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## Self-control, diet concerns and eater prototypes influence fatty foods consumption of adolescents in three countries

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### Abstract

As adolescent overweight has become a widespread problem in the developed world, it is timely to understand commonalities underlying dietary practices across countries. This study examines whether consumption of fruits and vegetables and fatty foods among adolescents in different countries is related to the same individual difference and social influence factors—in particular, adolescents' self-control, diet concerns and perceptions of typical (un)healthy eating peers (prototypes). We included 511 normal weight and overweight adolescents (14–19 years) from the United States, the Netherlands and Hungary, who completed a survey during class hours. After controlling for country and demographics, an additional 8% of the variance in the consumption of fatty foods was explained by self-control, diet concerns and prototypes of unhealthy eaters. Only 3% of fruit and vegetable consumption was explained by these factors, and only the association with self-control was significant. This study demonstrates that the same individual difference and social influence factors may influence adolescents' dietary practices in different countries. In addition to highlighting country differences in dietary practices and the prevalence of overweight, exploring common factors that may shape dietary practices

across countries is important for future research. These commonalities may advance conceptual understanding and inform prevention across developed countries.

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### Introduction

Adolescence is a time during which young persons experiment with a range of behaviours, including behaviours that pose a risk to their health. Smoking, alcohol use, inactive lifestyles and maladaptive dietary practices mostly develop during adolescence and are major risk factors for adult morbidity and mortality [1]. Poor eating habits established during adolescence may affect long-term health outcomes [2, 3]. Of particular concern is the increasing prevalence of overweight and obesity in young people in developed countries and associated changes in dietary practices, including an increased consumption of fatty (snack) foods [4] and a decreased consumption of fruits and vegetables [5].

A substantial body of research, including comparative studies [6], shows that the overweight epidemic among adolescents is not limited to specific countries but is a health issue in developed countries worldwide [6, 7]. In addition, cross-national studies have compared dietary practices of adolescents in different countries as partial explanations

for differences in the prevalence of overweight and obesity [8, 9]. When it comes to investigating individual and social factors that may influence adolescents' dietary practices, most studies thus far have focused on a single country, e.g. [10, 11] or on differences in the impact of those factors between countries [12, 13]. Notwithstanding the importance of studies that illuminate factors that may shape dietary practices in particular national contexts, identifying characteristics which adolescents from different countries share in explaining their food intake is also important because overweight and associated dietary practices among adolescents are widespread across developed countries.

In this study, we focus on three psychological variables that may contribute to the explanation of the consumption of fatty foods and fruits and vegetables by adolescents in different countries. These three factors encompass major eating-related indicators of individual differences and social influence—in particular, adolescents' self-control, diet concerns and prototypes of peers who eat healthy or unhealthy foods.

### **Self-control**

Many adolescents in developed countries live in 'obesogenic environments' [14], characterized by an affluence of easily accessible foods that are high in energy and low in nutrients. An early study suggested that as adolescents gain more access to foods outside their homes, they experiment with food choices as they would do with other behaviours [15]. Therefore, being able to control unwanted or impulsive responses to food is important to maintaining a balanced diet. Although many studies of self-control in adolescents focus mainly on smoking, drinking and delinquency, it is theoretically sound to assume that self-control is also influential in an environment in which high-energy fast foods, snacks and soft drinks are widely available. In support of this proposition, better self-control has been associated with fewer problems in regulating impulses for eating [16]. Furthermore, a study by Wills and colleagues demonstrated that young people who showed poor self-control reported more

saturated fat intake [17], whereas those who showed good self-control ate more fruits and vegetables. We therefore hypothesize that adolescents with higher self-control will consume less fatty foods and more fruits and vegetables.

### **Diet concerns**

To eat in a balanced way, it is important that one is aware of or concerned about one's dietary practices, and it has been shown that many adolescents think about or watch their weight [18]. For some, weight watching can result in negative outcomes, such as a preoccupation with a slim body or restrictive eating patterns [19, 20]. However, diet concerns can also promote adaptive behaviours, such as eating more fruits and vegetables, consuming low-fat foods or avoiding foods high in fat [21]. Moderate diet concerns, therefore, may indicate an adaptive awareness of the risks of eating in an unbalanced way. Importantly, in a large group of adolescents, it was found that adaptive weight-control practices were more commonly reported than maladaptive practices, such as skipping meals [18]. We hence hypothesize that higher diet concerns will predict more fruit and vegetable consumption and less fatty food consumption.

