

**Eating habits, body image and health  
and behavioural problems of adolescents  
The role of school and family context**

**Jana Holubčiková**



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The role of school and family context**

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Thesis for the University of Groningen, the Netherlands – with summary in Dutch and Slovak

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behavioural problems of adolescents:  
The role of school and family context**

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# Introduction

This thesis deals with eating habits and body image of adolescents and their associations with health and behavioural problems in the context of the school and family environment. This chapter explores the theoretical background of this research and describes the aim of the study, its theoretical model, its research questions and the structure of the further thesis.

## 1.1 Background

### *1.1.1 Eating habits in adolescents.*

Adolescence is a period of extensive psychosocial change, such as growing independence, the need to explore, to take risks and to seek one's self-identity, the need for peer acceptance, increased eating away from home, and busy schedules. These factors may have an effect on the eating patterns and food choices of adolescents (Sigman-Grant, 2002; Story, Neumark-Sztainer, & French, 2002). Since healthy eating habits support optimal health, growth and intellectual development of an individual, establishing and maintaining healthy eating patterns is crucial, especially during this period. Maintaining healthy eating habits during adolescence is important also from a long-term perspective. Adolescents who develop unhealthy eating patterns are likely to carry these practices into adulthood (Lake et al., 2004; Lien, Lytle, & Klepp, 2001). Much research shows that the eating habits of adolescents in industrialised countries are inappropriate. Results of the international Health Behaviour of School-aged Children (HBSC) study have shown that unhealthy eating habits, such as skipping breakfast, low fruit and vegetable consumption, high sweets consumption or frequent soft drinks consumption, are highly prevalent among European adolescents (Currie et al., 2012; Inchley et al., 2016). Since unhealthy eating habits are considered to be among the most important factors leading to overweight, obesity and other diet-related chronic diseases, there is a great need to optimise eating patterns in the world population, especially in children and adolescents. In line with this the World Health Organisation (WHO) draws attention to the alarming rise of childhood obesity and the serious threat it poses to the health of both children and adults (Nishtar, Gluckman, & Armstrong, 2016).

Following a theoretical framework based on social cognitive theory and an ecological perspective, adolescents' eating behaviour is viewed as a function of multiple levels of influence: (1) individual, (2) social environmental, (3) physical environmental and (4) a wider societal level (Story, Neumark-Sztainer, & French, 2002). The model explores adolescents' eating behaviour as affecting and being affected by multiple levels of influence. Intrapersonal (individual) characteristics include

psychosocial factors (attitudes, beliefs, knowledge, self-efficacy, food preferences), biological factors (hunger), behavioural factors (weight control behaviours, dieting) and lifestyle factors (time demands, convenience). Social environmental influences (i.e. interpersonal) include family, friends and peer networks. These affect eating behaviours through mechanisms such as modelling, reinforcement, social support and perceived norms. Physical environmental influences involve the accessibility and availability of foods. For example, offering sliced fruit or reducing the prices of healthy foods, such as fruit and vegetables, in school cafeterias should influence adolescents' food choices and thus improve overall eating patterns in this age group (Kessler, 2016). Wider societal influences play a more distal and indirect role in determining food behaviours; these include mass media and advertising, social and cultural norms and policies and laws that regulate or support food-related issues, such as availability and pricing.

As a part of the unhealthy eating habits, soft drinks and energy drinks consumption is becoming popular among adolescents. Scientific evidence from Europe and the US confirms that the prevalence of adolescents reporting frequent consumption of these beverages is high (Gallimberti et al., 2013; Seifert, Schaechter, Hershorin, & Lipschultz, 2011; Zucconi et al., 2013). Soft drinks (also called soda or carbonated beverages) are a type of drinks that typically contain carbonated water, a sweetener and a natural or artificial flavouring. They also contain large amounts of sugar or high-fructose syrup, fruit juice, sugar substitutes or some combination of these. Soft drinks may also contain caffeine, colourings, preservatives and other ingredients. Energy drinks are beverages which contain large doses of caffeine, sugar and a variety of other stimulants and substances, such as guarana, taurine or vitamins (Higgins, Tuttle, & Higgins, 2010).

Regular consumption of soft drinks and energy drinks in adolescents has previously been found to be strongly associated with several health and behavioural problems. Adolescents reporting regular consumption of these drinks were at higher risk of overweight, obesity and diabetes (Basu, McKee, Galea, & Stuckler, 2013; Grasser, Yepuri, Dulloo, & Montani, 2014; Kristjansson, Sigfusdottir, Mann, & James, 2014); mental health problems (Lien, Lien, Heyerdahl, Thoresen, & Bjertness, 2006; Shi, Taylor, Wittert, Goldney, & Gill, 2010); unhealthy behaviours, such as excessive screen-based activities (Larson, Dewolfe, Story, & Neumark-Sztainer, 2014; Olafsdottir et al., 2014; Verzeletti, Maes, Santinello, & Vereecken, 2010); substance use (Gallimberti et al., 2013) and aggressive behaviour (Kristjansson, Sigfusdottir, Frost, & James, 2013; Solnick & Hemenway, 2012). Moreover, a possible negative effect of energy drinks consumption on cognitive performance in adolescents has been suggested (Childs, 2014; Van Batenburg-Eddes, Lee, Weeda, Krabbendam, & Huizinga, 2014). As cognitive performance is strongly associated with academic success, adolescents consuming these drinks on a regular basis may be at higher risk of experiencing problems in school. Existing research on the possible effects of regular consumption of soft drinks and energy drinks on adolescents' school experiences is limited. Taken together, there is a growing body of research suggesting that the consumption of soft drinks and energy drinks poses a serious public health risk, mainly in children and adolescents (Ali, Rehman, Babayan, Stapleton, & Joshi, 2015; Goldman, 2013; Lien, Lien, Heyerdahl, Thoresen, & Bjertness, 2006; Owens, Mindell, & Baylor, 2014; Solnick & Hemenway, 2014), but further research is needed to fill the gap in knowledge on this recently emerging phenomenon, primarily in the group of young adolescents.

### *1.1.2 Body image in adolescents*

Body image is defined as the mental representation of the body's shape, form and size, which changes under biological, psychological, social and cultural influences (Eisenberg, Neumark-Sztainer, & Paxton, 2006). Body image is influenced by perception, emotions, physical sensations, and is not static, but can change in relation to mood, physical experience and environment. Because of adolescents' significant physical changes, their body image perception may be highly dynamic in this period, and adolescents are at higher risk of experiencing body image concerns than children (Croll, 2005). This can lead to body dissatisfaction – a person's negative thoughts and feelings about his or her body. Discrepancy between the self-perceived body appearance and the desired ideal body image is considered to be at the core of body dissatisfaction (Banfield & McCabe, 2002).

Adolescents dissatisfied with their bodies have been previously found to have higher ratings of peer stress and lower self-esteem (Murray, Rieger, & Byrne, 2015) and are also more likely to report eating disturbances (Gutiérrez et al., 2015). Moreover, body image dissatisfaction has been found to be a major predictor of eating disorders (Keery, & Thompson, 2004; Neumark-Sztainer, Paxton, Hannan, Haines, & Story, 2006; Neumark-Sztainer & Eisenberg, 2014). It may thus lead to anorexia or bulimia. In short, adolescents with body image concerns are at higher risk of serious health problems.

### *1.1.3 Parental influence and eating habits in adolescents*

Parents play an important role in the development of a healthy lifestyle and healthy eating habits of their children (van der Horst et al., 2007). Different ways regarding how parents influence the eating patterns of their children have been identified. Firstly, parents shape the eating habits of their children by providing the food. Strong associations between the availability and accessibility of healthy/unhealthy food and the eating habits of children have been documented by previous research (Patrick & Nicklas, 2005; van der Horst et al., 2007). More specifically, adolescents who reported the availability of fruit and vegetables at home showed higher consumption of these types of foods than others (Gross, Pollock, & Braun, 2010; Pearson, Biddle, & Gorely, 2009). Moreover, the availability of soft drinks at home has been shown to be associated with frequent consumption of these drinks (Denney-Wilson, Crawford, Dobbins, Hardy, & Okely, 2009).

Secondly, the parent-child interaction and parental behaviour have been identified as being strong promoters of healthy eating habits. This interaction has been shown to be expressed in a variety of mechanisms, such as modelling of food-related behaviours by parents (Boutelle, Fulkerson, Neumark-Sztainer, Story, & French, 2007; Pearson et al., 2009; Story, Kaphingst, Robinson-O'Brien, & Glanz, 2008; van der Horst et al., 2007; Verzeletti, Maes, Santinello, Baldassari, & Vereecken, 2010), family mealtimes (Hammons & Fiese, 2011) or applying parental rules (Lindsay, Sussner, Kim, & Gortmaker, 2006; Pedersen, Grønhøj, & Thøgersen, 2015; Van Lippevelde et al., 2013).

Given the importance of parents in shaping adolescents' eating patterns, the family environment should be one of the main targets of preventive activities aimed at improving eating patterns in children and adolescents.

#### *1.1.4 School environment and eating habits in adolescents*

The school environment has been recognised as one of the best settings for promoting healthy eating habits and healthy body weight (Foster et al., 2010). Since a substantial proportion of adolescents' lives is spent at school and they consume at least one meal and several snacks there, this environment is ideal for enhancing healthy eating in adolescents.

Modification of the school food environment was found to have a positive impact on eating behaviours (Driessen, Cameron, Thornton, Lai, & Barnett, 2014; Kessler, 2016). Schools can improve adolescents' eating patterns by a variety of strategies, such as influencing food availability, social norms, policy development or pricing (Lytle & Fulkerson, 2002). This suggests the need for early implementation of preventive programs based on a whole school approach with the involvement of parents (Peralta, Dudley, & Cotton, 2016).

#### *1.1.5 Eating habits in the context of problem behaviour in adolescents*

Based on the 'syndrome of problem behaviours' theory, different adolescent problem behaviours, such as alcohol consumption, substance use or delinquent behaviour, cluster together. This theory suggests that several problem behaviours in adolescence may be determined by similar psycho-social factors (de Looze et al., 2015; Jessor, 1991; Klein Velderman et al., 2015). Several specific categories of factors, such as biological and genetic factors, the social environment, the perceived environment and personality and behavioural factors, were proposed as determinants of problem behaviours (Jessor, 1991). In line with this, particular factors, such as family background, influence of a peer group or the wider environment, were found to be predictors of multiple health risk behaviours (de Winter, Visser, Verhulst, Vollebergh, & Reijneveld, 2016; Dusseldorp et al., 2014; Klein Velderman et al., 2015).

Although unhealthy eating habits do not appear to be part of the problem behaviour syndrome (Neumark-Sztainer et al., 1997), this type of health-compromising behaviour should be viewed in the context of this syndrome. More specifically, adolescents' health compromising behaviours, which include unhealthy eating habits, seem to create a separate cluster which is highly correlated with other types of problem behaviour (van Nieuwenhuizen et al., 2009). To conclude, unhealthy eating habits during adolescence are strongly associated with other types of problem behaviour, but the mechanisms behind this relationship remain not fully clarified.

## 1.2 Aims of the study and research questions

The general aim of this thesis is to examine the relationships between adolescents' eating habits and body image and health and behaviour problems. A further aim of this thesis is to assess the role of the school and family environment in eating habits and body image among adolescents. Finally, this thesis also explores the role of gender, age and socioeconomic differences in these associations.

Figure 1.1 presents the model of the relationships as examined within this thesis.

Five main research questions were formulated based on the previously stated aims.

### *Research question 1:*

Is there an association between subjective perception of negative body image and involvement in bullying among boys and girls? (Chapter 3)

### *Research question 2:*

Is involvement in bullying and fighting more likely with higher soft drinks consumption, and do nervousness and irritability add to this? (Chapter 4)

### *Research question 3:*

Are adolescents reporting a lack of eating-related parental rules more likely to have unhealthy eating habits, such as skipping breakfast, insufficient fruits and vegetables consumption, frequent sweets, soft drinks and energy drinks consumption? (Chapter 5)

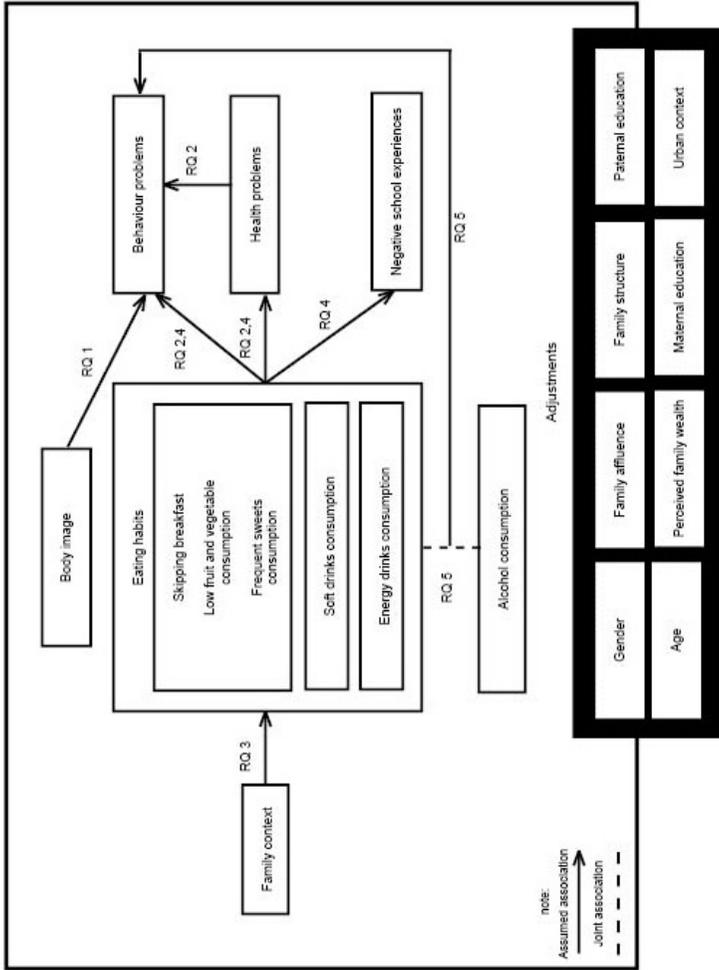
### *Research question 4:*

Is there an association between regular energy drinks consumption and negative health and behavioural outcomes among adolescents? (Chapter 6)

### *Research question 5:*

Do adolescents who combine alcohol and energy drinks report negative behaviour outcomes more frequently? (Chapter 7)

Figure 1.1 Model of the relationships examined in the thesis.



### 1.3 Outline of the thesis

**Chapter 1** provides general information and the scientific background on the key theoretical constructs of this thesis: eating habits, body image, health-related behaviours (e.g. health and behavioural outcomes, school experiences) and family context (e.g. parental rule-setting on eating, family affluence). The aim of the study as well as the research questions are formulated in this chapter.

**Chapter 2** contains the description of two research samples used in this thesis. It also provides information on the design of the study, measures and statistical analyses.

**Chapter 3** examines the associations between negative body image and involvement in bullying in the roles of bully, victim and bully-victim among adolescents and whether gender affects these associations.

**Chapter 4** focuses on the mediating effect of daily nervousness and irritability on the relationship between frequent soft drinks consumption and aggressive behaviour (bullying and fighting) of adolescents. Furthermore, gender, age and socioeconomic differences in this relationship are assessed.

**Chapter 5** explores the association between parental rule-setting on eating and unhealthy eating habits among adolescents with regard to gender, age and socioeconomic differences.

**Chapter 6** provides information on the relationship between frequent energy drinks consumption among adolescents and a wide range of negative health and behavioural outcomes. Furthermore, gender, age and socioeconomic differences regarding these relationships are assessed.

**Chapter 7** explores whether combining alcohol with energy drinks was associated with a higher risk to report negative behavioural outcomes among adolescents. Furthermore, the character of the joint association of alcohol and energy drinks consumption in this relationship is assessed.

**Chapter 8** summarises and discusses the main findings of this thesis. It also explores the strengths and limitations of the study and its implications for further research and practice.



## Chapter 2

# Data sources

This chapter provides a description of the study samples (2.1), measures (2.2) and statistical analyses (2.3) as used in this thesis.

### 2.1. Study samples and procedures

This thesis is based on two different samples from two surveys of the Health Behaviour in School-aged Children (HBSC) study, conducted in 2010 and 2014 in Slovakia. Sample 1, from 2010, was used in the Chapters 3 and 4, and sample 2, from 2014, in Chapters 5, 6 and 7. The studies were approved by the Ethics Committee of the Medical Faculty at Pavol Jozef Safarik University in Kosice. Parents were informed about the study via the school administration and could opt out if they disagreed with their child's participation. Participation in the study was fully voluntary and anonymous, with no explicit incentives provided for participation.

To obtain a representative sample, we used two-step sampling. Firstly, larger and smaller schools located in both rural and urban areas from all regions of Slovakia were randomly selected from a list of all eligible schools in Slovakia obtained from the Slovak Institute of Information and Prognosis for Education and were asked to participate in the study (N=134 in 2010, N=151 in 2014). The school response rates (RR) were 98.1% in 2010 and 86.1% in 2014. In the second step, we obtained data from a representative sample of adolescents from the fifth to ninth grades of elementary schools in Slovakia in the target group of 11- to 15-year-olds (N=8050 in 2010; RR: 79.5%, and N=9250 in 2014; RR: 78.8%). Non-response was mainly due to school absence because of illness or other reasons or the refusals of parents or adolescents to be involved in this study.

### 2.2 Measures

This section provides an overview of the variables used in this study. Brief information on the origin of the measures and a short description is provided in Table 1.

**Table 1** Overview of the variables used in this thesis

Measure	Source	Role in analysis	Chapters	Short description
Food consumption frequency	HBSC 2014	Dependent	5	Indicator of unhealthy eating behaviour
Breakfast consumption	HBSC 2014	Dependent	5	Indicator of unhealthy eating behaviour
Soft drinks consumption	HBSC 2010, 2014	Independent	4, 5	Indicator of unhealthy eating behaviour
Energy drinks consumption	HBSC 2014	Independent	5, 6, 7	Indicator of unhealthy eating behaviour
Body image	HBSC 2010	Independent	3	Indicator of negative body image
Self-rated health	HBSC 2014	Dependent	6, 7	Indicator of negative health outcome
Health complaints	HBSC 2010, 2014	Dependent/moderator	4, 6	Indicator of negative health outcome
Bullying	HBSC 2010, 2014	Dependent	3, 4, 6, 7	Indicator of problem behaviour
Fighting	HBSC 2010, 2014	Dependent	4, 6, 7	Indicator of problem behaviour
Truancy	HBSC 2014	Dependent	6, 7	Indicator of negative school experience
Academic achievement	HBSC 2014	Dependent	6, 7	Indicator of negative school experience
School liking	HBSC 2014	Dependent	6, 7	Indicator of negative school experience
Alcohol consumption	HBSC 2014	Independent	7	Indicator of substance use
Drunkenness	HBSC 2014	Dependent	6	Indicator of substance use
Smoking status	HBSC 2014	Dependent	6	Indicator of substance use
Parental rules on eating	HBSC 2014	Independent	5	Indicator of the parental rule-setting on eating
Perceived family wealth	HBSC 2014	Confounder	5	Indicator of subjective socioeconomic status
Family affluence	HBSC 2010, 2014	Confounder	4, 6, 7	Indicator of socioeconomic status

## **2.3 Statistical analyses**

Several statistical methods were used across this study. All analyses were performed using the statistical software package SPSS. Each chapter provides detailed information about the performed statistical analyses. In general, we first described the frequencies and simple prevalence rates of concerned behaviour, usually overall and split for gender or by category of this behaviour. Next, to answer the research questions of each sub-study, the associations between independent and dependent variables were computed using binary logistic or multinomial regressions, crude and adjusted for potential confounders. Potential mediating effects (Chapter 4) were assessed by mediation analyses and the use of Sobel tests. Potential synergy in joint association of variables (Chapter 7) was assessed by the synergy index using the algorithms of Andersson et al. (Andersson, Alfredsson, Källberg, Zdravkovic, & Ahlbom, 2005).



# Is subjective perception of negative body image among adolescents associated with bullying?

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## Abstract

Adolescents' body image dissatisfaction has an adverse effect on peer relationships. It may lead to changes in behaviour (aggressive or passive) and consequently to bullying behaviour. Our aim was to assess the association between body image dissatisfaction and involvement in bullying and whether this differs by gender. We used data from the Slovak part of the 2010 Health Behaviour in School-aged Children study. The final sample comprised 8050 adolescents aged 11 to 15 years old (mean age 13.57), less than half of whom were boys. The association between self-reported body image and involvement in bullying was determined using multinomial logistic regression. We found a significant association between body dissatisfaction and involvement in bullying. Adolescents dissatisfied with their bodies because due to feeling overweight were more likely to become passive or reactive victims. Self-reported thinness was found to be significantly associated with bully-victims only in boys. *Conclusion:* Adolescent body dissatisfaction is strongly associated with bullying behaviour. Our findings point out the importance of incorporating at schools different types of intervention programmes supporting positive self-perceptions of adolescents and reducing bullying behaviour.

**Keywords:** body image, dissatisfaction, bullying, bully, victim, bully-victim

## Introduction

Recent research shows that the experience of bullying perpetration and victimisation is prevalent among the population of school-aged children, but the prevalence rates differ between countries (Craig et al., 2009; DeVoe, Bauer, & National Center for Education Statistics, 2011; Eaton et al., 2012; Molcho et al., 2009). Bullying has been defined as negative physical or verbal actions that have a hostile intent, cause distress to victims, are repeated over time and involve a power differential between bullies and their victims (Olweus, 1991; Pepler & Craig, 2000).

