In D. Crawford, R.W. Jeffery, K. Ball, & J. Brug (Eds.), *Obesity epidemiology* (2nd edn.; pp. 43–58). Oxford: Oxford University Press.
- Lobstein, T., & Frelut, M.L. (2003). Prevalence of overweight among children in Europe. *Obesity Reviews*, *4*, 195–200. doi: 10.1046/j.1467-789X.2003.00116.x
- Luszczynska, A., de Wit, J.B.F., de Vet, E., Januszewicz, A., Liszewska, N., Johnson, F. et al. (2013). At-home environment, out-of-home environment, snacks and sweetened beverages intake in preadolescence, early and mid-adolescence: The interplay between environment and self-regulation. *Journal of Youth and Adolescence*, *42*, 1873–1883. doi: 10.1007/s10964-013-9908-6
- MacKinnon, D.P. (2008). *Introduction to statistical mediation analysis*. New York: Taylor & Francis.
- MacKinnon, D.P., Fairchild, A.J., & Fritz, M.S. (2007). Mediation analysis. *Annual Review of Psychology*, *58*, 593–614. doi: 10.1146/annurev.psych.58.110405.085542
- MacKinnon, D.P., Fritz, M.S., Williams, J., & Lockwood, C.M. (2007). Distribution of the product confidence limits for the indirect effect: Program PRODCLIN. *Behavior Research Methods*, *39*, 384–389. doi: 10.3758/BF03193007
- Pearson, N., Biddle, S.J.H., & Gorely, T. (2009). Family correlates of fruit and vegetable consumption in children and adolescents: A systematic review. *Public Health Nutrition*, *12*, 267–283. doi: 10.1017/S1368980008002589
- Pinard, C.A., Yaroch, A.L., Hart, M.H., Serrano, E.L., McFerren, M.M., & Estabrooks, P.A. (2012). Measures of the home environment related to childhood obesity: A systematic review. *Public Health Nutrition*, *15*, 97–109. doi: 10.1017/S1368980011002059

- Reilly, J.J., Houston-Callaghan, K.A., Donaghey, Z., & Hamed, S. (2010). Physical health consequences of child and adolescent obesity. In D. Crawford, R.W. Jeffery, K. Ball, & J. Brug (Eds.), *Obesity epidemiology; From aetiology to public health* (2nd edn.; pp. 27–42). Oxford: Oxford University Press.
- Reilly, J.J., & Kelly, J. (2011). Long-term impact of overweight and obesity in childhood and adolescence on morbidity and premature mortality in adulthood: Systematic review. *International Journal of Obesity*, *35*, 891–898. doi: 10.1038/ijo.2010.222
- Rokholm, B., Baker, J.L., & Sørensen, T.I. (2010). The levelling off of the obesity epidemic since the year 1999: A review of evidence and perspectives. *Obesity Reviews*, *11*, 835–846. doi: 10.1111/j.1467-789X.2010.00810.x
- Rozin, P. (2005). The meaning of food in our lives: A cross-cultural perspective on eating and well-being. *Journal of Nutrition Education and Behavior*, *37*(Suppl. 2), S107–S112. doi: 10.1016/S1499-4046(06)60209-1
- Rozin, P., Fischler, C., Imada, S., Sarubin, A., & Wrzesniewski, A. (1999). Attitudes to food and the role of food in life in the USA, Japan, Flemish Belgium and France: Possible implications for the diet–health debate. *Appetite*, *33*, 163–180. doi: 10.1006/appe.1999.0244
- Rozin, P., Fischler, C., Shields, C., & Masson, E. (2006). Attitudes towards large numbers of choices in the food domain: A cross-cultural study of five countries in Europe and the USA. *Appetite*, *46*, 304–308. doi: 10.1016/j.appet.2006.01.017
- Rozin, P., Kabnick, K., Pete, E., Fischler, C., & Shields, C. (2003). The ecology of eating: Smaller portion sizes in France than in the United States help explain the French paradox. *Psychological Science*, *14*, 450–454. doi: 10.1111/1467-9280.02452
- Rozin, P., Remick, A.K., & Fischler, C. (2011). Broad themes of difference between French and Americans in attitudes to food and other life domains: Personal versus communal values, quantity versus quality, and comforts versus joys. *Frontiers in Psychology*, *2*, 177. doi: 10.3389/fpsyg.2011.00177
- Singh, A.S., Mulder, C., Twisk, J.W., van Mechelen, W., & Chinapaw, M.J. (2008). Tracking of childhood overweight into adulthood: A systematic review of the literature. *Obesity Reviews*, *9*, 474–488. doi: 10.1111/j.1467-789X.2008.00475.x
- Stok, F.M., de Vet, E., Wardle, J., Chu, M.T., de Wit, J., & de Ridder, D.T.D. (2013). Taming the power of food: Self-regulation moderates the influence of sensitivity to the obesogenic food environment on adolescent snacking. Manuscript submitted for publication.
- Vohs, K.D., & Baumeister, R.F. (Eds.) (2011). *Handbook of self-regulation: Research, theory, and applications* (2nd edn.). New York: Guilford Press.
- Wang, Y., & Lobstein, T. (2006). Worldwide trends in childhood overweight and obesity. *International Journal of Pediatric Obesity*, *1*, 11–25. doi: 10.1080/17477160600586747
- World Bank (2013). *World Development Indicators*. Washington, DC: The World Bank. Retrieved 25 November 2013 from: <http://data.worldbank.org/data-catalog/world-development-indicators>