### **Eater prototypes**

Eating is an important form of socializing and peer influences may thus be important in understanding adolescents' dietary practices [11]. However, the influence that peers exert over adolescents' dietary practices is under-examined in the literature. In the studies that have been reported, adolescents are generally asked explicitly about peer-related social pressures concerning their dietary practices, and weak to moderate associations have been found [22–25]. However, adolescents may not be aware of, or may not want to admit, the influence that others exert over their behaviour [11]. For these reasons, the present study explores the influence of the prototypical images adolescents hold of peers who eat healthy or unhealthy foods, a more implicit measure of peer influence. For many behaviours, adolescents have clear social images (or prototypes) of peers who engage in these behaviours that can

significantly influence their own behaviours [26, 27]. The more favourable or acceptable the image is the more willing the individual, is to engage in the behaviour [28]. The present study explores whether healthy and unhealthy eater prototypes are related to the dietary practices of young people.

### **The present study**

Overweight in adolescents, as in adults, is increasingly a worldwide problem in developed nations rather than a problem for a specific country, and adolescents' dietary practices may, in part, reflect the influence of factors that operate across countries. The present study investigates whether individual difference and social influence factors that have previously been found to influence a range of adolescents' behaviours also contribute to an understanding of the dietary practices of young people. To establish whether adolescents' self-control, dietary concerns and eater prototypes are associated with their dietary practices in different countries, we conducted a study in the United States, the Netherlands and Hungary, Western countries that differ systematically in the prevalence of adolescent overweight, dietary practices and economic indicators that may affect weight and diet.

The 2001–02 Health Behaviour in School-aged Children (HBSC) survey estimated that 33% of 10- to 16-year olds in the United States were overweight or obese, while this figure was markedly lower in Hungary (13%) and the Netherlands (8%) [6]. The 2001–02 HBSC survey also showed that the percentage of 10- to 16-year olds who consumed fruits on 5–6 days per week was around 40% across the United States, the Netherlands and Hungary, but that the frequency of vegetable consumption was much higher in the Netherlands (almost 80% on 5–6 days per week) than in the United States (somewhat more than 40%) and, in particular, Hungary (less than 30%) [8]. In 2006, the gross national income per capita was US\$44 645 in the United States, US\$38 305 in the Netherlands and US\$16 839 in Hungary [29]. Despite these differences, a study in central and eastern European youth, including adolescents from Hungary, showed that body weight concerns were similar to

those of youth in the United States [30]. As adolescents within countries may also differ in socioeconomic status and body mass index (BMI), we will control for these factors, as well as for gender and age, in assessing the associations between dietary practices and self-control, dietary concerns and eater prototypes.

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## **Methods**

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### **Participants and procedure**

Participants in this study were 537 high school students (age range: 14–19,  $M = 16.3$  years, standard deviation = 1.3; 46% girls). After receiving the consent of school authorities, classes were randomly selected for participation and data were collected during the first semester of 2007. The US sample ( $N = 131$ ) was recruited from a public high school in a mid-sized town in Iowa. The Dutch sample ( $N = 154$ ) came from two high schools in two mid-sized towns. The Hungarian sample ( $N = 252$ ) came from a high school in an urban area. In each country, participants were recruited from schools for general education that would be completed around age 18. The survey was administered by a member of the research team and participants completed the questionnaire during class time. Participation in the study was entirely voluntary and the questionnaires were completed anonymously. Only in the United States were students reimbursed (US\$10) for participating, and response rates were over 90% in each of the countries. Informed consent was obtained from parents and students, and the study protocol was approved by the Institutional Review Boards of the researchers' respective universities.