Involvement in bullying during childhood and adolescence increases the risk of unhealthy development among bullies, victims and bully-victims (Gini & Pozzoli, 2009). This may concern psychosomatic problems, such as headache, stomach and back aches; psychological distress, such as depression, bad temper, loneliness (Due et al., 2005), depression and suicide ideation (Turner, Exum, Brame, & Holt, 2013) or substance use (Molcho, Harel, & Dina, 2004). Recent research suggests a typology of three categories of adolescents involved in bullying—“bullies only”, “victims only” and “bully-victims” (Solberg, Olweus, & Endresen, 2007; Veenstra et al., 2005). Typical victims are more anxious and insecure than adolescents in general; they suffer from low self-esteem, and they experience significantly greater levels of depression and suicide ideation (Turner et al., 2013). Bullies mostly have an aggressive reaction pattern (Book, Volk, & Hosker, 2012) and negative attitudes and beliefs about others (Cook, Williams, Guerra, Kim, & Sadek, 2010). A typical bully-victim holds significantly negative attitudes and beliefs about himself or herself and others (Cook, Williams, Guerra, Kim, & Sadek, 2010). Overall, adolescents involved in bullying tend to have lower self-esteem than uninvolved adolescents, which is connected with poor interpersonal relationships and unpopularity in the peer group (Lee, 2012).

Body image dissatisfaction has been found to be strongly associated with bullying, particularly with victimisation (Wilson, Viswanathan, Rousson, & Bovet, 2013), with bullying perpetration (Reulbach et al., 2013) and with an increased risk of aggression (Shelton & Liljequist, 2002). There is evidence that a preference for being of “average size” leads to a prejudice against thin and obese adolescents (Hansson, Karnehed, Tynelius, & Rasmussen, 2009) and to the exclusion of, or aggressive behaviour towards these adolescents. Specifically, body image dissatisfaction is an aspect of being different and standing out. Sentenac et al. proposed two different hypotheses to explain why children differing from the general population are victimised. Firstly, because of the difference in their appearance or behaviours: deviation in physical appearance may be a reason to be picked on by peers and victimised. Secondly, psychosocial adjustment may influence the association between differences in appearance and victimisation. Low self-esteem or peer rejection-related concerns may result in exclusion or feelings of being a victim (Sentenac et al., 2012).

In 2010, obesity or overweight affected almost 10 % of school-aged children in Slovakia, and compared with 2005, the prevalence of childhood overweight doubled (Madarasova Geckova, Veselska, & Kollarova, 2011). The association between body dissatisfaction and bullying has been studied mainly from the perspective of overweight. This evidence shows that overweight and also subjectively perceived overweight increases the chance of becoming a victim of bullying (Brixval, Rayce, Rasmussen, Holstein, & Due, 2012; Janssen, Craig, Boyce, & Pickett, 2004; Midei & Matthews, 2011). However, evidence on associations between self-reported thinness and involvement in bullying as a victim in adolescence is rather scarce (Reulbach et

al., 2013; Wilson, Viswanathan, Rousson, & Bovet, 2013).

The weight and shape of the body are valued differently by boys and girls (Al Sabbah et al., 2009). Both overweight/obese and underweight boys are at risk for low self-reported quality of life (Bonsergent et al., 2012; Lawler & Nixon, 2011). Girls have a tendency to report more negative body image than boys (Vilhjalmsson, Kristjansdottir, & Ward, 2012), and girls even in a healthy weight range may become increasingly at risk for weight and shape concerns potentially leading to negative body image (Calzo et al., 2012). This finding is consistent with the preference for a thin ideal in western European countries. However, the association of gender with negative body image might be mediated by different factors, e.g. parents' education, area of residence (Vilhjalmsson et al., 2012) or emotional symptoms (Farrow & Fox, 2011).

Therefore, the objective of this study was to examine the relationship between body dissatisfaction and involvement in bullying overall and by gender. We expect that adolescents who are dissatisfied with their body shape both regarding underweight and overweight will be more likely to be involved in bullying perpetration or victimisation, and furthermore, that in girls, this tendency will be more pronounced because of their tendency to report a more negative body image.

## **Material and methods**

### *Sample and procedure*

We used data from the Health Behaviour in School-aged Children (HBSC) study conducted in 2010 in Slovakia. To obtain a representative sample, 134 larger and smaller schools located in rural as well as in urban areas from all regions of Slovakia were randomly selected from a list of all eligible schools in Slovakia obtained from the Slovak Institute of Information and Prognosis for Education and were asked to participate in the study. The school response rate (RR) was 98.1 %. We obtained data from 8050 adolescents from the fifth to ninth grades of elementary schools in Slovakia (RR, 79.5 %) in the target group of 11 to 15 years old (mean age 13.57; 48.3 % boys). The study was approved by the Ethics Committee of the Medical Faculty at Pavol Jozef Safarik University in Kosice. Parents were informed about the study via the school administration and could opt out if they disagreed with their child's participation. Participation in the study was fully voluntary and anonymous with no explicit incentives provided for participation.

### *Measures*

The present study uses HBSC data related to adolescents' reports of bullying, victimisation and body image.

#### *Bullying*

The role of the adolescent in bullying was measured by the revised Olweus Bully/Victim Questionnaire (Solberg & Olweus, 2003b). After having read a standard definition of bullying, respondents were asked about their involvement in bullying—how often they had bullied others and had been bullied in school during the last few months. Responses were rated on a five-point scale ("I haven't been bullied/

bullied other students at school in the past couple of months”, “only once or twice”, “two or three times a month”, “about once a week”, “several times a week”). We chose the cut-off point of “two or three times a month”, and we dichotomized the responses to get four categories of bullying behaviour: being a bully, victim, bully-victim and not involved. This cut-off point indicates “chronic” bullying involvement and is widely used in a variety of reports and peer-review publications at national and cross-national levels (Craig et al., 2009; Harel-Fisch et al., 2011; Molcho et al., 2009).

#### *Body image*

Body perception was measured using the question: “Do you think your body is...” Response categories were as follows: much too thin, a bit too thin, about the right size, a bit too fat or much too fat. We categorised responses to obtain three categories of body image: too thin (much too thin and a bit too thin), normal weight status (about the right size) and too fat (bit too fat and much too fat). This item has been developed by the HBSC consortium; a validation study of this measure is underway.

#### *Statistical analyses*

Firstly, we computed prevalence rates for levels of age, gender and self-reported body image by roles in bullying. Next, we assessed the association with bullying involvement of age, gender and self-reported body image by multinomial logistic regression, leading to odds ratios (ORs) and 95 % confidence intervals (CIs). This analysis was done by regressing bullying involvement separately with each independent variable (crude associations) and thereafter in a multivariable model that includes all variables contributing to the model with statistical significance. Third, we analysed the degree to which gender modified the effect of self-reported body image by adding their interactions to the multinomial logistic regression model. In addition, we analysed the stratified effect of body image on bullying behaviour according to gender (Table 3). All data were analysed using IBM SPSS statistics 20.0 for Windows.

### **Results**

More than 20 % of our sample reported being involved in bullying. The most prevalent reported role in bullying was being a bully. Regarding body image, more than half of the adolescents considered their bodies to be the right size. The rest of the sample reported dissatisfaction with their figure, considering their body to be either too thin or too fat. Results of the descriptive statistics are presented in Table 1. In general, boys were more likely to be involved in bullying (as bullies, victims and bully-victims) than girls. The association between involvement in bullying and age was significant regarding being a bully and being a victim: the probability of bullying others increased with age, while the prevalence of reports of being a victim decreased with age.

**Table 1** Gender and self-reported body image of the total sample and by involvement in bullying: numbers and percentages.

	Total sample	Bully	Victim	Bully-victim	Not involved
	N=8050 (100%)	N=767 (9.8%)	N=515 (6.6%)	N=293 (3.8%)	N=6234 (79.8%)
<b>Gender</b>					
boys	3910 (48.6)	454 (12.1)	259 (6.9)	179 (4.7)	2876 (76.3)
girls	4132 (51.4)	310 (7.7)	255 (6.3)	114 (2.8)	3352 (83.2)
<b>Self-reported body image</b>					
too thin	1563 (19.6)	139 (18.2)	99 (19.3)	64 (22.0)	1226 (19.8)
too fat	1901 (23.9)	173 (22.6)	173 (33.8)	96 (33.0)	1410 (22.8)
normal	4503 (56.5)	452 (59.2)	240 (46.9)	131 (45.0)	3555 (57.4)

Number of missing values: role in bullying N=241 (3%), gender N=8 (0.1%), self-reported body image N=83 (1%);

The results of the multinomial logistic regression showed that adolescents who reported dissatisfaction with their body image (feeling either too thin or too fat) were more likely to become bully-victims. Being a target of a bullying-victim was connected with self-reported overweight. Being a bully was not associated with body image (Table 2). We found a statistically significant interaction between gender and body image regarding their association with bullying behaviour (Table 2, bottom row).

**Table 2** The effects of self-reported body image, gender, age and the interaction of gender\*body image and age\*body image on involvement in bullying among adolescents: ORs and 95% CIs in parentheses.

	Bully		Victim		Bully-victim	
	Crude OR (95% CI)	Adjusted OR (95% CI)	Crude OR (95% CI)	Adjusted OR (95% CI)	Crude OR (95% CI)	Adjusted OR (95% CI)
Gender						
Girls	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)
Boys	1.71 (1.47-1.99)***	1.70 (1.46-1.99)***	1.18 (0.98-1.41)	1.25 (1.04-1.50)*	1.83 (1.43-2.32)***	1.92 (1.51-2.45)***
Age	1.16 (1.09-1.22)***	1.15 (1.09-1.22)***	0.84 (0.78-0.89)***	0.83 (0.78-0.89)***	0.91 (0.84-1.00)	0.91 (0.84-1.00)
Self-reported body image						
Normal	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)
Too thin	0.89 (0.72-1.09)	0.89 (0.72-1.09)	1.19 (0.93-1.52)	1.21 (0.95-1.54)	1.41 (1.04-1.92)*	1.43 (1.05-1.95)*
Too fat	0.96 (0.80-1.16)	1.02 (0.85-1.23)	1.81 (1.48-2.23)***	1.88 (1.53-2.31)***	1.84 (1.41-2.42)***	1.98 (1.51-2.60)***
Interaction						
Self-reported body image * gender		NS		NS		***

Differences and overall models which are statistically significant ( $p < 0.05$ ) are in bold.

Odds ratios as shown have not been adjusted for the interaction.

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ , NS= not statistically significant at level  $p < 0.05$

We therefore repeated the analyses with stratification for gender among the bully-victims (Table 3). The association between feeling too thin or too fat with being a bully-victim was statistically significant. The relationship of being a bully-victim and self-reported overweight was significant at the level  $p < 0.001$  and the connection with thinness at  $p < 0.05$ . After stratification for gender, the association between being a bully-victim and self-reported thinness disappeared among girls and became strongly significant among boys.

**Table 3** Difference between boys and girls in involvement in the role of bully-victim by self-reported body image, associated ORs and 95% CIs

	Boys	Girls
	OR (95% CI)	OR (95% CI)
Self-reported body image		
Normal	1 (ref)	1 (ref)
Too thin	1.85 (1.27-2.68)***	0.86 (0.49-1.52)
Too fat	1.96 (1.36-2.84)***	1.88 (1.25-2.82)**

Differences and overall models which are statistically significant ( $p < 0.05$ ) are in bold.

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ , NS= not statistically significant at level  $p < 0.05$

## Discussion

The aim of the present study was to examine the relationship between a negative body image and involvement in bullying as well as the gender differences in this relationship. We found that adolescents reporting a negative body image—those who consider themselves to be too fat—were more likely to be victims and bully-victims. Self-reported thinness was associated with being a bully-victim only in boys. Contrary to our expectations, we found no association between negative body image and bullying others.

Previous research has documented well the vulnerability of adolescents reporting overweight, obesity, (Brixval et al., 2012; Fox & Farrow, 2009; Janssen et al., 2004; Midei & Matthews, 2011) or feelings of overweight (Sentenac et al., 2012; Wilson, Viswanathan, Rousson, & Bovet, 2013) to becoming victims of bullying, which is in line with our results. Low self-esteem and the different appearance of these adolescents can lead to their becoming easy targets for the aggressive behaviour of others or feelings of being a victim (Sentenac et al., 2012). Furthermore, we found that adolescents with a negative body image due to feeling too fat were found to be significantly more frequently bully-victims. In other words, these adolescents were more vulnerable to becoming victims and bullies than adolescents with a positive body image. The mixed effect of the different appearance, low self-esteem and social dysfunction of these adolescents may result in these adolescents becoming a bully-victim.

Self-reported thinness was related to a greater risk of becoming a bully-victim among boys, while this relationship was not significant among girls. To our knowledge, there is no previous evidence about the association between self-reported thinness and aggressive behaviour. An explanation for our finding may be the current ideal of a thin female and a muscular male (McCabe et al., 2011). This may be summarised like this: that thinness among boys indicates weakness, while girls are under the pressure of the slim ideal (Brixval et al., 2012). In line with this, boys dissatisfied with their bodies because of thinness are more vulnerable to suffering from mental and behavioural problems, leading to aggressive behaviour. In connection with their physical weakness the likelihood of becoming the target of bullying increases, and they are at risk of entering into the category of bully-victims.

The current study also showed that adolescents involved in bullying as bullies do not report a negative body image nor were gender differences found, which is in accordance with previous evidence. Bullies were found to have a lower level of psychosomatic problems (Isolan, Salum, Osowski, Zottis, & Manfro, 2013) and higher self-esteem than other adolescents involved in bullying (Andreou, 2000; Juvonen, Graham, & Schuster, 2003; O'Moore & Kirkham, 2001; Pollastri, Cardemil, & O'Donnell, 2010). In addition, recent finding suggests that bullies rate themselves as having a better physical appearance (O'Moore & Kirkham, 2001). On the other hand, it has been well documented that bullies report higher rates of psychosocial problems (Alikasifoglu, Erginoz, Ercan, Uysal, & Albayrak-Kaymak, 2007; Gobina, Zaborskis, Pudule, Kalnins, & Villerusa, 2008; Lien, Green, Welander-Vatn, & Bjertness, 2009) and lower self-esteem (Seals & Young, 2003) than uninvolved adolescents. Apparently, previous evidence about the psychosocial characteristics of bullies is not consistent. Pollastri et al. suggest that these inconsistencies are due to the fact that previous classifications also included bully-victims in to the category of bullies, whereas these have a different psychosocial background than bullies (Pollastri et al., 2010).

### *Strengths and limitations*

The major strengths of our study are that it concerns a large and representative sample of Slovak adolescents aged 11 to 15 years and has a high response rate. In addition, we used frequently applied measures for bullying, e.g. in the HBSC survey and in a variety of reports and peer-review publications at national and cross-national levels (Brixval et al., 2012; Craig et al., 2009; Harel-Fisch et al., 2011; Molcho et al., 2009).

A limitation is the cross-sectional design, which limits the potential for making causal inferences. A second limitation of our study is the use of self-report measures for assessing bullying behaviour. The question for assessing body image has not yet been validated. Its validity should be confirmed in future research.

### *Implications*

Our results imply that bullying prevention and intervention programmes at schools should also address body image. The target group should include all adolescents, not only those who are dissatisfied with their body image. Media literacy interventions may be useful tools for protecting young girls and boys from body dissatisfaction (Halliwell, Easun, & Harcourt, 2011). In synergy with other types of intervention, we could decrease the prevalence of body dissatisfaction-related problems among adolescence.

By decreasing the prevalence of bullying based on body dissatisfaction, it is possible to reduce the likelihood of various consequences of this type of aggressive behaviour: psychosomatic problems; psychological distress; risk behaviours, such as aggression, violence or substance use; serious anti-social problems in adolescence (Olweus, 2011) or becoming mothers in adolescence among girls (Lehti et al., 2011).

Our findings need confirmation, preferably in research that assesses bullying behaviour via techniques such as peer nominations for bullying and victimisation (Verlinden et al., 2014). It should focus on the identification of specific forms of weight-based bullying, taking into account the self-esteem of adolescents in order to help school staff and parents to reveal bullying in an early stage and intervene in an appropriate way. To disentangle causality, we need future longitudinal research or trend analyses on the relations between bullying behaviour and body dissatisfaction.

### **Conclusion**

To sum up, our study shows an association between body dissatisfaction and involvement in bullying. Self-reported feelings of overweight were found to be strongly connected with involvement in bullying as a victim and bully-victim among boys and girls. Gender differences emerged in the bully-victim category; boys feeling too thin were more likely to become bully-victims, unlike girls. Since negative body image and bullying are frequent among adolescents, further research is necessary to investigate the causal mechanism..



# The mediating effect of daily nervousness and irritability on the relationship between soft drink consumption and aggressive behaviour among adolescents

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## Abstract

**Objectives** This study investigated whether soft drink consumption is related to fighting and bullying behaviour among school-aged children and whether nervousness and irritation mediated this relationship.

**Methods** The data on 7583 adolescents aged 11–15 years from the Slovak part of the Health Behaviour in School-Aged Children (HBSC) study 2010 were analysed. Self-reported soft drink intake, bullying, fighting, nervousness, irritability and confounding variables were analysed using logistic regressions. To assess the potential mediation of daily nervousness and irritability on the association between soft drink consumption and aggressive behaviour, we used Sobel tests.

**Results** Adolescents' daily soft drink consumption was associated with bullying and fighting, and these relationships were partially mediated by nervousness and irritability. Adjustment of the analyses on gender, age and family affluence did not change the estimates.

**Conclusions** Adolescents' daily soft drink consumption was associated with negative mood deviations such as nervousness and irritability and with aggressive behaviour in the form of bullying and fighting. Our findings provide new evidence about soft drink consumption-related risks and thus can contribute to the preventive actions aimed at reducing them.

**Keywords:** soft drinks, aggressive behaviour, nervousness, irritability, bullying, fighting

## Introduction

Adolescents in industrialized countries consume on average a great many soft drinks, a behaviour which has a number of unfavourable side effects (Naska, Bountziouka, & Trichopoulou, 2010). Recent studies show soft drink consumption to be significantly linked to higher rates of overweight, obesity and diabetes (Basu et al., 2013) as well as to metabolic syndrome (Høstmark, 2010). Regarding psycho-social issues, mental health problems among adolescents have been shown to be more likely in cases of frequent and steady consumption of sugar-containing soft drinks (Lien, Lien, Heyerdahl, Thoresen, & Bjertness, 2006; Shi et al., 2010). Also, unhealthy behaviours, such as frequent television viewing, screen-based activities (Hasselkvist, Johansson, & Johansson, 2014; Olafsdottir et al., 2014; te Velde et al., 2014) or frequent meals in fast food restaurants (Verzeletti et al., 2010), were significantly linked to soft drink intake. To conclude, soft drink intake seems to be associated with a number of health and behavioural problems.

Generally, the prevalence of daily soft drink consumption was found to be higher among boys. When considering socioeconomic status, in Central and Eastern European countries, a significant increase in soft drink consumption was found with increasing family affluence (Vereecken, Inchley, Subramanian, Hublet, & Maes, 2005). Particularly in Slovakia, only boys of higher family affluence reported significantly higher soft drink consumption than other affluence groups (Currie et al., 2012).

Bullying and fighting are the most common forms of problematic aggressive behaviour among school-aged children. Recent research has shown that aggressive behaviour of adolescents is associated with fluctuations in their blood sugar level (DeWall, Deckman, Gailliot, & Bushman, 2011). A high intake of soft drinks makes such fluctuations more likely and can thus be indirectly linked to a higher prevalence of violent behaviour among children and adolescents. Such a relationship was confirmed in a recent study dealing with weapon carrying and violence towards peers, family members and dates (Solnick & Hemenway, 2012). In addition, adolescents with high soft drink consumption reported more likely involvement in a physical fight, feeling sad or hopeless and having suicidal thoughts and actions (Solnick & Hemenway, 2014).

A high soft drink intake may also make bullying and fighting among school-aged children more likely, either directly or mediated by other behavioural factors. Previous research showed that high and daily soft drink intake was significantly associated with a broad range of mental distress symptoms, such as anxiety, sadness, feeling panicked or being tense, among adolescents (Lien, Lien, Heyerdahl, Thoresen, & Bjertness, 2006). Further, irritability was associated with high physical and verbal aggression (Caprara, Paciello, Gerbino, & Cugini, 2007). In other words, children with daily soft drink intake might be more vulnerable to suffering from nervousness, irritability or other types of mental distress, and this may result in aggressive behaviour. Thus, the connection between daily soft drink intake and adolescents' involvement in bullying and physical fight may be explained by this self-reported nervousness and irritability. Evidence on this potential association is lacking, even though both soft drink consumption and violent behaviour among children and adolescents have become serious public health and public policy issues. Therefore, we investigated whether soft drink consumption was related to the fighting and bullying behaviour of school-aged children, and whether nervousness and irritation mediated this relationship.

## Material and methods

### *Sample and procedure*

The data from the Health Behaviour in School-aged Children (HBSC) study conducted in 2010 in Slovakia were analysed. To obtain a representative sample, we used a two-step sampling. In the first step, 134 larger and smaller elementary schools located in rural as well as in urban areas from all regions of Slovakia were asked to participate. These were randomly selected from a list of all eligible schools in Slovakia obtained from the Slovak Institute of Information and Prognosis for Education. School response rate (RR) was 98.1 %.

In the second step, the data from 8491 adolescents from the fifth to ninth grades of these schools (RR: 79.5 %) were obtained. The sample was reduced to adolescents aged 11–15 years, leading to a final sample of 7583 adolescents (mean age: 12.89; 48.2 % boys) in the target age group.