To determine participants' weight status (normal weight, overweight or obese), age and gender-specific cut-off points for BMI ( $BMI = \text{weight}/\text{height}^2$ ) were used [31] because adolescents' BMI changes substantially with age and this change is different for boys and girls. After removing 26 participants (14 from the United States, 2 from the Netherlands and 10 from Hungary), the final sample consisted of 511 adolescents (United

States:  $n = 117$ ; the Netherlands:  $n = 152$ ; Hungary:  $n = 242$ ). Of the removed participants, 7 failed to report their weight and 19 reported to be obese ( $BMI \geq 30$ ). As the aim of the present study is to understand the food habits of non-clinical samples of adolescents, it was essential that participants indicated their weight and height, and obese participants were removed from the analyses because they may differ substantially from normal weight and overweight individuals in the way they regulate their eating behaviour and in their relationship with food [32, 33].

## Measures

The questionnaire was developed in English and translated into Dutch and Hungarian and in each country only made available in the official language of the country. Care was taken to ensure similar meanings of items in the three language versions of the questionnaire. The main variables under study were assessed with established multiple-item measures derived from previously published research, as specified below.

### *Socio-economic status*

Differences in socio-economic status were assessed with the Family Affluence Scale (FAS), a four-item measure of family wealth [34] that is strongly correlated with macroeconomic indicators in different countries. Participants were asked about their family's car ownership (0 = no, 1 = yes, one, 2 = yes, two or more), computer ownership (0 = none, 1 = one, 2 = two, 3 = more than two), whether they had their own bedroom (0 = no, 1 = yes), and how many times in the past year they travelled away on (a short or long) holiday with their family (0 = never, 1 = once, 2 = twice, 3 = more than twice). A composite FAS score was calculated for each adolescent [34], with higher scores reflecting higher affluence (a score between 0 and 2 reflects low affluence, 3–5 reflects moderate affluence and 6–9 reflects high affluence).

### *Self-control*

Self-control was assessed with the 13-item Brief Self-Control Scale [16]. Using a five-point response

scale (ranging from 1 = not at all like me to 5 = very much like me), participants responded to statements such as: 'I am good at resisting temptations' and 'Sometimes I can't stop myself from doing something, even if I know it is wrong'. A composite score was calculated by averaging across items, with a higher score indicating higher self-control. The internal consistency of the scale in the present study was adequate (Cronbach's  $\alpha = 0.72$ ).

### *Diet concerns*

Diet concerns were assessed with three items [35]. Respondents were asked how strongly they agreed (ranging from 1 = strongly disagree to 4 = strongly agree) with 'I think a lot about being thinner' and 'I am worried about gaining weight'. In addition, respondents were asked 'How often have you thought about going on a diet in the past year', ranging from 1 (never) to 5 (I'm always on a diet). The three items showed good internal consistency (Cronbach's  $\alpha = 0.84$ ).

### *Eater prototypes*

Participants were asked to evaluate a typical healthy and a typical unhealthy eater their age. The instructions of the prototypes assessment read [36, 37]: 'When trying to describe someone, people usually use characteristics of that person. For example, if you describe someone of your age who always gets good marks, you might say that this person is smart, serious and bookish. We would like you to think about the image that you have of an (UN)HEALTHY EATER of your age for a moment. We are interested in your opinion about the typical (un)healthy eater of the same age as you. The typical (un)healthy eater is: ...'.

Participants were then asked to describe the typical (un)healthy eater by using 14 bipolar items reflecting personal characteristics and attributes of the target (e.g., insecure/self-confident, undisciplined/disciplined, dissatisfied/satisfied, unkempt/well-groomed, chubby/slim and unpopular/popular). Answers were provided on a seven-point scale. Both the healthy and the unhealthy eater prototype measures showed good reliability

(Cronbach's  $\alpha = 0.89$  and  $0.88$ ). The adjectives used were derived from a study of young people's eater prototypes [38].

### *Fruit and vegetable consumption*

Participants were asked how many servings of fruit and how many servings of vegetables they usually ate per day, ranging from 0 (less than one serving a day) to 3 (3 or more servings a day). These two scores were added so that higher scores indicate higher fruit and vegetable consumption (range 0–6).

### *Fatty foods consumption*

Nine food items with high fat content common in each country were assessed: crisps (potato chips), chips (fries), cakes, puddings/desserts, cookies, sweets/chocolate, sausages/burgers, meat snacks (appropriate for each country), and pizza. Participants were asked how often they ate each of these products using a six-point scale ranging from 0 (never) to 5 (more than once a day) [39]. Scores were summed to indicate fatty food intake; a score of 0 represents a low frequency of fatty food consumption and a score of 45 indicates a high frequency.