The study was approved by the Ethics Committee of the Medical Faculty at the P. J. Safarik University in Kosice. Parents were informed about the study via the school administration and could opt out if they disagreed with their child's participation. Participation in the study was fully voluntary and anonymous with no explicit incentives provided for participation.

### *Measures*

The present study uses HBSC data related to adolescents' reports of soft drink consumption rate, bullying behaviour, involvement in physical fights, nervousness, irritation and socio-demographic characteristics (age, family affluence and gender).

Soft drink consumption was measured by the question: "How many times a week do you usually drink coke or other soft drinks that contain sugar?" Possible responses were: "never", "less than once a week", "once a week", "2–4 days a week", "5–6 days a week", "once a day, every day", "every day, more than once". To obtain two groups of adolescents—those who drink soft drinks once a day or more and the others, we dichotomized the responses.

The role of the adolescent in bullying was measured using the revised Olweus Bully/Victim Questionnaire (Solberg & Olweus, 2003). After having read a standard definition of bullying, respondents were asked about their involvement in bullying—how often they had bullied others in school in the last few months. Responses were rated on a five-point scale ("I haven't been bullied/bullied other students at school in the past couple of months", "only once or twice", "two or three times a month", "about once a week", "several times a week"). We chose the cutoff point of "two or three times a month" and dichotomized the responses to get two categories of bullying behaviour.

Physical fight involvement was measured by the question "During the past 12 months, how many times were you in a physical fight?" Response categories were: "I have not been in a physical fight in the past 12 months", "one time", "two times", "three times", "four times or more". We dichotomized the responses to obtain category of adolescents who are involved in a physical fight more than three times in the past 12 months.

Nervousness and irritation was measured by two items from the HBSC symptom checklist (HBSC-SCL): "In the last 6 months: how often have you had

the following...?” and we focused on irritability and being nervous, with possible responses: “about every day”, “more than once a week”, “about every week”, “about every month”, “rarely or never”. In the dichotomization we distinguished the group of adolescents with daily complaints.

Family affluence was used to determine the socioeconomic status of adolescents and their families, measured with the Family Affluence Scale (FAS) widely used in the HBSC questionnaire. FAS items ask students about things they are likely to know about in their family (car, bedrooms, vacations and computers), thus limiting the number of non-responses in the study (Schnohr et al., 2013). The items and their response categories were: “Does your family own a car, van or truck?” (no = 0, yes, one = 1, yes, two or more = 2), “Do you have your own bedroom for yourself?” (no = 0, yes = 1), “During the past 12 months, how many times did you travel away on holiday with your family?” (not at all = 0, once = 1, twice = 2, more than twice = 3), “How many computers does your family own?” (none = 0, one = 1, two = 2, more than two = 3). The final score of every respondent determines the socioeconomic status (low—0 to 2 points; medium—3 to 5 points; high—6 to 9 points).

### Statistical analyses

First, the socio-demographic characteristics were described: gender, family affluence, age and the prevalence of soft drink consumption, involvement in bullying and a physical fight and daily nervousness and irritability. Differences between the groups were tested using Chi-square tests.

Second, we assessed the crude associations of daily soft drink consumption, irritability and being nervous and the confounding variables (gender, family affluence, age) with involvement in bullying and a physical fight (Model 1). We adjusted the crude effect of soft drink consumption on bullying and involvement in a physical fight for gender, age and family affluence (Model 2).

Third, we assessed the effect of soft drink consumption on bullying and on involvement in a physical fight after adding in daily health complaints—being irritated (Model 3a) and being nervous (Model 3b). To assess the mediating effect of nervousness and irritability, we used the Sobel test to explore whether the indirect effect of the independent variable on the dependent variable through the mediator variable was significant. The following formula was used:

$$t = \frac{\beta_a \beta_b}{\sqrt{(\beta_a^2 SE_{\beta_b}^2) + (\beta_b^2 SE_{\beta_a}^2)}}$$

where  $\beta_a$  is the regression coefficient for the relationship between the independent variable and the mediator variable,  $\beta_b$  is the regression coefficient for the relationship between the mediator variable and the dependent or the outcome variable,  $SE_{\beta_a}$  is the standard error of  $\beta_a$  (the relationship between the independent variable and the mediator variable), and  $SE_{\beta_b}$  is the standard error of  $\beta_b$  (the relationship between the mediator variable and the dependent or outcome variable). A significant Sobel test outcome suggests the existence of mediation between the independent variable and the dependent or the outcome variable (Sobel, 2008). The degree of reduction of the odds ratios (ORs) was computed using the formula:  $(OR_{crude} - OR_{adjusted}) / (OR_{crude} - 1)$

× 100 %. All data were analysed using IBM SPSS statistics 20.0 for Windows, and the Sobel tests were calculated via <http://www.danielsoper.com>.

## **Results**

Almost 40 % of our sample reported daily soft drink consumption. As to the aggressive behaviour, over 10 % of our sample bullied others two or three times a month and more and was involved in a physical fight three times or more in the last year. Daily nervousness and irritability were reported by one-tenth of the sample. Descriptive characteristics of the sample are shown in Table 1.

**Table 1** Background characteristics of the sample – gender, family affluence and prevalence of daily irritability, nervousness, bullying and involvement in physical fight – overall and by category of soft drinks consumption; Health Behaviour in School-Aged Children study Slovakia, 2009/2010

	Soft drinks consumption			Daily vs. Irregular soft drinks consumer
	Total	Daily	Irregular	
	N= 7583	N= 2722 (37%)	N= 4644 (63%)	
	N %	N %	N %	p value
Gender				<0.001
boy	3654 (48.2)	1379 (39.1)	2148 (60.1)	
girl	3921 (51.8)	1341 (35.0)	2490 (65.0)	
Family affluence				0.096
low	1659 (24.3)	572 (35.6)	1036 (64.4)	
medium	3482 (50.9)	1219 (35.6)	2201 (64.4)	
high	1696 (24.8)	638 (38.6)	1016 (61.4)	
Irritability				<0.001
yes	673 (9.0)	302 (47.0)	341 (53.0)	
no	6766 (91.0)	2377 (36.0)	4231 (64.0)	
Feeling nervous				<0.001
yes	771 (10.4)	345 (46.8)	392 (53.2)	
no	6676 (89.6)	2331 (35.7)	4190 (64.3)	
Bullying				<0.001
yes	961 (13.3)	416 (43.3)	545 (56.7)	
no	6250 (86.7)	2243 (35.9)	4007 (64.1)	
Fight				<0.001
yes	1028 (14.3)	479 (46.6)	549 (53.4)	
no	6197 (85.7)	2186 (35.3)	4011 (64.7)	

Only valid percentages are presented; missing values: gender N=8 (0.1%); soft drinks consumption N=217 (2.9%); family affluence N=746 (9.8%); irritability N=144 (1.9%); feeling nervous N=136 (1.8%); bullying N=174 (2.3%); fighting N=156 (2.1%);

Daily soft drink consumption was significantly associated with bullying others and involvement in a physical fight, and crude and also adjusted for potential confounders (Table 2). Odds ratios for soft drink consumption changed only marginally after adjustment. Adolescents who reported daily consumption were more likely to behave aggressively (to bully or fight with others).

**Table 2** The association between daily soft drinks consumption of adolescents and their involvement in bullying and fighting, crude and adjusted for age, gender and family affluence, and additionally adjusted for irritability and nervousness, separately and combined; odds ratios (OR) and 95% confidence intervals (CI) in parentheses; Health Behaviour in School-Aged Children study Slovakia, 2009/2010

	Model 1		Model 2		Model 3a		Model 3b		Model 4	
	OR	(95%CI)	OR	(95%CI)	OR	(95%CI)	OR	(95%CI)	OR	(95%CI)
<b>BULLYING</b>										
Daily soft drinks consumption	1.36	(1.18-1.56)	1.31	(1.13-1.51)	1.25	(1.08-1.45)	1.26	(1.09-1.46)	1.24	(1.07-1.44)
Gender (boy)	1.77	(1.54-2.03)	1.87	(1.62-2.17)	1.90	(1.64-2.20)	1.90	(1.64-2.20)	1.90	(1.64-2.21)
Age in years	1.11	(1.05-1.17)	1.08	(1.02-1.15)	1.09	(1.02-1.15)	1.08	(1.02-1.15)	1.09	(1.03-1.15)
Family affluence										
High	1	(ref)	1	(ref)	1	(ref)	1	(ref)	1	(ref)
Medium	0.80	(0.67-0.94)	0.81	(0.68-0.96)	0.81	(0.68-0.97)	0.80	(0.67-0.95)	0.81	(0.68-0.96)
Low	0.93	(0.77-1.13)	0.97	(0.79-1.18)	0.94	(0.77-1.15)	0.93	(0.76-1.14)	0.93	(0.75-1.14)
Irritability (daily)	2.62	(2.17-3.16)	-	-	2.54	(2.07-3.12)	-	-	2.01	(1.58-2.56)
Feeling nervous (daily)	2.10	(1.74-2.53)	-	-	-	-	2.14	(1.75-2.62)	1.55	(1.22-1.96)
* Change of OR for soft drinks	-	-	13.9%	13.9%	19.4%	19.4%	16.1%	16.1%	22.6%	22.6%
Cases included in the model N (%)			6568	(86.6)	6494	(85.6)	6497	(85.7)	6467	(85.3)

Table 2 (continued)

FIGHTING						
Daily soft drinks consumption	1.60 (1.40-1.82)	1.52 (1.31-1.76)	1.46 (1.26-1.70)	1.45 (1.25-1.69)	1.45 (1.24-1.68)	1.45 (1.24-1.68)
Gender (boy)	4.55 (3.91-5.30)	4.61 (3.92-5.42)	4.55 (3.85-5.37)	4.61 (3.90-5.45)	4.62 (3.91-5.46)	4.62 (3.91-5.46)
Age in years	0.98 (0.94-1.03)	0.97 (0.92-1.03)	0.97 (0.92-1.03)	0.97 (0.91-1.03)	0.97 (0.92-1.03)	0.97 (0.92-1.03)
Family affluence						
High	1 (ref)					
Medium	0.70 (0.59-0.82)	0.72 (0.61-0.85)	0.76 (0.64-0.90)	0.73 (0.61-0.87)	0.74 (0.63-0.88)	0.74 (0.63-0.88)
Low	0.60 (0.49-0.73)	0.69 (0.56-0.85)	0.69 (0.56-0.85)	0.66 (0.53-0.82)	0.66 (0.53-0.82)	0.66 (0.53-0.82)
Irritability (daily)	2.29 (1.89-2.77)	-	2.39 (1.93-2.97)	-	1.69 (1.31-2.18)	1.69 (1.31-2.18)
Feeling nervous (daily)	3.35 (1.97-2.81)	-	-	2.50 (2.04-3.07)	1.94 (1.52-2.48)	1.94 (1.52-2.48)
* Change of OR for soft drinks	-	13.3%	11.5%	13.5%	13.5%	13.5%
Cases included in the model N (%)	-	6595 (87.0)	6519 (86.0)	6525 (86.0)	6493 (85.6)	6493 (85.6)

Model 1: Crude effect of each variable separately on bullying and fighting

Model 2: Effect of each variable separately on bullying and fighting adjusted for family affluence, gender and age

Model 3a: Adjusted effect of daily soft drinks consumption controlled for irritability

Model 3b: Adjusted effect of daily soft drinks consumption controlled for being nervous

Model 4: Adjusted effect of daily soft drinks consumption controlled for irritability and being nervous

\* Decrease of OR for daily soft drinks consumption due to adjustment, compared with Model 1 (in Model 2) and compared with Model 2 (in Models 3a, 3b and 4); HBSC study Slovakia, 2009/2010

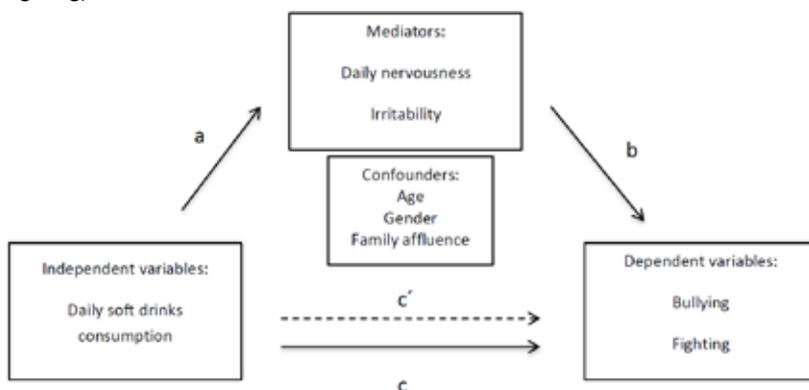
The association between soft drink consumption and aggressive behaviour (fighting and bullying) remained significant after additional adjustment for potential mediators, i.e. daily nervousness and irritability, separately (Models 3a and 3b) and combined (Model 4). Changes in the odds ratios (OR) in this relationship after inclusion of daily nervousness and irritation in the model suggest that these have a mediating role. As shown in Table 3, the outcomes of the Sobel tests confirmed the mediating role of daily nervousness and irritability on the association of daily soft drink consumption and aggressive behaviour—bullying and fighting of adolescents. The conceptual model of mediation is illustrated in Figure 1.

**Table 3** Mediation effects of daily irritability and nervousness on the relationship between daily soft drinks consumption and bullying and fighting; results of the Sobel tests; Health Behaviour in School-Aged Children study Slovakia, 2009/2010

Indirect path	$\beta_a$ (SE $\beta_a$ )	$\beta_b$ (SE $\beta_b$ )	t	p-value
Soft drinks consumption	0.459 (0.078) →	nervousness → 0.743 (0.095)	bullying 5.06	<0.001
Soft drinks consumption	0.455 (0.083) →	irritability → 0.963 (0.096)	bullying 4.97	<0.001
Soft drinks consumption	0.459 (0.078) →	nervousness → 0.856 (0.091)	fighting 5.31	<0.001
Soft drinks consumption	0.455 (0.083) →	irritability → 0.830 (0.096)	fighting 4.80	<0.001
Direct path	$\beta_c$ (SE $\beta_c$ )	$\beta_{c'}$ (SE $\beta_{c'}$ )		
Soft drinks consumption	0.310 (0.70)	0.260 (0.072)	bullying	
Soft drinks consumption	0.471 (0.068)	0.441 (0.70)	fighting	

$\beta$  = Standardized coefficient; SE = Standard error; a = Association between soft drinks consumption and potential mediators; b = Associations between the mediators and aggressive behaviour; c = Total association between soft drinks consumption and aggressive behaviour, unadjusted for the mediators; c' = Direct association between soft drinks consumption and aggressive behaviour, adjusted for the mediators

**Figure 1** Conceptual model for the mediated effect of daily health complaints on the association between soft drinks consumption and aggressive behaviour (bullying and fighting)



a = Association between soft drinks consumption and potential mediators. b = Associations between the mediators and aggressive behaviour. c = Total association between soft drinks consumption and aggressive behaviour, unadjusted for the mediators. c' = Direct association between soft drinks consumption and aggressive behaviour, adjusted for the mediators.

## Discussion

This study explored the associations between daily soft drink intake and bullying and fighting, and whether nervousness and irritability mediated these associations. Daily soft drink consumption was related to aggressive behaviour (bullying and fighting) among school-aged children. Furthermore, this relationship was found to be mediated by daily nervousness and irritability.

Our findings about the connection between soft drink consumption and aggressive behaviour of school-aged children are in line with previous findings. Solnick and Hemenway found an association between soft drink consumption and violent behaviour among high school students (Solnick & Hemenway, 2012). In addition, Shakira et al. found this association among 5-year-old children (Suglia, Solnick, & Hemenway, 2013). Other studies investigated the connection between consumption of caffeine, which is consumed by adolescents mostly via soft drinks, and violent behaviour of adolescents and found a significant relation (Kristjansson et al., 2013; Martin et al., 2008). Although the results of the first two studies did not take into account the socioeconomic status of adolescents' families as we did, we found the same results.

As we investigated the connection between soft drink intake and aggressive behaviour of adolescents cross-sectionally, our findings can be explained in two ways. Firstly, soft drink consumption may lead to frequent aggressive behaviour among adolescents. This causal path might be due to the influence of soft drink content, such as sugar, artificial sweeteners or caffeine, on adolescents' behaviour. Although previous studies have shown that consumption of artificial sweeteners (e.g. aspartame) had no relation to problem behaviour (Saravis, Schachar, Zlotkin, Leiter, & Anderson, 1990; Van den Eeden et al., 1994), these studies focused on the short-term behaviour immediately after consumption. However, daily consumption

of this substance can cause dramatic fluctuations in the blood glucose levels or even metabolic syndrome (Kristjansson et al., 2013; Tandel, 2011), which has been found to be related to behaviour deviations and violence (Benton, 2007). According to these findings, the components of soft drinks might provoke aggressive behaviour, although evidence on this causal relationship is lacking. A second possible explanation of the relationship we found is that adolescents reporting aggressive behaviour are more inclined to drink sweetened beverages than nonaggressive adolescents.

We found that daily self-reported nervousness and irritability mediated the relationship between daily soft drink intake and aggressive behaviour—bullying and fighting of adolescents. This means that children with daily soft drink intake might be more vulnerable to suffering from nervousness and irritability, which may result in aggressive behaviour. Thus, the connection between daily soft drink intake and adolescents' involvement in bullying and physical fighting may be explained by the self-reported nervousness and irritability.

### *Strengths and limitations*

We consider the large and representative study sample of adolescents aged from 11 to 15 years and the high response rate to be the major strengths of this study. In addition, we used validated measures of frequency of soft drink consumption (Carine & Maes, 2003; Vereecken, Rossi, Giacchi, & Maes, 2008), nervousness and irritability (Haugland & Wold, 2001), fighting (Brener, Collins, Kann, Warren, & Williams, 1995) and bullying (Vessey, Strout, DiFazio, & Walker, 2014), which have been well validated and the reliability ascertained with extensive use in a variety of reports and peer-reviewed publications at national and cross-national levels. A limitation of the current study is its cross-sectional design. Therefore, inferences regarding the cause and effect were not possible. In addition, our data were based on self-reports, which can be inaccurate or influenced by social desirability, though previous research has shown them to be valid.

### *Implications*

Taken together, our findings on the intake of soft drinks have important implications for interventions taking place both in the school and family environments. The association between excessive soft drink consumption and several health and behavioural problems, be it causal or not, provides a reason to monitor the soft drink intake at schools. If the relationship is indeed causal, preventive activities focused on adolescents during school time could aim at banning soft drinks at schools or providing information about adverse effect of soft drink consumption to adolescents and parents. However, this evidently requires further research on causality via a longitudinal study, and on the effectiveness of interventions. Further research is needed to examine the biological and psycho-social mechanisms affecting the relationship between soft drink consumption and aggressive behaviour.

### **Conclusion**

In conclusion, our results underline the fact that adolescents' daily soft drink consumption is associated with aggressive behaviour and that this relationship is mediated by negative mood deviations such as nervousness and irritability. Our

findings provide new evidence about risks related to soft drink consumption and thus can contribute to preventive actions aimed to reduce these. Longitudinal studies should explore the causal relationships between soft drink intake and health and behavioural outcomes among adolescents.



# Lack of parental rule-setting on eating is associated with a wide range of adolescent unhealthy eating behaviour both for boys and girls

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## Abstract

*Background* Unhealthy eating habits in adolescence lead to a wide variety of health problems and disorders. The aim of this study was to assess the prevalence of absence of parental rules on eating and unhealthy eating behaviour and to explore the relationships between parental rules on eating and a wide range of unhealthy eating habits of boys and girls. We also explored the association of sociodemographic characteristics such as gender, family affluence or parental education with eating related parental rules and eating habits of adolescents.

*Methods* The data on 2765 adolescents aged 13–15 years (mean age: 14.4; 50.7 % boys) from the Slovak part of the Health Behaviour in School-Aged Children (HBSC) study 2014 were assessed. The associations between eating-related parental rules and unhealthy eating patterns using logistic regression were assessed using logistic regression.

*Results* Unhealthy eating habits occurred frequently among adolescents (range: 18.0 % reported skipping breakfast during weekends vs. 75.8 % for low vegetables intake). Of all adolescents, 20.5 % reported a lack of any parental rules on eating (breakfast not mandatory, meal in front of TV allowed, no rules about sweets and soft drinks). These adolescents were more likely to eat unhealthily, i.e. to skip breakfast on weekdays (odds ratio/95 % confidence interval: 5.33/4.15–6.84) and on weekends (2.66/2.12–3.34), to report low consumption of fruits (1.63/1.30–2.04) and vegetables (1.32/1.04–1.68), and the frequent consumption of sweets (1.59/1.30–1.94), soft drinks (1.93/1.56–2.38) and energy drinks (2.15/1.72–2.70).

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*Conclusion* Parental rule-setting on eating is associated with eating behaviours of adolescents. Further research is needed to disentangle causality in this relationship. If causal, parents may be targeted to modify the eating habits of adolescents.

**Keywords:** unhealthy eating habits, parental rules, breakfast, fruits and vegetables consumption, sweets consumption, soft drinks, energy drinks

## Introduction

Unhealthy eating habits have been shown to be very common among adolescents in Europe (Currie et al., 2012; Fismen, Smith, Torsheim, & Samdal, 2014; Haug et al., 2009). Adolescents reporting unhealthy eating habits were at increased risk of becoming overweight (Haug et al., 2009) and suffering from fatigue, nutrient deficiencies, poor cognitive or physical performance (Taras, 2005), poorer mental health (O'Neil et al., 2014) and negative behavioural outcomes (Holubcikova, Kolarcik, Madarasova Geckova, Reijneveld, & van Dijk, 2015). Adolescents who develop unhealthy eating habits are likely to continue this behaviour into adulthood (Lake et al., 2004), which can lead to a higher risk of many chronic illnesses. It is the reason why in recent years, particular attention has been devoted to nutritional behaviour during this period of life.

Parental rules have been shown to be one of the most important factors related to eating habits among adolescents (Lindsay et al., 2006; Pedersen et al., 2015; Van Lippevelde et al., 2013). The association between eating-related parental rules and eating habits of adolescents is particularly well-documented (Bourcier, Bowen, Meischke, & Moinspour, 2003; DeJong, van Lenthe, & Oenema, 2009; Gross et al., 2010; Kristjansdottir, De Bourdeaudhuij, Klepp, & Thorsdottir, 2009; Van Lippevelde et al., 2013; Verzeletti, Maes, Santinello, Baldassari et al., 2010). This suggests that parental rules on eating are a strong promoter of healthy eating patterns among adolescents, like more consumption of fruit and vegetables (Bourcier et al., 2003; Gross et al., 2010; Kristjansdottir et al., 2009; Verzeletti et al., 2010), regular consumption of breakfast (DeJong et al., 2009; Van Lippevelde et al., 2013) and less frequent soft drinks intake (Verzeletti et al., 2010). The scope of the above-mentioned studies is limited in regard to specific unhealthy behaviours. There is a lack of studies investigating the wide range of behaviours of adolescents that contribute to the general profile of unhealthy eating among adolescents. Moreover, evidence on correlates of energy drink consumption, which is prevalent among adolescents, is scarce (Seifert et al., 2011).

Several sociodemographic characteristics such as maternal education or parental modelling have previously been identified to have strong association with eating habits of adolescents. More specifically unhealthy eating habits of adolescents have been shown to be more likely in case of low maternal education, low socio-economic status and lack of parental rules on eating (Jones, Steer, Rogers, & Emmett, 2010; Pearson et al., 2009; van Ansem, Wilke, Schrijvers, Rodenburg, & van de Mheen, 2014). Eating behaviour of adolescents differed between rural and urban areas in some European countries which can be due to cultural and economic differences between rural and urban areas (Gaspar, Gaspar de Matos, Luszczynska, Baban, & Wit). Finally, girls were in general found to have a healthier diet than boys. These gender differences in eating habits may be explained by girls' greater focus on healthy eating (Wardle et al., 2004).

The aim of our study was to assess the prevalence of parental rules on eating and the prevalence of a wide range of unhealthy eating behaviours among adolescents, to explore the associations between a lack of eating-related parental rules and various unhealthy eating habits, such as skipping breakfast, insufficient fruits and vegetables consumption, frequent sweets, soft drinks and energy drinks consumption of adolescents. Moreover we explored the association of sociodemographic characteristics such as gender, family affluence, completeness of

family, parental education and urban context with eating related parental rules and eating habits of adolescents.

## **Methods**

### *Sample and procedure*

We used data from the Health Behaviour in School-aged Children (HBSC) study conducted in 2014 in Slovakia. To obtain a representative sample, we used a two-step sampling. In the first step, 151 larger and smaller elementary schools located in rural as well as in urban areas from all regions of Slovakia were asked to participate. These were randomly selected from a list of all eligible schools in Slovakia obtained from the Slovak Institute of Information and Prognosis for Education. This resulted in 130 schools agreeing to participate (86.1%).

In the second step, we obtained data from 10,179 adolescents from the 5th to 9th grades of these schools (response rate: 78.8%). Our final sample consisted of adolescents who responded to questionnaires that included measures on parental rules. In order to reduce the duration of administration of the questionnaires we used two types of questionnaire which partially consisted of the same questions. These overlapping questions regarded the mandatory questions that have to be included in any HBSC questionnaire. To these partially differing sets of other questions were added, which is allowed in the HBSC design. Not all adolescents administered the same version of questionnaire to avoid that the total questionnaire would become too long. Thus we created two different sets of questions (equal in length, but differing in variables included) - version A and version B with an equal share (50/50). Those version were randomly distributed within the sample. In this way, we reduced the sample of adolescents, leading to a final sample of 2,765 adolescents (mean age: 14.38; 50.7% boys).

The study was approved by the Ethics Committee of the Medical Faculty at the P.J. Safarik University in Kosice. Parents were informed about the study via the school administration and could opt out if they disagreed with their child's participation. Participation in the study was fully voluntary and anonymous, with no explicit incentives provided for participation.

### *Measures*

Data for the present analyses were collected using questionnaires from the standardized research protocols for the 2014 WHO-collaborative HBSC study, with the aim of gaining insights into adolescents' eating behaviour, eating-related parental rules and socio-demographic characteristics. Table 1 provides an overview of the measures used in this study.

**Table 1** Description of items from the HBSC questionnaire used in this study

	Wording of the question	Options	Dichotomisation
<b>Eating-related parental rules</b>			
Breakfast mandatory	Breakfast is a mandatory part of the day in my family.	Always Mostly Rarely Never	<mostly
Meal in front of TV allowed	My parents allow me to eat (lunch and dinner) in front of the television or computer.		
Sweets and soft drinks consumption family rules	My parents allow me to eat sweets and drink sweetened beverages (e.g. Coca Cola, Fanta...) when I want and how much I want.		
<b>Eating patterns</b>			
Breakfast on weekends	How often do you usually have breakfast (more than a glass of milk or fruit juice)?	I never have breakfast One day Two days Three days Four days Five days	<two days (weekend) <five weekdays
Breakfast on weekdays	Please tick one box for weekdays and one box for weekend		
Low fruit consumption	How many times a week do you usually eat or drink....?	Never Less than once a week Once a week 2-4 days a week 5-6 days a week Once a day, every day Every day, more than once	Fruits and vegetables consumption <once a day
Low vegetables consumption			
High soft drinks consumption			Soft drinks and sweets consumption >5-6 days a week
High sweets consumption			Energy drinks consumption > once a week
High energy drinks consumption			
<b>Perceived family wealth</b>			
Low family affluence	How well off do you think your family is?	Very well off Quite well off Average Not so well off Not at all well off	<average

### *Statistical analyses*

Statistical analyses were performed using IBM SPSS statistics 20.0 for Windows. Firstly, the prevalence of parental rules and eating habits of adolescents were calculated for total sample and stratified by gender and family affluence. Differences between boys and girls and adolescents reporting low family affluence and others were tested using Chi-square tests. Secondly, the associations of sociodemographic characteristics (gender, family affluence, completeness of family, parental education and urban context) with parental rules and eating habits of adolescents were assessed. Thirdly, we assessed the associations between eating-related parental rules and unhealthy eating patterns using logistic regression. We adjusted these analyses for gender and family affluence.

### **Results**

Over 20% of the sample reported no parental rules on eating. Actually more than a half of adolescents admitted the absence of one of the following rules in their families: mandatory breakfast, meal in front of TV not allowed or no rules about sweets and soft drinks consumption. The prevalence of unhealthy eating behaviours among adolescents varied from 18% for skipping breakfast during the weekends to 75% for low vegetables consumption. (Table 2).

**Table 2** Description of the sample - parental rules on eating and unhealthy eating habits for the total sample and stratified by gender and family affluence

	Total N=2765 (%)	Boys N=1402 (%)	Girls N=1363 (%)	P value	Low family affluence N=134 (%)	Higher family affluence N=2571 (%)	P value
<b>Parental rules</b>							
No eating-related parental rules	524 (20.5)	212 (16.7)	312 (24.2)	0.000	38 (29.9)	484 (20.1)	0.008
Breakfast not mandatory	1324 (51.1)	601 (46.7)	723 (55.5)	0.000	81 (62.8)	1230 (50.5)	0.006
Meal in front of TV allowed	1420 (54.6)	698 (54.2)	722 (55.0)	0.652	77 (60.2)	1335 (54.5)	0.213
No rules about sweets and soft drinks	1421 (54.3)	723 (55.5)	698 (53.2)	0.232	79 (60.8)	1336 (54.3)	0.148
<b>Eating behaviours</b>							
Skip breakfast weekend	489 (18.0)	240 (17.5)	249 (18.4)	0.541	36 (27.5)	440 (17.4)	0.003
Skip breakfast weekday	1511 (55.4)	711 (51.6)	800 (59.4)	0.000	89 (66.9)	1393 (54.9)	0.006
Low fruit consumption	1894 (69.6)	1022 (74.5)	872 (64.6)	0.000	98 (74.2)	1759 (69.4)	0.237
Low vegetables consumption	2042 (75.8)	1100 (80.6)	942 (70.8)	0.000	102 (77.9)	1892 (75.4)	0.529
High sweets consumption	973 (36.2)	445 (32.9)	528 (39.6)	0.000	50 (38.8)	905 (36.1)	0.546
High soft drinks consumption	697 (25.6)	381 (27.6)	316 (23.5)	0.014	32 (24.4)	649 (25.6)	0.760
High energy drinks consumption	604 (22.2)	395 (28.8)	209 (15.5)	0.000	25 (18.9)	560 (22.1)	0.395

Missing values N(%): No eating-related parental rules 207 (7.5%), Breakfast not mandatory 175 (6.3%), Meal in front of TV allowed 164 (5.9%), No rules about sweets and soft drinks 149 (5.4%), Skip breakfast weekend 47 (1.7%), Skip breakfast weekday 39 (1.4%), Low fruit consumption 45 (1.6%), Low vegetables consumption 71 (2.6%), Sweets every day 79 (2.9%), Soft drinks every day 45 (1.6%), Energy drinks regularly 44 (1.6%), Low family affluence 60 (2.2%)

**Table 3** The association of gender, family affluence, family completeness, urban context and parents' educational level with eating-related parental rules and unhealthy eating habits among adolescents; odds ratios (OR), and 95% confidence intervals (CI) between parentheses

	No eating-related parental rules	Skip breakfast weekend	Skip breakfast weekday	Low fruit consumption	Low vegetables consumption	High sweets consumption	High soft drinks consumption	High energy drinks consumption
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Gender - boy	0.62 (0.51-0.76)***	ns	0.72 (0.62-0.84)***	1.60 (1.35-1.88)***	1.71 (1.43-2.05)***	ns	1.24 (1.04-1.47)*	2.20 (1.82-2.65)***
Family affluence- low	1.69 (1.14-2.51)**	1.80 (1.21-2.67)**	1.66 (1.14-2.40)**	ns	ns	ns	ns	ns
Incomplete family	1.43 (1.03-1.98)*	ns	1.39 (1.05-1.84)*	ns	ns	ns	ns	ns
Rural area	0.75 (0.61-0.92)**	ns	ns	1.30 (1.09-1.54)**	ns	1.18 (1.01-1.39)*	1.34 (1.12-1.60)**	1.22 (1.01-1.46)*
Mother education - low	1.30 (1.04-1.61)*	1.64 (1.31-2.05)***	1.25 (1.05-1.49)*	1.42 (1.17-1.73)***	ns	1.37 (1.14-1.64)**	1.67 (1.37-2.03)***	1.80 (1.46-2.21)***
Father education - low	1.33 (1.07-1.64)**	1.50 (1.27-1.78)***	1.50 (1.27-1.78)***	1.37 (1.14-1.65)**	ns	1.34 (1.12-1.60)**	1.82 (1.50-2.21)***	1.81 (1.48-2.23)***

\*p<0.05, \*\*p<0.01, \*\*\*p<0.001, ns= not statistically significant at level p<0.05

The results of the multiple logistic regressions showed that adolescents who reported a lack of eating-related parental rules were more likely to eat unhealthily. In the analyses of each eating-related rule separately, we found that unhealthy eating habits among adolescents were associated with an absence of these parental rules. Only low consumption of fruit and vegetables showed no relationship with some rules on eating. Adding gender and perceived family wealth into the models did not affect the strength of the association of rule setting on eating and the unhealthy eating habits of adolescents (Table 4). When exploring clustering by class and school, multilevel analyses showed a very small and non-significant clustering and yielded identical or nearly identical ORs and 95% CIs.

**Table 4** The association between eating-related parental rules and unhealthy eating habits among adolescents adjusted for gender and perceived family health; odds ratios (OR), and 95% confidence intervals (CI) between parentheses

	Skip breakfast weekend	Skip breakfast weekday	Low fruit consumption	Low vegetables consumption	High sweets consumption	High soft drinks consumption	High energy drinks consumption
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
No eating-related parental rules	2.66 (2.12-3.34)*	5.33 (4.15-6.84)*	1.63 (1.30-2.04)*	1.32 (1.04-1.68)*	1.59 (1.30-1.94)*	1.93 (1.56-2.38)*	2.15 (1.72-2.70)*
Breakfast not mandatory	2.30 (1.85-2.86)*	13.21 (10.90-16.02)*	1.37 (1.15-1.63)*	1.34 (1.12-1.62)*	1.20 (1.02-1.41)*	1.42 (1.18-1.70)*	1.66 (1.36-2.02)*
Meal in front of TV allowed	1.64 (1.33-2.03)*	1.18 (1.01-1.38)*	ns	ns	1.30 (1.10-1.53)*	1.56 (1.29-1.87)*	1.74 (1.43-2.12)*
No rules about sweets and soft drinks	1.58 (1.28-1.95)*	1.27 (1.08-1.49)*	1.40 (1.18-1.66)*	ns	1.54 (1.30-1.82)*	2.67 (2.20-3.23)*	2.21 (1.80-2.71)*

\*p<0.05, ns= not statistically significant at level p<0.05

## Discussion

We found that more than 20% of adolescents reported having no parental rules on eating, and the prevalence of unhealthy eating habits varied between 18% for skipping breakfast during weekends to 75% for low consumption of vegetables. A lack of parental rule-setting on eating was strongly associated with unhealthy eating habits among boys and girls. Several sociodemographic characteristics such as gender, family affluence, family structure, urban context and education of parents were related to unhealthy eating habits of adolescents and to lack of parental rules on eating.

More than 20% of the adolescents perceived no parental rules on eating. Previous evidence focused rather on the association of the presence of parental rules and unhealthy eating habits; literature dealing with the absence of parental rules on eating is scarce. Our further findings suggest that unhealthy eating habits, such as skipping breakfast, low fruit and vegetable consumption, frequent sweets, soft drinks and energy drinks consumption, were very frequent among adolescents. Compared with the findings of the previous HBSC survey in 2009, the prevalence of fruit and vegetable consumption and breakfast skipping did not change importantly, and the prevalence of sweets and soft drinks consumption decreased slightly (Currie et al., 2012). The consumption of energy drinks among adolescents was found to be considerably higher than existing findings from Europe suggest (Gallimberti et al., 2013). The high prevalence of unhealthy eating habits among adolescents may reflect the limited effectiveness of preventive strategies aimed at improving their eating habits. Generally, these strategies take place in the school environment, which may be the reason of their limited effectiveness. In line with this, Lindsay et al. (Lindsay et al., 2006) highlight the success of interventions within a variety of settings, including schools, health services and the family setting, and emphasize the critical role of parents in these interventions (Lindsay et al., 2006).

Adolescents who perceived a lack of parental rules on eating were at higher risk to eat unhealthily. Those who reported an absence of one of three examined parental rules were also at risk of unhealthy eating, but the chances were lower. Our findings confirm previous evidence about the connection between parental rule-setting on eating and unhealthy behaviour of adolescents (Bourcier et al., 2003; Gross et al., 2010; Kristjansdottir et al., 2009; C. Verzeletti, Maes, Santinello, & Vereecken, 2010; Verzeletti, Maes, Santinello, Baldassari et al., 2010). In addition, the present findings suggest that when the number of parental rules was reduced, the prevalence of unhealthy eating behaviours increased. Taking into account that parents have been shown to have a crucial role in shaping their children's dietary practices (Lindsay et al., 2006; Pedersen et al., 2015), our findings indicate this to be a possible factor contributing to unhealthy eating habits among adolescents. Given the cross-sectional design of present study, the findings do not imply a causal path. An alternative explanation could be that having parental rules are an expression of more general family food and eating practices which may determine both parental rules and eating habits of adolescents. This is definitely of interest for further research.

Gender was found to have an important association with eating habits of adolescents. Although boys reported a lack of parental rules on eating less often, they were more likely to eat unhealthily than girls. This can point at gender differences regarding the degree of obedience of adolescents to these rules – boys may perceive the existence of the rule but may not follow it. On the other side, given the vulnerability of boys to eat unhealthy (Currie et al., 2012), parental rules on eating may be stricter

in boys than in girls.

Our findings indicate that several sociodemographic characteristics such as family affluence, family structure, urban context and educational level of parents were associated with parental rule setting on eating and also with eating habits of adolescents. Adolescents reporting low family affluence, incomplete family, low parental education, living in a rural area and a lower socioeconomic status were at higher risk of unhealthy eating habits which is in line with previous findings (Currie et al., 2012; Pitel, Madarasová Gecková, Reijneveld, & van Dijk, 2013). We explored this relationship using several indicators related to socioeconomic status (such as education of parents) to ascertain the validity of the results.

### *Strengths and limitations*

The major strengths of our study are its large sample and representativeness for Slovak adolescents and its high response rate. In addition, the measures of food consumption frequency used in the present study have been well-validated (Carine & Maes, 2003) and extensively used in HBSC surveys. We studied a wide range of unhealthy eating habits in the context of parental rules on eating. However, some limitations should be also noted. Firstly, we used a cross-sectional design; thus, no final causal conclusion can be drawn. Second, our data were based on self-reports of adolescents, which are based on the subjective perception of the adolescent including his or her disobedience to rules and may also be influenced by social desirability. Moreover, the measures of parental rules were based on subjective perception which can reflect rather the obedience degree of the adolescents to these rules. However considerable proportion of adolescents do not follow the rules which their parents apply based on their reports, so obedience bias this measurement only marginal. Thirdly, analyses provided in this study targeted the main relationship between parental rule-setting on eating and unhealthy eating of adolescents; we did not address the role of biological and psycho-social factors which can influence this relationship.

### *Implications*

The frequent lack of parental rule-setting on eating and the high prevalence of unhealthy eating habits among adolescents indicate the need for interventions carried out in family settings. The findings of the present study on the connection between a lack of parental rule-setting on eating and unhealthy eating habits of adolescents suggest that reinforcing parental rule-setting on eating may improve adolescent eating habits especially among boys and among adolescents with low socioeconomic status.

The associations of a lack of parental rule-setting on eating with unhealthy eating habits of adolescents requires further study to disentangle causality and the mechanisms behind the connection between parental rule-setting and adolescent behaviour. Longitudinal and experimental study designs are needed for this. Moreover objective measures of eating habits (such as anthropometric measures, body composition or body fat) should be explored in future research of family context of unhealthy eating habits of adolescents.

## **Conclusion**

This study demonstrated an association between a frequent lack of parental rules on eating and the high prevalence of a wide range of unhealthy eating habits among boys and girls. Adolescents perceiving the lack of parental rules on eating were at higher risk of unhealthy eating habits. Public health strategies should address family eating practices.



# Regular energy drinks consumption in adolescents is associated with negative health and behavioural outcomes and negative school experiences

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## Abstract

Consumption of energy drinks has become popular and frequent among adolescents across Europe. Previous research showed that regular consumption of these drinks was associated with several health and behavioural problems. The aim of the present study was to determine the socio-demographic groups at risk for regular energy drinks consumption and the association of regular energy drinks consumption with negative health and behavioural outcomes, and negative school experiences in adolescents. Data from the Health Behaviour in School-aged Children study conducted in 2014 in Slovakia were analysed. We assessed socio-demographic characteristics, energy drinks consumption, negative health and behavioural outcomes, and negative school experiences based on self-reports from 9,250 adolescents aged 11 to 15 years (mean age 13.48; 50.3% boys). Regular energy drinks consumption was more frequent among boys, and older adolescents. Adolescents with a medium level family affluence were less likely to drink energy drinks regularly. Adolescents who consumed energy drinks consumption regularly had more negative health and behavioural outcomes, and negative school experiences *Conclusion:* Adolescents drinking energy drinks are at risk of a wide range of negative outcomes and should be specifically addressed by preventive interventions

**Keywords:** Adolescents, energy drinks, negative health and behavioural outcome, negative school experience

## Introduction

Health experts have given numerous warnings on the unsuitability of energy drinks (ED) for adolescents (Schneider & Benjamin, 2011; Zucconi et al., 2013), but despite the consumption of these drinks has become popular and frequent among adolescents across Europe. Several studies from Europe and the US confirm that the prevalences of adolescents reporting ED consumption vary from 20% to 50% (Gallimberti et al., 2013; Seifert et al., 2011; Zucconi et al., 2013).

ED are beverages which contain large doses of caffeine, sugar and a variety of other stimulants and substances such as guarana, taurine or vitamins (Higgins et al., 2010). Caffeine is considered as the main substance which is associated with adverse health consequences among adolescents (Ruxton, 2014; Temple, 2009). Also, the high amounts of sugar contained in these beverages have previously been linked to adverse health and behavioural outcomes in adolescence (Holubčíková et al., 2015; Ruxton, 2014). The effect of other ingredients contained in ED on health and behaviour of adolescents remains unclear (Seifert et al., 2011). In addition, information lacks on a potentially synergistic effect of the ED content – caffeine, sugar and other substances – on negative health and behavioural outcomes in adolescents.