### **Statistical analysis**

To assess country differences in participants' socio-demographic characteristics (gender, age, BMI and family affluence), self-control, diet concerns and eater prototypes, and dietary practices (daily servings of fruits and vegetables and frequency of eating fatty foods), analyses of variance were conducted for all variables except gender, for which a contingency table analysis was performed. Univariate associations between variables were assessed by the calculation of correlation coefficients. Multivariate associations between participants' dietary practices and self-control, dietary concerns and eater prototypes, controlling for differences related to country and socio-demographic characteristics, were assessed using hierarchical linear regression analyses. (As our measures of dietary practices may not be regarded as a fully continuous scales, we also analysed multivariate associations

using ordinal regression. Findings were similar to those obtained in the presented linear regression analyses. Linear regression analyses are generally more familiar and are presented for ease of interpretation.) Country, gender, age, BMI and family affluence were entered in the first step of these analyses as control variables, and adolescents' self-control, dietary concerns and eater prototypes were entered in the second step. Country was recoded into two dummy variables that contrasted the United States with the Netherlands and Hungary, and the Netherlands with the United States and Hungary. Hungary was chosen as the reference category for this dummy coding as participants from this country scored lowest on daily servings of fruits and vegetables, and frequency of consumption of fatty foods [40]. All statistical analyses were conducted with SPSS (version 18).

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## **Results**

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### **Description of main variables**

Adolescents overall reported moderate self-control, with adolescents from the United States reporting higher self-control than adolescents from the Netherlands and Hungary (means and standard deviations by country are presented in Table I). On the whole, adolescents reported modest diet concerns, with adolescents from the United States reporting highest concerns and adolescents from Hungary reporting lowest concerns. Furthermore, adolescents had positive perceptions of the typical healthy eater their age, and negative perceptions of the typical unhealthy eater their age. Healthy eaters were, for example, more likely to be perceived as slim, sporty, active and responsible, whereas unhealthy eaters were more likely to be rated as chubby, not sporty, lazy and irresponsible. Adolescents from the United States had more positive healthy prototypes than adolescents in the Netherlands, which, in turn, had more positive healthy prototypes than adolescents in Hungary. For unhealthy prototypes, adolescents from the United States and the Netherlands had more negative ratings than adolescents from Hungary. Mean ratings of the healthy and

**Table I.** Descriptive statistics of demographic characteristics and key variables per country

	United States M (SD)	the Netherlands M (SD)	Hungary M (SD)
Gender (%)			
Male	45	43	65
Female	55	57	35
Age	16.32 (1.17) <sup>a</sup>	15.64 (1.08) <sup>b</sup>	16.80 (1.25) <sup>c</sup>
BMI	21.95 (2.50) <sup>a</sup>	20.10 (2.62) <sup>b</sup>	21.00 (2.76) <sup>c</sup>
Family affluence	6.68 (1.44) <sup>a</sup>	6.59 (1.51) <sup>a</sup>	4.33 (1.71) <sup>b</sup>
Self-control	3.29 (0.59) <sup>a</sup>	3.01 (0.60) <sup>b</sup>	2.97 (0.50) <sup>b</sup>
Diet concerns	2.30 (0.86) <sup>a</sup>	2.08 (0.98) <sup>a,b</sup>	1.87 (0.92) <sup>b,c</sup>
Healthy prototype	5.80 (0.65) <sup>a</sup>	5.47 (0.84) <sup>b</sup>	4.89 (0.87) <sup>c</sup>
Unhealthy prototype	2.79 (0.90) <sup>a</sup>	2.88 (1.02) <sup>a</sup>	3.50 (0.84) <sup>b</sup>
Fruit/vegetable intake	3.21 (1.49) <sup>a</sup>	2.43 (1.37) <sup>b</sup>	1.95 (1.45) <sup>c</sup>
Fatty food intake	13.69 (4.39) <sup>a</sup>	16.64 (5.33) <sup>b</sup>	13.07 (3.83) <sup>a</sup>

Means in a row with different superscripts differ significantly from each other (Tukey's Honestly Significant Difference test,  $P < 0.05$ ). SD, standard deviation.

unhealthy eater prototypes differed significantly in each country [United States,  $t(115) = -25.54$ ,  $P < 0.001$ ; Netherlands,  $t(149) = -19.76$ ,  $P < 0.001$ ; Hungary,  $t(235) = -14.85$ ,  $P < 0.001$ ]. Adolescents in the United States had the most divergent ratings of the prototypical healthy and unhealthy eaters, whereas adolescents in Hungary had the least divergent views. Young people from the three countries differed in their fruit and vegetable intake: adolescents from the United States reported the highest intake, followed by the Dutch adolescents; Hungarian adolescents reported a relatively low intake. The intake of fatty foods was moderate, with Dutch adolescents reporting higher intake than adolescents in the United States and Hungary.

### Correlations between main variables

Overall means, standard deviations and correlations between study variables are presented in Table II. Self-control was positively correlated with the healthy eater prototype ( $r = 0.20$ ,  $P < 0.01$ ), and the healthy and unhealthy eater prototypes were negatively correlated ( $r = -0.50$ ,  $P < 0.01$ ). In addition, self-control was positively associated with

affluence ( $r = 0.19$ ,  $P < 0.01$ ) and diet concerns were associated with females ( $r = 0.47$ ,  $P < 0.01$ ) and higher BMI ( $r = 0.28$ ,  $P < 0.01$ ). As expected, higher fruit and vegetable consumption was associated with higher self-control ( $r = 0.23$ ,  $P < 0.01$ ), more diet concerns ( $r = 0.17$ ,  $P < 0.01$ ) and more positive healthy eater prototypes ( $r = 0.19$ ,  $P < 0.01$ ), but, unexpectedly, not with unhealthy eater prototypes. Fatty foods consumption was associated with self-control ( $r = -0.18$ ,  $P < 0.01$ ) and diet concerns ( $r = -0.29$ ,  $P < 0.01$ ) in the expected directions, but not with prototypes.

### Associations with dietary practices

To examine the associations between adolescents' self-control, diet concerns, eater prototypes and dietary practices, separate hierarchical multiple regression analyses were conducted for fruit and vegetable consumption, and fatty food consumption. Regarding fruit and vegetable consumption, country and social-demographic characteristics (step 1) accounted for 14% of the variance, and the proposed predictors accounted for an additional variance of 3% (step 2, see Table III). The full model for fruit and vegetable consumption, accounted for 17% of the variance (adjusted  $R^2 = 15\%$ ),  $F(9,483) = 10.83$ ,  $P < 0.001$ . In the full model, US participants consumed significantly more fruits and vegetables than participants from the Netherlands and Hungary, and higher family affluence was also significantly related to more fruit and vegetable consumption. Of the individual difference and social influence variables, higher self-control was significantly associated with higher fruit and vegetable consumption. Diet concerns and healthy eater prototypes were not significantly associated with fruit and vegetable consumption.

With respect to the consumption of fatty foods, country and socio-demographic characteristics (step 1) accounted for 19% of the variance. The individual difference and social influence variables (step 2) were all significantly related to fatty food consumption and together explained 8% of additional variance. The full model for fatty foods consumption accounted for 27% of the variance

**Table II.** Means, standard deviations and correlations for the variables under study ( $N = 511$ )

	2	3	4	5	6	7	8	9	10	M	SD
1. Gender <sup>a</sup>	-0.04	-0.10*	0.05	0.01	0.47**	0.15**	-0.08 <sup>#</sup>	0.15**	-0.16**	—	—
2. Age		0.22**	-0.33**	-0.08 <sup>#</sup>	-0.01	-0.13**	0.16**	-0.11**	-0.18**	16.35	1.28
3. BMI			-0.04	0.04	0.28**	-0.02	0.06	0.03	-0.16**	20.94	2.74
4. Family affluence				0.19**	0.09*	0.27**	-0.15**	0.26**	0.18**	5.54	1.96
5. Self-control					0.01	0.20**	-0.03	0.23**	-0.18**	3.05	0.57
6. Diet concerns						0.07	-0.07	0.17**	-0.29**	2.03	0.94
7. Healthy eater prototype							-0.50**	0.19**	0.02	5.27	0.91
8. Unhealthy eater prototype								-0.07	0.01	3.15	0.97
9. Fruit and vegetable consumption									0.10	2.38	1.52
10. Fatty foods consumption										14.28	4.71

<sup>a</sup>Gender: 0 = male, 1 = female. <sup>#</sup> $P > 0.10$ , \* $P < 0.05$ , \*\* $P < 0.01$ . SD, standard deviation.