Evidence indicating adverse health effects of ED consumption is growing. Regular ED consumption among adolescents was found to be associated with cardiovascular problems, diabetes (Grasser et al., 2014; Kristjansson et al., 2014; Kristjansson, Sigfusdóttir, Frost, & James, 2013; Seifert et al., 2011; Van Batenburg-Eddes et al., 2014) and depression (Azagba, Langille, & Asbridge, 2014a). Behavioural correlates were also found, with ED consumption being associated with more video games use (Larson et al., 2014), attention deficit hyperactivity disorder symptoms, delinquency, violent behaviours (Kristjansson et al., 2013), sensation seeking, risk-taking behaviour (Arria, Bugbee, Caldeira, & Vincent, 2014; Miller, 2008) and substance use (Azagba & Sharaf, 2014b; Gallimberti et al., 2013; Terry-McElrath, O'Malley, & Johnston, 2014). Adolescents consuming ED are at risk for later alcohol use (Miyake & Marmorstein, 2015). Furthermore, it has been suggested that ED consumption in adolescence may serve as a gateway to other forms of drug dependence (Reissig, Strain, & Griffiths, 2009).

The worldwide prevalence of ED consumption is high and a growing body of evidence has documented the potential adverse effects of these drinks on health and behaviour. General awareness of the adverse effects of ED consumption is increasing, but evidence on this topic regarding young adolescents is limited. Therefore, the aim of present study was to determine the socio-demographic groups at risk for regular energy drinks consumption and the association of regular energy drinks consumption with negative health and behavioural outcomes, and negative school experiences in adolescents. These findings should help making a choice between preventive programs and implement evidence-based practices that will better target adolescents.

## Material and methods

### *Sample and procedure*

We used data from the Health Behaviour in School-aged Children (HBSC) study conducted in 2014 in Slovakia. To obtain a representative sample, we used two-step sampling. In the first step, 151 larger and smaller elementary schools located in rural

as well as in urban areas from all regions of Slovakia were asked to participate. These were randomly selected from a list of all eligible schools in Slovakia obtained from the Slovak Institute of Information and Prognosis for Education. School response rate (RR) was 86.1%. In the second step, we obtained data from 9,250 adolescents from the fifth to ninth grades of elementary schools in Slovakia in the target group of 11 to 15 years old (mean age 13.48; 50.3% boys), one from each grade per school.

The study was approved by the Ethics Committee of the Medical Faculty at the P. J. Safarik University in Kosice. Parents were informed about the study via the school administration and could opt out if they disagreed with their child's participation. Participation in the study was fully voluntary and anonymous with no explicit incentives provided for participation.

### *Measures*

Data for the present analyses were collected using questionnaires from the standardized research protocols for the 2014 WHO-collaborative HBSC study.

Energy drink consumption was measured by the question: "How many times a week do you usually drink energy drinks, for example Red Bull?" with as response options: never, less than once a week, once a week, 2-4 days a week, 5-6 days a week, once a day, every day, every day, more than once. The European Food Safety Authority has identified adolescents consuming ED once a week and more as a chronic users of this beverage (Zucconi et al., 2013). In line with this policy we dichotomised responses on use of energy drinks to obtain two groups of adolescents – regular (chronic) energy drinks consumers (once a week and more) and the other ones.

Daily health complaints were measured by the HBSC symptom checklist (HBSC-SCL): "In the last 6 months: how often have you had the following....?" With the following options: "headache, stomach-ache, backache, feeling low, irritability or bad temper, feeling nervous, difficulties in getting to sleep, feeling dizzy" with response options: about every day, more than once a week, about every week, about every month, rarely or never. We dichotomised the response options to obtain two groups of adolescents: those who reported daily health complaints and others.

Self-rated health assesses the general health of adolescents and was measured by the question "Would you say your health is...?" with response options: excellent, good, fair or poor. The response options were dichotomised to get two groups of adolescents: those who reported fair or poor health, and other ones (Cavallo et al. 2006).

School liking is an item assessing the emotional and psychological connectedness to school in terms of liking school: "How do you feel about school at present?" Response options: I like it a lot, like it a bit, not very much, not at all. We dichotomised the response options to get the group of adolescents who liked a school a bit or a lot.

Physical fight involvement was measured by the question "During the past 12 months, how many times were you in a physical fight?" with response options: I have not been in a physical fight in the past 12 months, 1 time, 2 times, 3 times, 4 times or more. We dichotomised the response options to obtain the category of adolescents who were involved in a physical fight more than 3 times in the past 12 months.

Bullying behaviour of adolescents was measured using the revised Olweus

Bully/Victim Questionnaire (Solberg & Olweus, 2003b). After having read a standard definition of bullying, respondents were asked about their involvement in bullying – how often they had bullied others in school in the last few months with response options: I haven't bullied other students at school in the past couple of months, only once or twice, two or three times a month, about once a week, several times a week. We chose "two or three times a month" as a cut-off point and dichotomised the responses to get two categories of bullying behaviour.

Truancy was measured by asking: "How many days have you skipped classes or school (without permission) this term?" with response options: never, one, two, three days or four days or more. We dichotomised the responses to distinguish those who skipped school more than once from the others.

Current smoking status was defined on the basis of the question "How often do you smoke tobacco at present?" with response options: every day; at least once a week; but not every day; less than once a week; or never. We focused on adolescents smoking at least once a week.

Drunkenness was assessed with the question: "Have you ever had so much alcohol that you were really drunk?" with response options: never, once, two or three times, four to ten times, more than ten times. We identified adolescents being drunk more than once in the last 30 days.

Perceived school performance was measured by the item "In your opinion, what does your class teacher(s) think about your school performance compared to your classmates?" with response options: very good, good, average, below average. Responses were dichotomised to obtain the group of adolescents reporting academic achievement below average.

Family affluence was measured using the Family Affluence Scale III (FAS III), which consists of six questions: "Does your family own a car, van or truck", "Do you have your own bedroom for yourself?", "How many computers does your family own?", "How many bathrooms (room with a bath/shower or both) are in your home?", "Does your family have a dishwasher at home?", "How many times did you and your family travel out of Slovakia for a holiday/vacation last year?". We converted the FAS summary scores to a final score, which has a consistent, normal distribution and a range from 0 to 1. We then created tertile groups of low (0 to .333), middle (.334 to .666) and high (.667 to 1) socio-economic position (Elgar et al., 2015).

### *Statistical analyses*

In the first step, the socio-demographic characteristics of the sample were described: the prevalence of gender, age and family affluence was computed for the total sample and stratified by category of ED consumption (Table 1). Second, associations between regular ED consumption and gender, age and family affluence were assessed (Table 2). Third, the associations (crude and adjusted for potential confounders) of regular ED consumption with health and behavioural outcomes were assessed using multiple logistic regressions (Table 3). Statistical analyses were performed using IBM SPSS statistics 20.0 for Windows.

## **Results**

Regular consumption of ED was reported by more than 20% of adolescents (Table 1).

**Table 1** Background characteristics of the sample – gender, family affluence and the prevalence of negative health and behaviour outcomes and negative school experiences – overall and by category of energy drinks consumption

		Total	Regular energy drinks consumption	Irregular energy drinks consumption	Regular vs. irregular energy drinks consumption
		N=9250 (100%)	N=1849 (20.6%)	N=7128 (79.4%)	P value
Gender	Boys	4656(50.3)	1239(27.6)	3251(72.4)	<0.001
	Girls	4594(49.7)	610(13.6)	3877(86.4)	
Family affluence	Low	3236(39.8)	650(20.6)	2498(79.4)	ns
	Middle	2285(28.1)	413(18.5)	1824(81.5)	
	High	2601(32.0)	506(19.9)	2042(80.1)	
Health complaints (daily)	Head ache	1759(19.2)	486(26.8)	1221(17.3)	<0.001
	Stomach-ache	1200(13.2)	332(18.2)	834(11.8)	<0.001
	Back ache	1295(14.3)	372(20.8)	889(12.7)	<0.001
	Feeling low	1786(19.7)	474(26.3)	1254(17.9)	<0.001
	Irritability or bad temper	2562(28.1)	654(36.0)	1835(26.0)	<0.001
	Feeling nervous	2610(28.7)	673(37.2)	1865(26.5)	<0.001
	Difficulties with sleeping	1445(15.9)	389(21.6)	1024(14.5)	<0.001
	Feeling dizzy	920(10.1)	277(15.3)	608(8.6)	<0.001
Self-rated health (fair and poor)	1015(11.1)	280(15.4)	703(10.0)	<0.001	
Fighting (three times and more)	1174(12.9)	450(25.1)	693(9.9)	<0.001	
Bullying (two or three times a week)	1206(13.4)	358(20.0)	801(11.4)	<0.001	
Smoking (more than once a week)	431(4.7)	280(15.4)	127(1.8)	<0.001	
Drunkenness (more than once in last 30 days)	667(7.7)	334(20.4)	317(4.6)	<0.001	
School dislike (not very much or not at all)	3620(39.3)	1087(59.0)	2424(34.1)	<0.001	
Academic achievement (below average)	360(3.9)	164(8.9)	174(2.5)	<0.001	
Truancy (once and more)	1515(16.6)	533(29.6)	933(13.2)	<0.001	

Only the percentages of valid answers are presented; missing values: Energy drinks consumption 273(3.0), Gender 0(0), Family affluence 1128(12.2), Head ache 112(1.2), Stomach-ache 128(1.4), Back ache (225(2.4), Feeling low 192(2.1), Irritability or bad temper 139(1.5), Feeling nervous 156(1.7), Difficulties with sleeping 172(1.9), Feeling dizzy 136(1.5), Self-rated health 117(1.3), School dislike 46(0.5), Fighting 178(1.9), Bullying 218(2.4), Truancy 146(1.6), Smoking 109(1.2), Drunkenness 606(6.6), Academic achievement 74(0.8); ns – non-significant

Regular ED consumption was more frequent among boys and increased with age, and adolescents reporting family affluence at a medium level were at lower risk to drink ED regularly than those reporting low family affluence (Table 2).

**Table 2** The association between age, gender and family affluence and regular energy drinks consumption of adolescents; odds ratios (OR) and 95% confidence intervals (CI) in parentheses

		Model 1	Model 2
		OR (95%CI)	OR (95%CI)
<b>Gender</b>			
	Girl	1 (ref)	1 (ref)
	Boy	2.42(2.17-2.69)***	2.43(2.17-1.74)***
Age		1.25(1.20-1.30)***	1.26(1.20-1.31)***
<b>Family affluence</b>			
	Low	1 (ref)	1 (ref)
	Medium	0.87(0.75-0.99)*	0.84(0.73-0.97)*
	High	0.95(0.83-1.08)	0.91(0.80-1.04)

Model 1: Crude effect of gender, age and family affluence separately on energy drinks consumption

Model 2: Combined effect of gender, age and family affluence on regular energy drinks consumption

\*\*\*p<0.001, \*p<0.05

Results of multiple logistic regressions showed that regular ED consumption among adolescents was related to negative health and behavioural outcomes and negative school experiences and problem behaviours. Adolescents reporting regular ED consumption were at higher risk suffering from various health complaints, reporting unfavourable self-rated health and disliking school. In addition, these adolescents were more likely to fight, bully others, skip the school lessons, smoke, drink alcohol and report low academic achievement. Adding gender, age and family affluence to the models did not affect the strength of the association of regular ED consumption with the examined types of negative outcomes (Table 3).

**Table 3** The association between regular energy drinks consumption (independent variable) of adolescents and a wide range of negative health and behavioural outcomes and negative school experiences, crude and adjusted for age, gender and family affluence; odds ratios (OR) and 95% confidence intervals (CI) in parentheses

	Crude model		Number of cases included in the crude model		Adjusted model		Number of cases included in the adjusted model	
	OR (95%CI)		N (%)		OR (95%CI)		N (%)	
Health complaints (daily)								
Head ache	1.75(1.55-1.98)***		8889 (96.1)		2.12(1.85-2.44)***		7865 (85.0)	
Stomach-ache	1.66(1.44-1.91)***		8881 (96.0)		2.00(1.71-2.35)***		7852 (84.9)	
Back ache	1.81(1.58-2.07)***		8787 (95.0)		1.97(1.70-2.29)***		7778 (84.1)	
Feeling low	1.63(1.45-1.84)***		8816 (95.3)		2.12(1.84-2.43)***		7808 (84.4)	
Irritability or bad temper	1.59(1.43-1.78)***		8856 (95.7)		1.84(1.63-2.08)***		7854 (84.9)	
Feeling nervous	1.64(1.47-1.83)***		8866 (95.8)		1.80(1.60-2.04)***		7843 (84.8)	
Difficulties with sleeping	1.61(1.41-1.83)***		8843 (95.6)		1.88(1.63-2.17)***		7834 (84.7)	
Feeling dizzy	1.91(1.64-2.23)***		8875 (95.9)		2.13(1.79-2.53)***		7861 (85.0)	
Self-rated health (fair and poor)	1.63(1.41-1.90)***		8871 (95.9)		1.80(1.52-2.12)***		7847 (84.8)	
Fighting (three times and more)	3.06(2.68-3.49)***		8822 (95.4)		2.62(2.26-3.04)***		7867 (85.0)	
Bullying (two or three times a week)	1.93(1.68-2.21)***		8792 (95.0)		1.78(1.53-2.07)***		7825 (84.6)	
Smoking (more than once a week)	9.92(7.99-12.32)***		8874 (95.9)		9.07(7.11-11.58)***		7848 (84.8)	
Drunkenness (more than once in last 30 days)	5.25(4.45-6.19)***		8461 (91.5)		4.71(3.91-5.68)***		7526 (81.4)	
School dislike (not very much or not at all)	2.78(2.50-3.08)***		8941 (96.7)		2.46(2.19-2.76)***		7904 (85.4)	
Academic achievement (below average)	3.89(3.12-4.85)***		8911 (96.3)		3.43(2.67-4.41)***		7890 (85.3)	
Truancy (once and more)	2.76(2.44-3.12)***		8850 (95.7)		2.63(2.29-3.01)***		7881 (85.2)	

Table 3 (continued)

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Model 1: Crude effect of energy drinks consumption on problem behaviour

Model 2: Effect of regular energy drinks consumption on each variable separately adjusted for gender, age and family affluence

\*\*\*p<0.001

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## Discussion

The aim of this study was to explore the relationship between regular ED consumption among adolescents and health and behavioural outcomes. We found that regular consumers of ED were more likely to report a wide range of damaging health and behavioural outcomes and negative school experiences, such as daily health complaints, poor self-rated health, school dislike, low academic achievement, truancy, fighting, bullying, smoking and drunkenness.

ED consumption was more prevalent among boys and older adolescents which fits with previous evidence (Gallimberti et al., 2013). In general, boys and older adolescents were identified as being more vulnerable to having unhealthy eating habits (Taut et al., 2015). Adolescents reporting low family affluence showed higher ED consumption than their peers. Generally, low socio-economic status was previously associated with higher consumption of ED as a part of an unhealthy dietary pattern (Beckford, Grimes, & Riddell, 2015; Grandner et al., 2014).

Given the cross-sectional design of present study, we cannot make causal inferences regarding this relationship. Three explanations may hold. Firstly, there is growing evidence that ED consumption in childhood and adolescence may have adverse physiological effects (Harris & Munsell, 2015) due to the high amount of caffeine (Temple, 2009). Other substances, such as sugar (glucose and fructose), have also been identified as the metabolically deleterious ingredients. In combination with caffeine, it has the greatest metabolic impact and potential influence on overall health (Shearer, 2014). A recent study on adolescents' consumption of sugary and caffeinated drinks suggested the possible explanation that adolescents reporting regular consumption of these drinks are more likely to report mood deviations and subsequently aggressive behaviour (Holubcikova et al., 2015). This can be caused by fluctuations in blood glucose levels, which has been found to be related to behavioural deviations.

A second explanation is that ED consumption might be a part of a broader cluster of adverse behaviours (van Nieuwenhuizen et al., 2009). According to this hypothesis adolescents vulnerable to behave in a risky manner might prefer these beverages. More specifically, previous research has found that a significant number of young adults mix energy drinks with alcohol (Malinauskas, Aeby, Overton, Carpenter-Aeby, & Barber-Heidal, 2007). This habit –mixing alcohol with energy drinks - may be a main motivation and a gateway to future alcohol use (Reissig, Strain, & Griffiths, 2009).

Thirdly, ED consumption as part of a broader cluster of adverse behaviours could be determined by other psycho-social factors, such as family background, peers or wider environmental factors. In this case, a common cause of these outcomes exists. Practically, this may also be associated with the second explanation, as such a common cause might lead to a clustering of the outcomes. This has been documented for a number of causes of adverse health-behaviours in adolescents, with e.g. norms of friend (Dusseldorp et al., 2014) and parenting practices (Klein Velderman et al., 2015) being such common causes.

### *Strengths and limitations*

As far as we know, this is the first study on the prevalence and correlates of ED consumption on large and representative sample of adolescents 11 to 15 years old, which represents a major strength. In addition, we used measures which have

been well validated and extensively used in a variety of reports and peer-reviewed publications at the cross-national level. A limitation of the present study is its cross-sectional design, which hampers making causal inferences. In addition, the present data were based on self-reports, which can be inaccurate or influenced by social desirability, though previous research has shown them to be valid. Our results might be affected by assessing multiple comparisons which might have caused some associations to spuriously significant. However, we used a level of statistical significance of  $p < 0.001$ , to avoid this effect.

### *Implications*

The present study provides important evidence related to the patterns of adolescents' ED consumption. Regular ED consumption may serve as a screening indicator to identify adolescents at risk for problem behaviour and for a large number of health problems.

Future studies should explore the causality of the relationship between adolescents' ED consumption and negative health and behavioural outcomes via a longitudinal study or randomised controlled trials. Further research is needed to examine the effect of the ingredients of ED on physiology, health and behaviour of adolescents and the factors entering into this relationship. Finally, the topic of the ease of buying ED should be studied to explore the possibilities of price policies.

### **Conclusion**

In conclusion, ED consumption was very frequent among adolescents, especially among boys and older adolescents. Regular ED consumption was found to be associated with a wide range of negative health and behavioural outcomes and negative school experience. Our findings provide evidence about the importance of preventive actions aimed at reducing adolescents' consumption of ED. Longitudinal studies are needed to explore the causal relationships between ED consumption and health and behavioural outcomes among adolescents and to explore the possibilities of price policies.

# Young adolescents who combine alcohol and energy drinks have a higher risk of reporting negative behavioural outcomes

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## Abstract

*Objectives* To explore whether young adolescents consuming alcohol and energy drinks combined were more likely to report negative behavioural outcomes than their peers who drink only one type of these beverages or are abstinent.

*Methods* We analysed data on a representative sample of Slovak adolescents 8,502 adolescents (mean age 13.21, 49.4% boys) from the 2014 Health Behaviour in School-aged Children cross-sectional study. We assessed the associations of alcohol and energy drinks consumption with negative outcomes and their potential synergy, as measured by the synergy index (SI).

*Results* Adolescents consuming both alcohol and energy drinks were at higher risk of negative behavioural outcomes than their peers who drank only alcohol or energy drinks or were non-consumers. Consumers of alcohol and energy drinks were highly prone to be involved in fighting – the joint association of alcohol and energy drinks consumption was greater than sum of its associations separately in relation to fighting (SI 1.49;95% confidence interval 1.03-2.16).

*Conclusions* Preventive strategies should aim at increasing awareness of negative behavioural outcomes – especially aggressive behaviour associated with alcohol and energy drinks consumption among young adolescents.

**Keywords:** Young adolescents, alcohol, energy drinks, negative behavioural outcomes

## Introduction

Simultaneous use of alcohol and energy drinks (ED) has become popular among youth, but knowledge about their health effects is limited. General awareness on the relationship of combining of ED and alcohol with negative behavioural outcomes is rising, but there is a lack of evidence on this topic in the group of young adolescents. A growing body of research reporting this evidence highlights the harmful effect of combining alcohol and ED, which may lead to several problems, such as increased risk behaviour, injuries, alcohol and drug use, sexual risk behaviour or smoking (Bonar et al. 2015, Flotta et al. 2014, Ilie et al. 2015).

Existing evidence on risks associated with consumption of ED and alcohol separately suggests that consumers of ED are at higher risk to several health and behavioural problems such as cardiovascular problems, diabetes (Seifert et al. 2011, Grasser et al. 2014), frequent health complaints, sleeping problems (Koivusilta et al. 2016), attention deficit hyperactivity disorder symptoms, delinquency, violent behaviours (Kristjansson et al. 2013, Van Batenburg-Eddes et al. 2014) or substance use (Azagba et al. 2014, Gallimberti et al. 2013, Terry-McElarth et al. 2014). Moreover, adolescents' alcohol consumption was associated with a wide range of negative outcomes such as future drinking and drug use (Guo et al. 2000), problems in school (Grunbaum et al. 2004), or several physical and emotional problems (Brown et al. 2008). Previous research dealing with the adverse consequences of simultaneous consumption of alcohol and ED has been performed mainly in the USA and Australia. Evidence on European adolescents is rather limited (Flotta et al. 2014, Kristjansson et al. 2015, Magnezi et al. 2015). Moreover, this relationship has mostly been explored among older adolescents (aged 14 years and older).

Simultaneous use of alcohol and ED may lead to negative health and behavioural outcomes for several reasons (Howland and Rohsenow 2013, Vida and Rácz 2015). Consumption of alcohol with ED improves the taste of the drink, thus making high alcohol intake more likely. Furthermore, consumption of alcohol with ED reduces sleepiness and counteracts the sedating effects of alcohol and the sensation of intoxication. This can prolong the drinking session and induce more alcohol consumption, which in turn further impairs judgement and neurocognitive functioning. The combined effect may eventually lead to engagement in other risky behaviours, too. Given the higher caffeine sensitivity of adolescents and their vulnerability to the adverse effects of this beverage (Temple 2009), the impact of consumption of alcohol with ED on negative behavioural outcomes in adolescents might be even greater than in adults.