**Table III.** Hierarchical linear regression of fruit/vegetable intake and fatty food intake on self-control, diet concerns and prototypes ( $N = 496$ )

	Fruit/vegetable intake			Fatty food intake		
	$\beta_{full\ model}$	$\Delta R^2$ (%)	$\Delta F$	$\beta_{full\ model}$	$\Delta R^2$ (%)	$\Delta F$
Step 1		14	13.40***		19	18.46***
Country dummy 1	0.19**			0.16**		
Country dummy 2	0.02			0.36***		
Age	-0.04			-0.05		
Gender	0.07			-0.11*		
BMI	-0.03			-0.08		
FAS	0.16**			0.06		
Step 2		3	5.03**		8	18.52***
Self-control	0.15***			-0.20***		
Diet concerns	0.09			-0.26***		
Healthy prototype	0.01			—		
Unhealthy prototype	—			0.09*		
Total $R^2$ (%)	17			27		
Total adjusted $R^2$ (%)	15			26		

Country dummy 1 = United States versus the Netherlands and Hungary, Country dummy 2 = the Netherlands versus United States and Hungary. \* $P < 0.05$ , \*\* $P < 0.01$ , \*\*\* $P < 0.001$ .

(adjusted  $R^2 = 26\%$ ),  $F(9,486) = 19.80$ ,  $P < 0.001$ . Young people from the United States and the Netherlands showed higher consumption of fatty foods than adolescents from Hungary. In addition, girls reported significantly lower fatty food consumption than boys. Furthermore, higher self-control and more diet concerns were related to lower consumption of fatty foods, while a more positive unhealthy eater prototype was associated with higher fatty food consumption.

## Discussion

The aim of this study was to explore characteristics that adolescents from three different countries, the United States, the Netherlands and Hungary, share in explaining their dietary practices. Both fruit and vegetable consumption and fatty food consumption were examined. Our study demonstrated that, despite differences between countries that have been noted in terms of dietary practices [8–11] and views

of food [12, 13], individual difference and social influence factors explained additional variance in the dietary practices of adolescents, particularly for fatty food consumption, when controlling for country of recruitment and participants' demographic characteristics.

Three potential influences on adolescents' dietary practices were assessed: self-control, diet concerns and (un)healthy eater prototypes. The results generally supported the hypotheses, particularly in relation to fatty food consumption. As hypothesized, and consistent with research findings [17], higher self-control was related to more fruit and vegetable consumption and lower consumption of fatty foods. This finding suggests that being able to regulate one's impulses is helpful in avoiding foods high in fat, and may be related to having the self-discipline to eat healthy foods when faced with competing dietary options [16]. It also supports the more general observation that self-control is important in inhibiting unwanted behaviour [41].

Furthermore, having more diet concerns was related to less fatty food consumption, supporting the notion that being aware or concerned about one's diet may be a necessary condition to eat healthily, at least at moderate levels of concern. However, diet concerns were not associated with higher fruit and vegetable consumption, suggesting that worrying about one's weight and thinking of being thinner does not necessarily result in a more deliberate choice of healthy foods. In fact, research in the United States has shown that high school students employ a variety of techniques to control their body weight, including calorie counting, eating healthy, and food restriction [42]. Importantly, our findings also did not indicate the presence of a restrictive eating pattern (i.e. lower fruit and vegetable consumption) related to diet concerns.