To our best knowledge, evidence is fully lacking on the joint association of alcohol and ED consumption and negative behavioural outcomes among European young adolescents. Thus, the aim of the present study was to explore whether young adolescents who combine alcohol and energy drinks are more likely to report problematic behaviour than their peers who drink just one type of these beverages or are non-consumers.

## **Methods**

### *Sample and procedure*

We used data from the Health Behaviour in School-aged Children (HBSC) study conducted in 2014 in Slovakia. The HBSC used two-step sampling to obtain a representative sample. In the first step, 151 larger and smaller elementary schools located in rural as well as in urban areas from all regions of Slovakia were asked to participate. These were randomly selected from a list of all eligible schools in Slovakia obtained from the Slovak Institute of Information and Prognosis for Education. School response rate (RR) was 86.1%. In the second step, we obtained data from 9,250 adolescents from the fifth to ninth grades of elementary schools in Slovakia in the target group of young adolescents aged 11 to 15 years. Due to missing responses on questions about alcohol and/or ED consumption 748 respondents were excluded. Analyses were thus performed on a final sample of 8,502 adolescents (mean age 13.21, 49.4% boys).

The study was approved by the Ethics Committee of the Medical Faculty at P.J. Safarik University in Kosice. Parents were informed about the study via the school administration and could opt out if they disagreed with their child's participation. Participation in the study was fully voluntary and anonymous.

### *Measures*

Data for the present analyses were collected using questionnaires from the standardized research protocols for the 2014 WHO-collaborative HBSC study. We distinguished (1) adolescents who reported consumption of ED at least once a week and alcohol more than three to five days in last 30 days– combined users, (2) only ED consumers, (3) only alcohol consumers and (4) non-consumers of both alcohol and ED. Table 1 provides an overview of the measures used in this study.

**Table 1** Description of items from the HBSC questionnaire used in this study, with answering categories and dichotomisation; Health Behaviour in School-Aged Children study Slovakia, 2013/2014

Variable	Wording of the question	Options	Dichotomisation
Energy drinks consumption	How many times a week do you usually drink energy drinks, for example Red Bull?	never, less than once a week, once a week, 2-4 days a week, 5-6 days a week, once a day, every day, more than once a day	energy drinks consumption >more than once a week
Alcohol consumption	On how many days (if any) have you drunk alcohol in the last 30 days?	never, 1-2 days, 3-5 days, 6-9 days, 10-19 days, 20-29 days, 30 days (or more)	more than 3-5 times vs. other
School dislike	How do you feel about school at present?	I like it a lot, like it a bit, not very much, not at all	adolescents who liked a school a bit or a lot vs. other
Fighting	During the past 12 months, how many times were you in a physical fight?	not, 1 time, 2 times, 3 times, 4 times or more	3 times and more in the past 12 months vs. other
Bullying	After having read a standard definition of bullying, respondents were asked about their involvement in bullying – how often they had bullied others in school in the last few months with response options	not, only once or twice, two or three times a month, about once a week, several times a week	two or three times a month and more often vs. other
Tuancy	How many days have you skipped classes or school (without permission) this term?	never, one, two, three days or four days or more	more than once vs. others
Low academic achievement	In your opinion, what does your class teacher(s) think about your school performance compared to your classmates?	very good, good, average, below average	below average vs. others
Family affluence	“Does your family own a car, van or truck”, “Do you have your own bedroom for yourself?”, “How many computers does your family own?”, “How many bathrooms (room with a bath/shower or both) are in your home?”, “Does your family have a dishwasher at home?”, “How many times did you and your family travel out of Slovakia for a holiday/vacation last year?”	We converted the FAS summary scores into a final score, which has a consistent, normal distribution and a range from 0 to 1. Then we created groups of low (0 to .333), middle (.334 to .666) and high (.667 to 1) socioeconomic position (Elgar et al. 2015).	

### *Statistical analyses*

First, we described the prevalence of each problem behaviour for the total sample and stratified by the categories of ED and alcohol consumption (Table 3). Second, we assessed the odds of being involved in each form of problem behaviour for each category of adolescents – combined users, ED consumers and alcohol consumers, all compared to non-consumers. Third, we assessed the associations of each drinking category with problem behaviour, crude and adjusted for potential confounders – gender, age and family affluence, using multiple logistic regressions (Table 4).

Finally, we assessed the synergy in the negative effects of combined alcohol and ED consumption by assessing whether the joint association was greater than the sum of associations of ED consumption and alcohol consumption separately (Table 4). We did this using the algorithms of Andersson (Andersson et al. 2005), by using the odds ratios (OR) per drinking category. We used  $OR_{ij}$  where  $i$  denotes alcohol consumption and  $j$  denotes ED consumption. In each case the value 0 stands for no consumption and 1 for consumption of the beverage. If alcohol and ED consumption was present, then we obtained  $OR_{11}$ , if alcohol consumption was present without ED consumption, we obtained  $OR_{10}$  etc. In this manner, we calculated three OR representing the exposure category by logistic regression analyses (i.e.,  $OR_{11}$ ,  $OR_{10}$ ,  $OR_{01}$ ). Synergy in the joint association of ED and alcohol consumption with negative behavioural outcomes was assessed with the synergy index (SI). The SI was calculated using the formula:  $SI = (OR_{11} - 1) / [(OR_{10} + OR_{01}) - 2]$ .  $SI=1$  indicates that there is additivity, but no synergy in the association of ED and alcohol consumption with negative behavioural outcomes. A positive synergistic association of alcohol and energy drinks consumption with negative behavioural outcomes is reflected by an  $SI>1$ . Statistical analyses were performed using IBM SPSS statistics 20.0 for Windows.

## **Results**

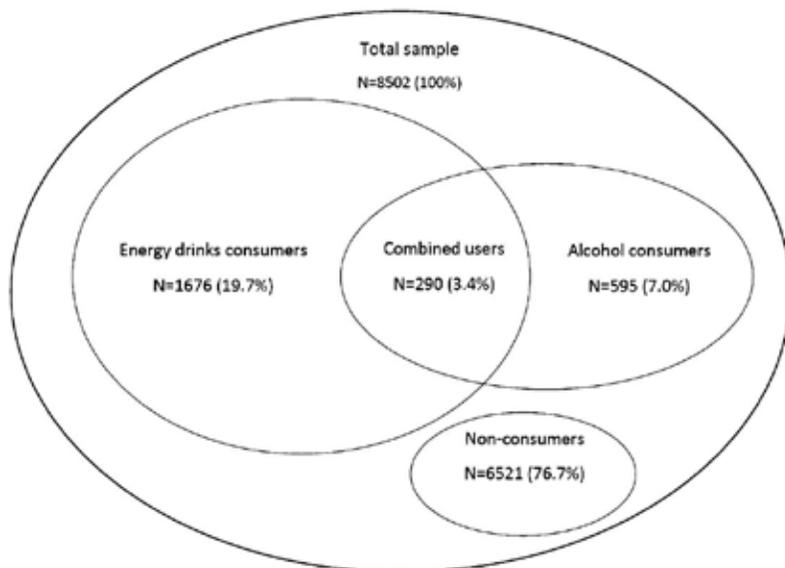
The sociodemographic characteristics of the sample and the prevalence of ED, alcohol consumption and the examined measures of negative behavioural outcomes are presented in Table 3. Almost 25% of adolescents reported the consumption of ED, consumption of alcohol or a combination of both on a regular basis. More than 15% of adolescents were only ED consumers, 3% of them reported to consume only alcohol regularly and 3% of adolescents reported to combine alcohol with ED on a regular basis. The distribution of adolescents' reports of alcohol and energy drinks consumption including the frequency of responses per answer option is presented in Table 2. Figure 1 shows the distribution of adolescents' consumption of alcohol and ED per drinking group.

**Table 2** Distribution of adolescents' reports of alcohol and energy drinks consumption - frequency of responses per answer option; Health Behaviour in School-Aged Children study Slovakia, 2013/2014

		N	%
ED consumption	Never	5065	59.6
	Less than once a week	1761	20.7
	Once a week	806	9.5
	2-4 days a week	385	4.5
	5-6 days a week	169	2.0
	Once daily	119	1.4
	More than once daily	197	2.3
Alcohol consumption	Never	6696	78.8
	1-2 days	1211	14.2
	3-5 days	328	3.9
	6-9 days	131	1.5
	10-19 days	60	0,7
	20-29 days	14	0.2
	30 days (or more)	62	0.7

Note: the dichotomisation of the measures of alcohol and ED consumption is indicated by separate colours of the table.

**Figure 1** Distribution of adolescents' consumption of alcohol and energy drinks



**Table 3** Background characteristics of the sample of 11- to 15-year-old adolescents – gender, family affluence, self-rated health, aggressive behaviour and negative school experiences – overall and by category of energy drinks and alcohol consumers; Health Behaviour in School-Aged Children study Slovakia, 2013/2014

	Total	Energy drinks consumers	Alcohol consumers	Combined users	Non consumers	Overall P value
	N=8502 100%	N=1386 (16.3%)	N=305 (3.6%)	N=290 (3.4%)	N=6521 (76.7%)	
Gender						
Boys	4197 (49.4)	931 (22.2)	153 (3.6)	189 (4.5)	2924 (69.7)	<0.001
Girls	4305 (50.6)	455 (10.6)	152 (3.5)	101 (2.3)	3597 (83.6)	
Family affluence						
Low	2979 (39.4)	507 (17.0)	92 (3.1)	79 (2.7)	2301 (77.2)	<0.01
Middle	2140 (28.3)	305 (14.3)	88 (4.1)	74 (3.5)	1673 (18.2)	
High	2438 (32.3)	378 (15.5)	97 (4.0)	95 (3.9)	1868 (76.6)	
School dislike						
Not very much or not at all	3317 (39.2)	795 (24.0)	166 (5.0)	194 (5.8)	2162 (65.2)	<0.001
Like it	5152 (60.8)	585 (11.4)	138 (2.7)	95 (1.8)	4334 (84.1)	
Truancy						
Once and more	1360 (16.2)	361 (26.5)	94 (6.9)	115 (8.5)	790 (58.1)	<0.001
Never	7034 (83.8)	991 (14.1)	210 (3.0)	169 (2.4)	5664 (80.5)	
Academic achievement						
Below average	306 (3.6)	110 (35.9)	20 (6.5)	32 (10.5)	144 (47.1)	<0.001
Average and better	8138 (96.4)	1266 (15.6)	285 (3.5)	256 (3.1)	6331 (77.8)	
Fighting						
Three times and more	1061 (12.7)	293 (27.6)	68 (6.4)	112 (10.6)	588 (55.4)	<0.001
Less often	7308 (87.3)	1050 (14.4)	236 (3.2)	173 (2.4)	5849 (80.0)	
Bullying						
Two or three times a week	1066 (12.8)	239 (22.4)	56 (5.3)	69 (6.5)	702 (65.9)	<0.001
Less often	7276 (87.2)	1106 (15.2)	248 (3.4)	213 (2.9)	5709 (78.5)	

**Table 3** (continued)

Only valid percentages are presented; the number (and percentages) of missing values are: Gender 0 (0), Family affluence 945 (11.1), School dislike 33 (0.3), Truancy 108 (1.2), Academic achievement 58 (0.6), Fighting 133 (1.5), Bullying 160 (1.8)

Overall P value – test of differences in proportion between energy drinks consumers, alcohol consumers, combined users and non consumers in gender, family affluence and negative behavioural outcomes

Adolescents who combined ED and alcohol were more likely to be involved in each type of problem behaviour than non-consumers. Also, consumers of alcohol only and ED only were at higher risk to report negative behavioural outcomes but at lower odds than the combined users. When comparing consumers of ED only and alcohol only, both groups of adolescents showed comparable risks to report negative behavioural outcomes. The associations between consumption of ED and alcohol consumption with negative behavioural outcomes remained statistically significant after adjustment for potential confounders – gender, age and family affluence. When exploring the potential synergistic association of alcohol and energy drinks consumption with behavioural problems, we found that the joint association was greater than the sum of the associations of ED consumption and alcohol consumption separately in relation to fighting. After adjustment for gender, age and family affluence this synergistic association became non-significant (Table 4).

**Table 4** The association between regular consumption of energy drinks and alcohol and problematic behaviours among adolescents, crude and adjusted for age, gender and family affluence: odds ratios (OR) and 95% confidence interval (CI); and synergy in the joint association of consumption of energy drinks and alcohol with negative behavioural outcomes: synergy index (SI) and 95% CI; Health Behaviour in School-Aged Children study Slovakia, 2013/2014

	Crude model		SI		Adjusted modela		Sia	
	OR (95%CI)		(95%CI)	P value	OR (95%CI)		(95%CI)	P value
<b>School dislike</b>								
Non-consumer	1 (reference)		0.99 (0.68–1.43)		1 (reference)		1.06 (0.68 – 1.66)	
Energy drinks consumer	2.72 (2.42-3.07)***		0.94		2.43 (2.13-2.76)***		0.79	
Alcohol consumer	2.41 (1.91-3.04)***				1.91 (1.50-2.44)***			
Combined user	4.09 (3.19-5.26)***				3.48 (2.64-4.58)***			
<b>Truancy</b>								
Non-consumer	1 (reference)		1.01 (0.70 – 1.48)		1 (reference)		0.98 (0.65 – 1.48)	
Energy drinks consumer	2.61 (2.27-3.01)***		0.93		2.55 (2.18-2.98)***		0.91	
Alcohol consumer	3.21 (2.49-4.14)***				2.65 (2.02-3.48)***			
Combined user	4.88 (3.80-6.25)***				4.13 (3.14-5.43)***			
<b>Low academic achievement</b>								
Non-consumer	1 (reference)		0.92 (0.53 – 1.59)		1 (reference)		0.87 (0.47 – 1.61)	
Energy drinks consumer	3.82 (2.96-4.93)***		0.76		3.44 (2.57-4.59)***		0.66	
Alcohol consumer	3.08 (1.90-5.00)***				3.13 (1.90-5.16)***			
Combined user	5.50 (3.67-8.22)***				4.98 (3.18-7.80)***			

Table 4 (continued)

Fighting					
Non-consumer					
Energy drinks consumer	1 (reference)	1.49 (1.03 – 2.16)*	1 (reference)	1 (reference)	1.49 (0.98 – 2.27)
Alcohol consumer	2.78 (2.38-3.24)***	0.03	2.39 (2.02-2.84)***	0.06	
Combined user	2.87 (2.16-3.80)***		3.21 (2.35-4.39)***		
Bullying	6.44 (5.00-8.29)***		6.39 (4.80-8.50)***		
Non-consumer					
Energy drinks consumer	1 (reference)	1.03 (0.58 – 1.81)	1 (reference)	0.99 (0.51 – 1.91)	
Alcohol consumer	1.76 (1.50-2.06)***	0.93	1.65 (1.39-1.97)***	0.979	
Combined user	1.84 (1.36-2.48)***		1.81 (1.31-2.49)***		

a The model was adjusted for gender, age and family affluence

\*p<0.05, \*\*\*p<0.001

## Discussion

We explored the associations between consumption of alcohol and ED and behavioural problems, thus becoming the first to conduct such a study in young adolescents. We found that adolescents who consumed both alcohol and ED were at higher risk of behavioural problems than their peers who drank only alcohol or ED, or were non-consumers. We only found a synergy regarding the association of alcohol and ED consumption with fighting, but this synergy became non-significant after taking into account gender, age and family affluence.

Our finding that young adolescents consuming alcohol and ED were more likely to report negative behavioural outcomes such as truancy, school dislike, low academic achievement, bullying and fighting, is in line with previous evidence on older adolescents from the USA and Australia (Bonar et al. 2015, Flotta et al. 2014, Kponee et al. 2014). We cannot compare our findings with those on young adolescents in Europe, as this study is the first conducted on that group. However, our findings can be interpreted such that the same mechanisms apply to young European adolescents as to older adolescents in other industrialised countries. Our findings thus highly contribute to the understanding of the onset and initial occurrence of problem behaviour in adolescence. However, these findings need to be confirmed in other countries, in Europe and elsewhere.

Our finding that adolescents reporting consumption of alcohol and ED were at higher risk of negative behavioural outcomes such as school dislike, truancy, low academic achievement and bullying compared with consumers of alcohol only and ED only suggests an additivity of the associations. This finding may be explained in two ways. Firstly, the negative behavioural outcomes of these adolescents could be caused by the fact that simultaneous consumption of alcohol and ED may induce more alcohol consumption due to impaired judgement and neurocognitive functioning, which leads to negative behavioural outcomes (Howland and Rohsenow 2013, Vida and Rácz 2015). The potential mechanism behind this causal path was described in a study dealing with adolescents' consumption of soft drinks which contained substances like those in energy drinks. Adolescents reporting consumption of these drinks were found to be more vulnerable to daily mood deviations. This may in turn result in aggressive behaviour (Holubcikova et al. 2015). These findings suggest that the substances contained in these drinks may cause fluctuations in blood glucose levels leading in turn to aggressive behaviour. Previous research supports this potential explanation. (Harris and Munsell 2015, Temple 2009). However, our finding of only an additive association of ED and alcohol with behavioural problems partially disproves this explanation. If the consumption of ED really induces more alcohol consumption, we would expect more than additivity.

A second explanation for the association between adolescents' consumption of alcohol and ED and negative behavioural outcomes is that these associations are due to a general underlying vulnerability to adverse outcomes. Adolescents vulnerable to behave in a risky way may also have a higher tendency to drink alcohol with ED. This explanation is in line with previous findings on the clustering of health-compromising behaviours and delinquency (Dusseldorp et al. 2014, van Nieuwenhuizen et al. 2009). The additivity that we found may be interpreted as support for this second explanation.

We found a synergistic association of alcohol and ED with adolescents' involvement in fighting. This association became non-significant after adding gender,

age and family affluence to the model. However, the value of the SI remained unchanged, suggesting that the synergy may not be due to confounding. Thus our results suggest a substantial association of consumption of alcohol and energy drinks with fighting in adolescents regardless of sociodemographic characteristics such as gender, age or family affluence. Fighting behaviour has been shown to be strongly associated with adolescents' alcohol consumption (Swahn et al. 2004), and we can hypothesize that ED consumption potentiates this effect of alcohol use. Specific substances, such as the caffeine, taurine and artificial sweeteners contained in energy drinks, may add to the aggressive behaviour of adolescents. In addition, the setting in which young adolescents combined ED and alcohol may add to this. High alcohol use in this young age category is rather deviant, making it more likely that peers taking part in it will come together. In this case, a clustering of young adolescents using both ED and alcohol becomes likely, which may offer an environment promoting mutual aggression and fights. This topic evidently requires particular attention, given its consequences for the health of young adolescents.

### *Strengths and limitations*

This study has several strengths. Firstly, it is the first to deal with the joint association between alcohol and ED consumption with problem behaviour among young European adolescents ranging from 11 to 15 years old. Second, its large and nationally representative sample is a further major strength of this study. Third, we employed well-validated and widely used measures. The understanding of the term "energy drink" has been proven in several focus groups by the group of young adolescents (Costa et al. 2014).

Some limitations of the present study should be noted, too. First, its cross-sectional design allows us to make only inferences about associations, and no strong ones about causality. Second, data were based on self-reports, which can be influenced by social desirability. However, this effect will probably be limited, as we guaranteed confidentiality and used well-validated measures. In addition, social desirability probably did not affect reports on energy drinks consumption, since it is legal for adolescents to drink them. Furthermore, the combined consumption of alcohol and ED was measured by two separate questions related to the frequency of alcohol consumption and of ED consumption which can lead to incorrect measurement of the simultaneous consumption of these two beverages.

### *Implications*

Adolescents reporting consumption of alcohol and energy drinks were at higher risk for behavioural problems, which implies a need for preventive strategies aimed at broadening adolescents' knowledge about the adverse effects of combining alcohol with ED. This particularly regards aggressive behaviour in young adolescents who combine these drinks. The adverse effect of ED consumption on behaviour is comparable to that of alcohol consumption, but its prevalence is much higher. Our findings should thus alarm and mobilize public health experts and other stakeholders, who should increase awareness about the adverse effects of ED consumption and implement interventions aimed at reducing the consumption of these beverages by adolescents.

The measures of simultaneous consumption of alcohol with energy drinks

should be used in further research to eliminate a potential measurement bias. Moreover, future research should explore the causal pathways between consumption of alcohol and energy drinks and negative behavioural outcomes in adolescents. This may provide more insight regarding the best way to restrain this potential threat for adolescent health.

## **Conclusion**

Adolescents consuming alcohol and energy drinks were more likely to report behaviour problems, such as school dislike, truancy, low academic achievement or bullying, than consumers of alcohol only, and of energy drinks only, as well as non-consumers. Consumers of alcohol and energy drinks were highly prone to be involved in fighting. Preventive strategies should aim at improving public awareness of the negative outcomes associated with alcohol and energy drinks consumption, especially among young adolescents.

# General discussion

The aim of this study was to explore eating habits and body image of adolescents and the associations of these with health and behavioural problems in the context of the school and family environment. In addition, we explored whether sociodemographic characteristics, such as gender, age or family affluence, affected these associations.

This final chapter summarises and discusses (8.2) the main findings of the study. Then the methodological considerations of the study (8.3) and the implications for practice and future research (8.4) are addressed.

## 8.1 Main findings

The main findings are summarized per research question.

### *Research question 1*

Is there an association between subjective perception of negative body image and involvement in bullying among boys and girls?

We found an association between a negative body image and involvement in bullying among adolescents. Self-reported dissatisfaction because of overweight was found to be strongly connected with involvement in bullying as a victim and as a bully-victim among both boys and girls. Regarding feeling too thin, we found gender differences in the bully-victim category: boys feeling too thin were more likely to become bully-victims, whereas girls were not.

### Research question 2

Is involvement in bullying and fighting more likely with higher soft drinks consumption, and do nervousness and irritability add to this?

We found that adolescents reporting daily soft drinks consumption were more likely to be involved in bullying and fighting. The associations between daily soft drinks consumption and bullying and fighting were mediated by daily nervousness and irritability. Adding gender, age and family affluence did not change the results.

### Research question 3

Are adolescents reporting a lack of eating-related parental rules more likely to have unhealthy eating habits, such as skipping breakfast, insufficient fruits and vegetables consumption, and frequent sweets, soft drinks and energy drinks consumption?

This study demonstrated that in the case of a lack of parental rules on eating, boys and girls more frequently had a wide range of unhealthy eating habits, such as skipping breakfast, insufficient fruits and vegetables consumption and frequent use of sweets,

soft drinks and energy drinks. Adolescents perceiving a lack of parental rules on eating were thus at higher risk of unhealthy eating habits.

#### Research question 4

Is there an association between regular energy drinks consumption and negative health and behavioural outcomes among adolescents?

Adolescents reporting regular energy drinks consumption were at higher risk of a wide range of negative health and behavioural outcomes and negative school experiences. This association did not change after adjustment for gender, age and family affluence. The association thus seems to be rather robust.

#### Research question 5

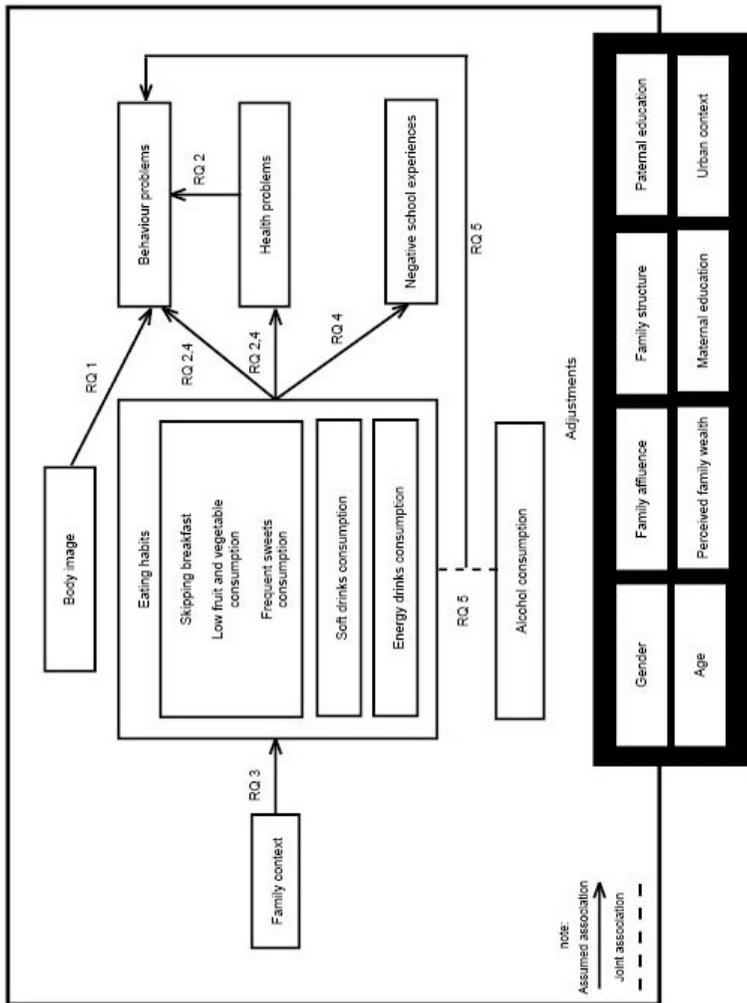
Do adolescents who combine alcohol and energy drinks report negative behavioural outcomes more frequently?

Adolescents consuming alcohol and energy drinks were more likely to report behavioural problems than consumers of alcohol only, energy drinks only and non-consumers. The joint association of alcohol and energy drinks consumption was greater than the sum of the associations of energy drinks consumption and alcohol consumption separately regarding fighting but not regarding the other behavioural outcomes.

## 8.2 Discussion of the main findings

The main findings will be discussed within the framework of the general aims, as outlined in Chapter 1, and repeated in figure 8.1. We will focus on the association of eating habits and body image in adolescents with health and behavioural problems. Furthermore, we will discuss the relationship between the family and school environments and eating behaviour in adolescents. Finally, we will also discuss the role of other factors, such as gender, age and the indicators of socioeconomic status (Figure 8.1).

Figure 8.1 Model of the relationships examined in this thesis



### *8.2.1 Eating habits and body image in adolescents*

Unhealthy eating behaviour, such as skipping breakfast, low fruit and vegetable consumption, high sweets consumption or frequent soft drinks and energy drinks consumption, was highly prevalent among Slovak adolescents. Around 50% of them reported skipping breakfast on school days; more than 60% of adolescents reported insufficient fruit consumption and more than 20% reported consumption of soft drinks on a daily basis. Internationally, based on the results of Health Behaviour in School-aged study 2014, the rates of soft drinks consumption and breakfast-skipping among Slovak adolescents were higher than the average values for adolescents from Europe and South America (Inschley et al., 2016). This suggests a need for more efficient and better suited strategies supporting healthy eating behaviour in adolescents. For example, adolescents from Finland, Norway or Sweden reported the lowest prevalence of soft drinks consumption among European adolescents (Inschley et al., 2016), which can be associated with stricter actions and legislation aimed at decreasing the consumption of these drinks (Seifert et al., 2011). Moreover, Finland introduced health education as a stand-alone school subject, which might also contribute to the low prevalence of unhealthy eating habits in adolescents (Aira, Välimaa, Paakkari, Villberg, & Kannas, 2014). These examples show the potential for improvement of the situation in the eating habits of Slovak adolescents.

Adolescents' soft drinks and energy drinks consumption was associated with a wide range of health and behavioural problems in adolescents (Chapters 4, 6 and 7). Moreover, adolescents reporting simultaneous consumption of energy drinks with alcohol were at higher risk to behavioural problems compared with consumers of alcohol only and consumers of energy drinks only. This indicates an additive-synergistic association of energy drinks and alcohol consumption with negative behaviour outcomes. Our results are in line with already available evidence on the association between negative health and behaviour and the consumption of these beverages or the substances they contained (Kristjansson et al., 2013; Kristjansson et al., 2014; Martin et al., 2008; Solnick, & Hemenway, 2012; Suglia et al., 2013). The present study confirms this association but now based on a large and representative sample of adolescents and with inclusion of a wide range of health and problem behaviours.

Moreover, this study shows that energy drinks consumption in European adolescents is rather high, thus filling a knowledge-gap regarding this recent phenomenon. More specifically, existing evidence exploring adolescents' energy drinks consumption in European countries and in the USA suggests that prevalences range from 5% to 80% (Gallimberti et al., 2013; Kumar, Park, & Onufrak, 2015; Seifert et al., 2011; Zucconi et al., 2013). This wide range of estimates could be explained by different measures of energy drinks consumption, different inclusion criteria of chronic/regular energy drinks consumption and the different sociodemographic characteristics of the respondents involved in the studies. The results of the present study, based on a large and representative sample of Slovak adolescents, suggest that a significant number (20%) of the study participants aged 11 to 15 years old regularly consume energy drinks. A lower age of first energy drink consumption has been shown to be a risk factor for chronic consumption of these drinks in future (Sather, 2013), but evidence on the context of consumption of these drinks in young adolescents is rather limited. Our findings based on data from young adolescents provide important information on the initiation of energy drinks consumption and

thus add to the existing knowledge. By preventing energy drinks consumption during early adolescence, future chronic consumption of these drinks in adolescents could be avoided.

This study also showed that parents play an important role in the occurrence of energy drinks consumption. Adolescents reporting no eating-related parental rules in their families were at higher risk to drink these beverages regularly. Relatively little is known on the psycho-social mechanisms affecting adolescents' energy drinks consumption. Prior research on the patterns and context of this phenomenon identified several factors that contribute to energy drinks consumption in Australian adolescents (Costa, Hayley, & Miller, 2014): limited awareness of energy drinks ingredients, peer and parental influence and the influence of mass media. We can hypothesize that consumption of these drinks in Slovak adolescents is due to the same factors as in other countries and that they can be tackled using similar approaches. More specifically, the inclusion of health education into the school curriculum is essential for increasing overall health literacy and adolescents' awareness on adverse effect of energy drinks consumption (Aira et al., 2014). Another example of effective preventive action (already applied in Norway or Sweden) could be regulation of the sales of these drinks by age or warning labels about their high caffeine content (Oddy & O'Sullivan, 2010; Seifert et al., 2011). To date, scientific evidence on the effectiveness of strategies aimed at decreasing the prevalence of consumption of energy drinks is limited. Systematic development and evaluation of policies and interventions is definitely needed to minimize the prevalence of adolescent energy drinks consumers.

We found an association between adolescents' soft drinks and energy drinks consumption and various health and behavioural problems, which can be explained in two ways. Firstly, this association may be caused by the adverse effect of the substances that these drinks contain (high doses of sugar or high-fructose syrup, fruit juice, sugar substitutes, caffeine and a variety of other stimulants and substances, such as guarana, taurine and vitamins). There is a growing body of research suggesting an adverse physiological effect of these substances (Harris & Munsell, 2015; Shearer & Graham, 2014; Temple, 2009). Our findings related to the mediating effect of nervousness and irritability on the relationship between soft drinks consumption and aggressive behaviour support the hypothesis that consumption of soft and energy drinks may have adverse effect on adolescents' health and behaviour. Adolescents' consumption of soft drinks or energy drinks may further cause frequent fluctuations in the blood glucose, subjectively perceived as health difficulties, which may also lead to behaviour problems. If this explanation holds, then a reduction in the consumption of drinks may really reduce negative outcomes in adolescents.

A second explanation of the association between frequent consumption of soft drinks and energy drinks and negative health and behavioural outcomes may be a clustering of health-compromising behaviours (e.g. de Winter et al., 2016; van Nieuwenhuizen et al., 2009). Evidence for the coexistence of behaviours is particularly strong for e.g. alcohol consumption, substance use and delinquent behaviours, which are commonly reported to comprise a 'syndrome' of problem behaviours (de Looze et al., 2015; Jessor, 1991; Klein Velderman et al., 2015). Unhealthy eating and other forms of health-compromising behaviours may each be manifestations of underlying psycho-social factors, such as family background, composition of peer group and wider environmental factors. This has been documented for several individual and social factors – predictors of the initiation of multiple health-risk behaviours (de Winter et al., 2016; Dusseldorp et al., 2014; Klein Velderman et al., 2015). In terms

of this hypothesis, adolescents vulnerable to behave in a risky manner might prefer to drink these soft drinks and energy drinks too. In that case, preventive strategies should be aimed at a broad spectrum of health-compromising behaviours and their determinants and on assessing adolescents who show multiple problem behaviour. Based on our cross-sectional data, we cannot make an evidence-based choice for either of these two explanations.

Furthermore, we found that a negative body image was associated with involvement in bullying as victim and as bully-victim (Chapter 3). This is in line with previous evidence (Brixval et al., 2012; Fox & Farrow, 2009; Wilson, Viswanathan, Rousson, & Bovet, 2013a) suggesting that adolescents who are dissatisfied because of self-perceived overweight are vulnerable to becoming victims in bullying. This vulnerability might be due to a combination of a low self-esteem and a different appearance, which can increase the probability of these adolescents becoming an easy target of bullying.

We also found that boys dissatisfied with their bodies due to thinness had higher risk of becoming a bully-victim. In general, boys run the risk of being under pressure due to the muscular male ideal (Cook, Williams, Guerra, Kim, & Sadek, 2010; McCabe et al., 2011). Thus, those who perceive their body to be too thin may be more vulnerable to suffering from mental and behavioural problems, leading to aggressive behaviour. Low self-esteem and different appearance may be reasons why these boys also become the victim of bullying. Taken together, our findings add to the knowledge about body image among adolescents – body image dissatisfaction due to feelings of thinness may be associated with adverse experiences among boys. Given that a significant number of adolescent boys from Europe and South America were found to have concerns with muscularity (Field et al., 2014; Jones & Crawford, 2005), not only girls, but all adolescents should be supported to develop and maintain a positive body image.

### *8.2.2 Family environment and eating behaviours in adolescents*

Adolescents who perceived a lack of parental rules on eating were more likely to report unhealthy eating habits. These unhealthy habits included skipping breakfast, low fruit and vegetable consumption and frequent sweets, soft drinks and energy drinks consumption. Previous research has also shown an association between parental rule-setting on eating and some types of unhealthy behaviour of adolescents (Bourcier et al., 2003; Gross et al., 2010; Kristjansdottir et al., 2009; Verzeletti et al., 2010; Verzeletti, Maes, Santinello, Baldassari et al., 2010). However, we found that a lack of parental rules is associated with a wide range of unhealthy eating habits of adolescents, including regular consumption of soft drinks and energy drinks, which is a phenomenon of the last decade.

Our findings regarding the association between a lack of parental rules on eating and unhealthy eating habits in adolescents may be explained in two ways. Firstly, applying eating-related parental rules may shape the eating habits of adolescents, and then a lack of such rules leads to poorer habits. A second explanation could be that the general family food-eating practice or culture determines both particular eating-related parental activities, such as applying rules and eating habits of adolescents. Based on our data, we cannot discriminate between these two explanations. However, in general our findings point to the important role of parents in shaping eating habits of adolescents, with an emphasis on particular mechanisms, such as applying eating-

related rules. In general, family practices have a significant impact on a wide range of health-related behaviours (Haggerty, McGlynn-Wright, & Klima, 2013). Multiple problem behaviour in adolescents should be prevented or reduced by optimisation of family influence.

### *8.2.3 School environment and eating behaviour in adolescents*

High soft drinks or energy drinks consumption was strongly associated with negative school experiences, such as bullying, fighting, school dislike, low academic achievement or truancy. This finding is in line with previous evidence showing that adolescents consuming these beverages were more likely to report aggressive behaviour (Solnick & Hemenway, 2012), problems with school performance (Owens et al., 2014) or mood deviations (Lien et al., 2009), which may contribute to negative school experiences. In general, school experiences, such as academic achievement or school connectedness, are related to self-rated health and well-being (Danielsen, Samdal, Hetland, & Wold, 2009; Suldo, Riley, & Shaffer, 2006) and are an important health predictor (Cole, Jacquez, & Maschman, 2001); this area thus deserves special attention in public health practice.

Although the results of the present study confirmed the association of regular consumption of soft and energy drinks consumption with negative school experiences, we did not find any clustering per class or per school. In other words, adolescents' affiliation to a particular school or class had no impact on this association. This may be interpreted as being a general characteristic of the association between adolescents' consumption of soft and energy drinks and negative school experiences rather than the influence of a particular condition in a class or school. Thus, unhealthy eating habits, such as soft drinks and energy drinks consumption, may serve as a good indicator of adolescents at risk of adverse outcomes. Furthermore, reduction in the prevalence of soft drinks and energy drinks consumption in adolescents might also prevent negative school experience, such as poor relationships with peers, poor school performance or even absenteeism in school in this population.

## **8.3 Methodological considerations**

### *8.3.1 Sample*

The present study used two large and nationally representative samples of adolescents aged 11 to 15 years old, which represents a major strength of the study. Moreover, the response rates in both study samples used in this thesis were high. Next, a limitation might be that some adolescents do not attend school. However, this is a rather small group, i.e. less than 100 adolescents educated by home schooling in Slovakia during the 2014/2015 academic year.

### *8.3.2 Information*

A further strength of this study is the use of validated measures that have been used in various studies and documented in a variety of reports and peer-reviewed publications at national and cross-national levels. A limitation of the present study might be that the data were based on adolescent self-reports, which can be inaccurate and biased by social desirability. More concretely, previous evidence dealing with the

level of agreement between adolescents' and parents' reports on adolescents' eating behaviour showed differences between these reports. For example, adolescents reported a higher soft drinks consumption than that reported by their parents (van de Gaar, Jansen, van der Kleij, & Raat). The probability of under or over reporting was decreased by guaranteeing confidentiality, anonymity and privacy during self-administration of questionnaires in the absence of teachers. In addition, previous research has shown the high validity of the measures used by the present study (Currie et al., 2014). Another limitation might be that parental rule-setting on eating was measured based on the perception of adolescents (Chapter 5). This measurement may reflect the obedience degree of the adolescents in the face of these rules rather than the objective rules as enforced, and thus the real prevalence of parental rules applied in families should be underreported. However, the present study showed that even though a significant number of Slovak adolescents perceived the existence of parental rules, they did not follow them. Thus, it seems likely that the bias of this measure of parental rules perceived by adolescents is limited.

### *8.3.3 Causality*

Another limitation of present study is its cross-sectional design, which limits the potential for making causal inferences. Adjustment for potential confounders, such as age, gender and family affluence, did not affect the associations that we found to a significant degree. However, this does not guarantee that the association that we found were indeed causal. In particular, they might also be due to common causes, e.g. an underlying personality trait that makes both consumption of energy drinks and aggression more likely, instead of consumption. However, it should be noted that such common causes might even lead to longitudinal associations, implying that probably the best design to establish causality would be an experimental one in which adolescents are stimulated to withdraw from energy drinks in order to establish a causal principle. Taking into account these caveats, the robustness of the associations and the biological plausibility of certain mechanisms provides at least some support for causality and for proposing interventions based on this causality.

## **8.4 Implications**

Our study has several important implications for public health practice and policy, as well as for further research.

### *8.4.1 Implications for practice*

Regular soft drinks and energy drinks consumption was very frequent among adolescents and seems to have adverse effects; therefore preventive actions should be aimed at decreasing this phenomenon. Following the theoretical framework of the social cognitive theory and an ecological perspective, preventive strategies should be targeted at each level of influence (individual, social environmental, physical environmental and societal level) (Story et al., 2002).

First, adolescents' as well as parents' knowledge about the adverse consequences of soft drinks and energy drinks consumption should be extended. Although educational interventions were considered more effective for improving

eating habits in adolescents compared with children (Zota et al., 2016), preventive strategies based on providing only information had only a minor effect on improving the eating behaviour of adolescents (Koivisto Hursti, & Sjödén, 1997). However, education was identified as one of the most important intervention tools aimed at improving health-related behaviour (Nutbeam, 2000). Thus, providing information on nutrition should be a necessary part of interventions targeted on improving eating habits.

Next, at the level of the physical environment, accessibility and availability of foods should be regulated within the family and with the school environment. As to the family environment, existing evidence suggests that home availability of specific foods was positively associated with children's consumption of fruits and vegetables (Gross et al., 2010; Pearson et al., 2009) but also with frequent soft drinks consumption (Denney-Wilson et al., 2009). Parents could thus improve the eating habits of their children by providing healthy food and by lowering the availability of unhealthy food at home. Within the school environment, unhealthy eating practices of adolescents were associated with the availability of vending machines (Park, Sappenfield, Huang, Sherry, & Bensyl, 2010) and the presence of fast-food retailers near schools (Virtanen et al., 2015). In contrast to having such detrimental effects, the school environment may also support healthy eating habits in adolescents by reducing the prices of healthy food in the school cafeteria (Kessler, 2016) and by providing school gardens (Utter, Denny, & Dyson, 2016). The overall school nutrition climate as perceived by adolescents further appears to have a positive influence on the eating behaviour of adolescents (Cvjetan, Utter, Robinson, & Denny, 2014). Taken together, schools may thus also serve as a strong promotor of healthy eating habits in adolescents.

Finally, at the societal level price policies could be implemented to decrease the purchase and consumption of unhealthy products. Examples of this may be a sugar-tax and regulations on the sale of drinks containing sugar or caffeine to children and adolescents, as was recently implemented in some EU countries (Seifert et al., 2011). The prevalence of soft drinks and energy drinks consumption is lower in countries that have regulated energy drinks availability, such as Norway or Sweden, than in other European countries (Inschley et al., 2016; Seifert et al., 2011; Zucconi et al., 2013). Taking into account time trends of adolescents' soft drinks consumption in northern countries, such as Norway, Finland or Sweden, the prevalence of adolescents consuming these drinks has slightly decreased in these countries in recent years (Currie et al., 2012; Inschley et al., 2016). This suggests that these regulations are effective and contribute to the decrease of adolescents' consumption of such drinks. Combining preventive strategies at various levels may reinforce their effectiveness, leading to multicomponent and multilevel interventions. The success of multi-level interventions within a variety of settings, including schools, health services and the family setting, has been well documented (Lindsay et al., 2006).

Regular soft drinks and energy drinks consumption in adolescents was found to be strongly associated with a wide range of negative health and behaviour outcomes. The consumption of these drinks could thus be used as an indicator to identify adolescents at potential risk to multiple problem behaviours and particularly for direct preventive actions aimed at these endangered adolescents, as described in the previous paragraphs.

Adolescents who consumed alcohol with energy drinks were at higher risk to report negative health and behaviour outcomes than their peers who drank only alcohol or energy drinks or were abstinent. These adolescents had especially a

higher risk of being aggressive. If causal indeed, this implies a need for broadening adolescents' knowledge about the adverse effects of mixing alcohol with energy drinks, in addition to the risks associated with only energy drinks, as noted above. In particular, adolescents who are prone to aggressive behaviour should be the target of such preventive actions. The information on the association between mixing alcohol and energy drinks with aggressive behaviour should be a part of anti-bullying programs and activities aimed at optimising peer relationships in school.