In addition, we examined whether eater prototypes were related to adolescents' dietary practices. In general, adolescents in this study reported positive perceptions of healthy eating peers. In spite of these positive perceptions, no relation with adolescents' dietary practices was found. Adolescents also generally reported a negative image of unhealthy eating peers, and results showed that adolescents

with a less negative unhealthy eater prototype reported higher consumption of fatty foods, but not more or less fruit and vegetable consumption. These findings speak to the idea proposed by Deviance Regulation Theory [43] that adolescents are more influenced by negative than positive images. Although scores for healthy eater prototypes ranged from less positive to more positive and scores for unhealthy eater prototypes ranged from less negative to more negative, variation on the positive dimension (i.e. seeing healthy eaters as more or less positive) did not significantly influence adolescents' eating behaviour. This result may suggest that peer influence is less important for healthy eating than unhealthy eating—in fact, adolescents often mention healthy eating in connection with family members, and less with friends or in other social situations [22]. In contrast, more negative images of the typical unhealthy eating peer did seem to influence adolescents' eating behaviour. Our findings regarding eater prototypes also show that it is possible to measure peer influences indirectly, and demonstrate the relevance of peer influence with respect to adolescents' dietary practices.

Controlling for country and demographic characteristics, an additional 8% of variance in fatty food consumption was explained jointly by self-control, diet concerns and eater prototypes. Although limited, this figure does reflect that the consumption of 1 in 12 fatty food items is explained by these three variables. The hypothesized variables, however, added only 3% to the explained variance in adolescents' fruit and vegetable consumption. To some extent, this may reflect that adolescents have less choice over their consumption of fruits and vegetables than over fatty foods. The consumption of fruits and, in particular, vegetables, may be part of meals that are provided in the home or school environment, whereas fatty foods are more likely consumed as snacks that adolescents may obtain independently. Furthermore, it has been shown that home availability of fruits and vegetables is highly correlated with actual intake [44].

Taken together, the findings of this study show that low self-control, few diet concerns and less negative perceptions of prototypical unhealthy

eat-ers were related to higher fatty food consumption in samples from sites in the United States, the Netherlands and Hungary. Only self-control was found to be significantly related to adolescents' fruit and vegetable intake in all three country sites. However, there are some limitations to our study that need to be taken into consideration. This study was based on self-reports that may have been affected by memory and social desirability biases. Also, the study had a cross sectional design that does not allow for causal inferences. Only 11% of the adolescents in this study were overweight, which is a relatively low percentage [45], and may reflect that samples were small and non-representative. The reported pattern of consumption of fruits and vegetables (highest in the United States, lower in the Netherlands and lowest in Hungary) also partially differed from that in representative samples of adolescents from these countries. In particular, the 2001–02 HBSC survey found that the frequency of consumption of fruits was comparable among 10- to 16-year olds in the United States, the Netherlands and Hungary, while in the current study the frequency of consumption of vegetables was highest in the Netherlands, lower in the United States and lowest in Hungary. Compared with what has been reported in the literature [4, 9, 11, 46], fatty foods consumption was relatively low in all three country samples. While this discrepancy may reflect the weight status of participants, it may also be that asking adolescents only about the frequency, and not the quantity, of their consumption of fatty foods resulted in low estimates. Alternatively, the significant negative correlation between BMI and fatty food consumption suggests that some adolescents may have been restraining their intake. This interpretation is also supported by the significant positive correlation between BMI and diet concerns. Moreover, the 2001–02 HBSC survey found that in 91% of the countries examined, the frequency of sweets consumption was lower in overweight than normal weight adolescents [6].

Despite these limitations, an important strength and innovation of this study is that it provides evidence that some influences on adolescents' food intake may generalize across countries, and

illustrates the importance of addressing shared factors that may shape dietary practices, rather than focusing on differences between countries, as is more common. This approach also highlights commonalities for prevention research, suggesting that it may be important across country contexts to raise young people's awareness about their dietary practices, strengthen their self-control and prepare adolescents for self-control challenges in their environment when they encounter unhealthy temptations or unhelpful peer influences. These promising directions for the prevention of overweight in different country contexts are all the more important in view of the general increase in adolescents' weight in developed countries [45, 47]. While decreasing adolescents' consumption of fatty foods may be an important target for prevention, it is also important to promote their fruit and vegetable consumption. The individual difference and social influence factors addressed in this study offered only limited explanation of the consumption of fruits and vegetables among adolescents in three different country sites. Future research should, in particular, be concerned with identifying those variables and related prevention strategies that promote adolescents' fruit and vegetable intake and enable youth worldwide in making healthier food choices.

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### Conflict of interest statement

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None declared.

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