We further found that adolescents reporting a lack of parental rules on eating were more likely to eat unhealthily. Since the family has been shown to have a crucial role in shaping their children's dietary practices (Lindsay et al., 2006; Pedersen et al., 2015), overall family food and eating practices could be a promising target for preventive actions. Parents should be aware that they play an important role in the development of eating habits of their children, taking into account the importance of particular mechanisms, such as modelling, food-related parental rules or food availability. By optimization of such mechanisms, parents could significantly improve the eating habits of their children. The effectiveness of preventive strategies involving parents has been well documented (Hart et al., 2015).

Bullying, as a form of aggressive behaviour, was reported significantly more often by adolescents dissatisfied with their bodies than by their peers. Those who considered themselves to be too fat were more likely to be victims and bully-victims. Self-reported thinness was associated with being a bully-victim, but only in boys. These findings suggest that not only girls but also boys dissatisfied with their bodies are at risk of negative behavioural outcomes. This may be translated in a number of interventions. First, early intervention at schools should be provided to reduce the onset of body image dissatisfaction among girls and boys. Primary prevention activities should become a part of the school curriculum and thus reach every adolescent potentially at risk to body image dissatisfaction. Second, overweight or underweight adolescents potentially at risk of image dissatisfaction should be targeted by bullying prevention and intervention strategies. A school psychologist or other professional present in school should actively work with these adolescents. Third, existing programs focused on eating-disorder prevention should address a wider range of factors, such as self-esteem, body image and aggressive behaviour. The effectiveness of programs based on media literacy enhancement, incorporating health education activities or on supporting self-esteem has been confirmed (Stice, Shaw, Becker, & Rohde, 2008; Yager & O'Dea, 2008).

#### *8.4.2 Implications for future research*

Our findings suggest that unhealthy eating habits are very common in Slovak adolescents. Adolescents from other countries, such as Finland, have been shown to have overall healthier eating habits (Inschley et al., 2016), providing a benchmark for what could be improved. Future research should explore the effectiveness of preventive actions and legislation with the goal of reaching in Slovakia the more favourable levels achieved in other countries.

Moreover, adolescents reporting regular soft drinks and energy drinks consumption were at higher risk of a wide range of negative health and behavioural outcomes. Further research is needed to examine the biological and social mechanisms affecting the relationship between consumption of substances contained in soft drinks and energy drinks and negative outcomes among adolescents and the psycho-

social factors that influence these mechanisms. In addition, objective measures of eating behaviour, anthropometric measures (such as BMI or body-fat content) or family eating-related rules reported by parents could be included in the design. An additional topic of study may be general family eating habits, including particular mechanisms, such as modelling or availability of healthy food. This may provide an overview of possible family influence on the eating habits of children. In the case of reporting on bullying behaviour or fighting, techniques such as peer nomination or triangulation are needed to ascertain the validity of measures.

Given the cross-sectional design of the present study, we could not make strong causal inferences. To disentangle causality, future longitudinal studies and trend analyses on these relations are needed, and perhaps also some experimental research aiming to confirm the concepts. Furthermore, the adverse effect of adolescents' eating habits in the context of sleeping habits, screen-based behaviour or sedentary behaviour should be explored, since these behaviours are strongly interrelated. Some previous works have explored screen based behaviour and sedentary behaviour in association with health complaints, body image, physical activity or parental influence (Brindova et al., 2014; Husarova et al., 2016; Kopcakova et al., 2014).

Finally, further research on the role of adolescents' eating behaviour in the context of wider health-related behaviour is needed. The association of health literacy of adolescents with eating practices should be assessed in particular to evaluate the potential effectiveness of health education on improving the eating habits of adolescents.

## **8.5 Conclusion**

Unhealthy eating habits were highly prevalent among Slovak adolescents. Adolescents reporting regular soft drinks and energy drinks consumption were at higher risk of negative health and behaviour outcomes. Especially the combination of energy drinks and alcohol consumption in adolescents was related to multiple adverse outcomes. Moreover, the family environment was found to have an important role in shaping the eating habits of adolescents. And finally, adolescents reporting body image dissatisfaction were at higher risk of being involved in bullying. Our findings highlight the need for improving public awareness about the negative consequences of regular soft drinks and energy drinks consumption. Preventive strategies should involve multiple levels of adolescents' influence, including the family, the school setting and legislation and should target the wide range of problem behaviours, ranging from unhealthy eating habits or body image dissatisfaction to negative health and behaviour outcomes involving multiple levels of influence. Much can be gained regarding these relatively new challenges for adolescent public health.



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# Summary

Healthy eating habits in adolescence support optimal health, growth and intellectual development of the individual. Thus, nutrition is one of the most important aspects of the health behaviour of adolescents. In Slovakia, a significant number of adolescents reported unhealthy eating habits, such as skipping breakfast or insufficient fruit and vegetables intake. Especially in the last decade, regular consumption of soft drinks and energy drinks has become very common in adolescents. Unhealthy eating habits have been identified as one of the main contributors to overweight, obesity and other diet-related chronic diseases. Moreover, consumption of soft drinks and energy drinks in adolescence has been found to be strongly associated with a wide range of health and behavioural problems in adolescents, and to date only a few studies have explored this relationship. Therefore, the aim of this study was to further explore eating habits and body image of adolescents and their associations with health and behavioural problems in the context of the school and family environment. The association of adolescents' soft drinks and energy drinks consumption with health and behavioural problems was explored in particular.

Chapter 1 summarises the available evidence about eating habits and body image in adolescents in the context of social environments, such as family and school. Moreover, the relationship of unhealthy eating habits and body image dissatisfaction with health and behaviour problems is explored. At the end of the chapter, the theoretical framework, the general aim of the study, as well as the research questions are presented.

Chapter 2 describes the two research samples used in this thesis. It also provides information on the design of the studies, measures and statistical analyses.

Chapter 3 explores the associations between a negative body image and involvement in bullying among adolescents and whether gender affects these associations. A negative body image was strongly related to involvement in bullying among adolescents. Self-reported dissatisfaction because of overweight was found to be strongly connected with involvement in bullying as a victim and as a bully-victim among boys and girls. Boys feeling too thin were more likely to become bully-victims, whereas girls were not.

Chapter 4 deals with the mediating effect of daily nervousness and irritability on the relationship between frequent soft drinks consumption and aggressive behaviour (bullying and fighting) of adolescents, taking into account possible gender, age and socioeconomic differences. Adolescents reporting daily soft drinks consumption were more likely to be involved in bullying and fighting. The associations between daily soft drinks consumption and bullying and fighting were mediated by daily nervousness and irritability. Gender, age and family affluence did not affect this relationship.

Chapter 5 examines the association between parental rule-setting on eating and unhealthy eating habits among adolescents adjusted on gender, age and socioeconomic differences. Adolescents reporting a lack of parental rules on eating were at higher risk of a wide range of unhealthy eating habits, such as skipping breakfast, insufficient fruit and vegetables consumption, and frequent use of sweets,

soft drinks and energy drinks.

Chapter 6 focuses on the relationship between frequent energy drinks consumption among adolescents and a wide range of negative health and behavioural outcomes. Adolescents reporting regular energy drinks consumption were at higher risk of a wide range of negative health and behavioural outcomes, and of negative school experiences.

Chapter 7 explores whether mixing alcohol with energy drinks was associated with a higher risk of reporting negative behavioural outcomes among adolescents. Furthermore, the character of the joint association of alcohol and energy drinks consumption in this relationship was assessed. Adolescents consuming both alcohol and energy drinks were more likely to report behavioural problems than consumers of alcohol only, energy drinks only and non-consumers. The joint association of alcohol and energy drinks consumption was greater than the sum of the associations of energy drinks consumption and alcohol consumption separately regarding fighting but not regarding the other behavioural outcomes.

Chapter 8 discusses the main findings of the previous chapters in the context of previous knowledge. We found that unhealthy eating, such as skipping breakfast, low fruit and vegetable consumption and frequent consumption soft drinks and energy drinks, occurred frequently among Slovak adolescents. Moreover, frequent soft drinks and energy drinks consumption in adolescents was found to be related to a wide range of health and behavioural problems. Our findings add to the limited but growing body of scientific evidence exploring the adverse consequences of soft drinks and energy drinks consumption in young adolescents. They show that adolescents consuming these drinks on regular basis are at higher risk of multiple negative health and behavioural outcomes.

Our findings imply a need for optimising eating habits in adolescence. Moreover, public awareness about the negative consequences of regular soft drinks and energy drinks consumption needs to be improved. Preventive strategies should address adolescents at multiple levels, including family, school setting and also legislation. They should address a wide range of problem behaviours, from unhealthy eating habits and body image dissatisfaction to negative health and behaviour outcomes. Successfully addressing these issues may highly add to adolescent health. Preventive strategies could be targeted toward adolescents with a subculture affiliation and their parents as they are in higher risk of problem behaviour. Our results imply that the common cause of problem behaviour in youth subcultures might be a lack of protective factors as result of rebellion against parents and against conforming to the society, which is embodied in youth subcultures. Another explanation could be that the lack of protective factors leads to problem behaviour which gathers adolescents in youth subcultures via peer selection. These causal pathways should be relevant for future research.

# Samenvatting

Gezonde eetgewoonten in de adolescentie ondersteunen een optimale gezondheid, groei en intellectuele ontwikkeling van het individu. Voeding is één van de belangrijkste aspecten van het gezondheidsgedrag van adolescenten. In Slowakije rapporteerde een aanzienlijk deel van de jongeren ongezonde eetgewoonten, zoals het overslaan van het ontbijt of onvoldoende inname van groenten en fruit. Vooral in het laatste decennium is regelmatige consumptie van frisdranken en energiedranken heel gebruikelijk bij adolescenten geworden. Ongezonde eetgewoonten leveren een belangrijke bijdragen aan overgewicht, obesitas en andere aan voeding gerelateerde chronische ziekten. Bovendien is gebleken dat de consumptie van frisdranken en energiedranken in de adolescentiefase sterk samenhangt met een breed scala aan gezondheids- en gedragsproblemen bij adolescenten. Tot op heden is dit verband echter in slechts een paar studies onderzocht. Daarom was het doel van deze studie om het verband tussen het lichaamsbeeld van adolescenten, hun eetgewoonten en hun gezondheid en gedragsproblemen verder te verkennen in de context van de school en familie. De samenhang van het gebruik van frisdranken en energiedranken door adolescenten met gezondheids- en gedragsproblemen werd in het bijzonder onderzocht.

In Hoofdstuk 1 wordt ingegaan op de beschikbare kennis over eetgewoonten en het lichaamsbeeld bij adolescenten in de context van de sociale omgeving, zoals familie en school. Verder wordt ingegaan op het verband tussen ongezonde eetgewoonten en ontevredenheid met het lichaamsbeeld en gezondheid en gedragsproblemen. Aan het einde van het hoofdstuk wordt ingegaan op het theoretische kader en het algemene doel van het onderzoek, en worden de onderzoeksvragen gepresenteerd.

In Hoofdstuk 2 worden de twee onderzoeksgroepen beschreven die gebruikt zijn in dit proefschrift. Ook wordt informatie gegeven over de opzet van de betreffende studies, de gehanteerde meetinstrumenten en de statistische analyses. In Hoofdstuk 3 wordt nagegaan wat de samenhang is tussen een negatief lichaamsbeeld en betrokkenheid bij pesten, onder adolescenten en verder of het geslacht van invloed is op deze verbanden. Een negatief lichaamsbeeld is sterk gerelateerd aan betrokkenheid bij pesten onder jongeren. Zelf-gerapporteerde ontevredenheid vanwege overgewicht bleek sterk samen te hangen met betrokkenheid bij pesten als slachtoffer bij jongens en meisjes. Jongens die zeiden te dun te zijn hadden een grotere kans om gelijktijdig pester te zijn en gepest te worden, terwijl meisjes dat niet waren.

In Hoofdstuk 4 wordt nagegaan of het verband tussen frequente frisdrank consumptie en agressief gedrag (pesten en vechten) van adolescenten verloopt via elke dag nerveus en prikkelbaar zijn, rekening houdend met geslachts-, leeftijds- en sociaal-economische verschillen. Adolescenten die dagelijks frisdrank drinken hebben meer kans te worden betrokken bij pesten en vechten. Deze samenhang verloopt via elke dag nerveus en prikkelbaar zijn. Geslacht, leeftijd en de gezinswelstand had geen invloed op dit verband.

In Hoofdstuk 5 wordt ingegaan op het verband tussen ouderlijke regels met betrekking

tot eetgedrag en ongezonde eetgewoonten bij adolescenten met betrekking tot geslacht, leeftijd en sociaal-economische verschillen. Adolescenten die weinig ouderlijke regels over eten rapporteren hadden een hoger risico op een breed scala aan ongezonde eetgewoonten, zoals het overslaan van het ontbijt, te weinig groente en fruit eten en veelvuldig gebruik van snoep, frisdranken en energiedranken.

In Hoofdstuk 6 wordt het verband nagegaan tussen veelvuldig gebruik van energiedranken door adolescenten en een breed scala aan negatieve gezondheids- en gedragsuitkomsten. Adolescenten die rapporteren regelmatig energiedranken te gebruiken hebben een hoger risico op een breed scala aan negatieve gezondheidsuitkomsten en gedragsproblemen, en op negatieve schoolervaringen. In Hoofdstuk 7 wordt nagegaan of het gecombineerd nuttigen van alcohol met energiedranken verband houdt met een hoger risico op het rapporteren van negatieve gedragsuitkomsten bij adolescenten. Bovendien wordt nagegaan wat de aard van het verband tussen het gecombineerde gebruik van alcohol en energie dranken is. Adolescenten die zowel alcohol als energiedranken consumeren hadden meer kans om gedragsproblemen te rapporteren dan adolescenten die alleen alcohol consumeren, alleen energiedranken consumeren of geen van beide dranken consumeren. Het verband van een gecombineerde consumptie van alcohol en energie dranken was groter dan de som van de verbanden van de consumptie van energie dranken en alcohol afzonderlijk, wat betreft vechten maar niet wat betreft de andere gedragsuitkomsten.

In Hoofdstuk 8 worden de belangrijkste bevindingen van de voorgaande hoofdstukken besproken in samenhang met de al beschikbare kennis. We vonden dat ongezond eten, zoals het overslaan van het ontbijt, een lage groente- en fruitconsumptie en een frequente consumptie frisdranken en energiedranken vaak voorkwamen bij Slowaakse adolescenten. Bovendien bleek een veelvuldig gebruik van frisdrank en energiedrank bij adolescenten samen te hangen met een breed scala aan gezondheids- en gedragsproblemen. Onze bevindingen leveren een bijdrage aan de beperkte maar groeiende hoeveelheid wetenschappelijk onderzoek naar de negatieve gevolgen van frisdrank- en energiedrankgebruik bij jonge adolescenten. Ze laten zien dat jongeren die dit soort dranken op regelmatige basis gebruiken een hoger risico hebben op meerdere negatieve gezondheidseffecten en gedragsuitkomsten.

Onze bevindingen laten zien dat het nodig is om de eetgewoonten in de adolescentie te optimaliseren. Bovendien zal het bewustzijn bij het algemene publiek met betrekking tot de negatieve gevolgen van het regelmatige frisdrank- en energiedrankgebruik moeten worden vergroot. Preventieve strategieën gericht op adolescenten moeten meerdere niveaus betreffen, waaronder van de familie, de school en ook de wetgeving. Deze moeten een breed scala van probleemgedrag beslaan, van ongezonde eetgewoonten en ontevredenheid met het lichaamsbeeld tot negatieve gezondheids- en gedragsuitkomsten. Het succesvol aanpakken van deze problemen kan een belangrijke bijdrage leveren aan de gezondheid van adolescenten.

# Zhrnutie

Výživa je jedným z najdôležitejších aspektov zdravia adolescentov. Zdravé stravovacie návyky v tomto období podporujú optimálne zdravie, rast a intelektuálny vývin. Napriek tomu sú nezdravé stravovacie návyky ako napríklad vynechávanie raňajok, alebo nedostatočná konzumácia ovocia a zeleniny veľmi časté u slovenských adolescentov. Hlavne konzumácia sladených a energetických nápojov sa stala veľmi populárnou v priebehu poslednej dekády. Nezdravé stravovacie návyky boli identifikované ako jedna z hlavných príčin nadváhy, obezity a iných chronických ochorení. Navyše bolo vedecky dokázané, že konzumácia sladených a energetických nápojov súvisí so širokým spektrom problémov so zdravím a správaním. Zatiaľ však málo štúdií skúmalo tento vzťah u adolescentov. Cieľom našej štúdie bolo skúmať stravovacie návyky a nespokojnosť s postavou adolescentov vo vzťahu k problémom so zdravím a správaním v kontexte školského a rodinného prostredia. Štúdia sa zamerala hlavne na vzťah konzumácie sladených a energetických nápojov s výskytom problémov so zdravím a správaním adolescentov.

Kapitola 1 sumarizuje dostupné informácie o stravovacích návykoch a subjektívnom hodnotení postavy adolescentov v ich sociálnom kontexte. Kapitola taktiež pojednáva o vzťahu medzi nezdravými stravovacími návykmi, nespokojnosťou s postavou a problémami so zdravím a správaním u adolescentov. Na konci kapitoly sú prezentované všeobecné ciele práce a výskumné otázky.

Kapitola 2 popisuje dve výskumné vzorky použité v tejto štúdii. Kapitola taktiež obsahuje informácie o dizajne štúdie a štatistických analýzach.

Kapitola 3 skúma vzťah medzi nespokojnosťou s postavou a šikanovaním u adolescentov. Adolescenti, ktorí boli nespokojní so svojou postavou mali väčšiu šancu zapájať sa do šikanovania. Chlapci a dievčatá, ktorí boli nespokojní so svojou postavou kvôli nadváhe uvádzali častejšie, že sa zapojili do šikanovania v roli obeť alebo reaktívnej obeť. Chlapci uvádzajúci nespokojnosť kvôli podváhe boli častejšie zapojení do šikanovania ako reaktívna obeť, pričom u dievčat sa tento vzťah nepotvrdil.

Kapitola 4 sa zaoberá mediálnym efektom nervozity a podráždenosti na vzťah medzi pravidelnou konzumáciou sladených nápojov a agresívnym správaním adolescentov berúc do úvahy možný vplyv pohlavia, veku a socioekonomických rozdielov. Adolescenti, ktorí uvádzali dennú konzumáciu sladených nápojov mali väčšiu šancu byť zapojení do fyzickej bitky a šikanovania. Tento vzťah medzi dennou konzumáciou sladených nápojov a agresívnym správaním bol mediovaný nervozitou a podráždenosťou. Pohlavie, vek ani socioekonomický status neovplyvňovali tento vzťah.

Kapitola 5 skúma vzťah medzi nastavením rodičovských pravidiel a nezdravými stravovacími návykmi adolescentov s ohľadom na pohlavie, vek a socioekonomický status. Adolescenti, ktorí uvádzali, že ich rodičia neuplatňujú pravidlá týkajúce sa jedenia mali väčšiu šancu stravovať sa nezdravo – častejšie uvádzali vynechávanie raňajok, nedostatočný príjem ovocia a zeleniny a konzumáciu sladkostí, sladených nápojov a energetických nápojov.

Kapitola 6 skúma vzťah pravidelnej konzumácie energetických nápojov so širokým spektrom problémov so zdravím a správaním u adolescentov. Adolescenti

uvádzajúci pravidelnú konzumáciu energetických nápojov boli náchylnejší k problémom so zdravím a správaním.

Kapitola 7 skúma vzťah medzi kombinovaním alkoholu a energetických nápojov a problémami so správaním u adolescentov. Kapitola taktiež skúma synergický efekt konzumácie alkoholu a energetických nápojov v tomto vzťahu. Adolescenti uvádzajúci konzumáciu alkoholu a energetických nápojov mali častejšie problémy so správaním v porovnaní s ostatnými adolescentmi (konzumentmi iba alkoholu, iba energetických nápojov alebo tými, ktorí nekonzumovali ani jeden z nápojov). V prípade zapájania sa do fyzickej bitky bol synergický efekt konzumácie alkoholu a energetických nápojov silnejší ako súčet vplyvu konzumácie alkoholu a energetických nápojov samostatne.

Kapitola 8 sumarizuje hlavné zistenia štúdie v kontexte predchádzajúcich znalostí v tejto oblasti. Zistili sme, že nezdravé stravovacie návyky ako napríklad vynechávanie raňajok, nedostatočný príjem ovocia a zeleniny a častá konzumácia sladených a energetických nápojov je veľmi častý fenomén u slovenských adolescentov. Navyše častá konzumácia sladených a energetických nápojov je spojená so širokým spektrom problémov so zdravím a správaním u adolescentov. Zistenia našej štúdie dopĺňujú a rozširujú zatiaľ obmedzené ale rastúce spektrum zistení o nepriaznivých následkoch konzumácie sladených a energetických nápojov u adolescentov. Dokazujú, že adolescenti, ktorí pravidelne pijú sladené a energetické nápoje sú ohrození viacnásobnými problémami so zdravím a správaním.

Naše zistenia zdôrazňujú veľkú potrebu optimalizovať stravovacie návyky adolescentov. Všeobecné povedomie o nepriaznivých účinkoch pravidelnej konzumácie sladených a energetických nápojov by sa malo zvýšiť. Preventívne stratégie by mali pôsobiť na adolescentov prostredníctvom viacerých úrovní – cez rodinné, školské prostredie a taktiež prostredníctvom úpravy legislatívy. Tieto stratégie by mali byť namierené na široké spektrum problémového správania – od stravovacích návykov, vnímania vlastnej postavy až po problémy so zdravím a správaním. Pozitívne pôsobenie v týchto oblastiach by mohlo optimalizovať celkové zdravie adolescentov.

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## About the author



Jana Holubcikova was born on 17<sup>th</sup> September 1985 in Bratislava. She graduated at the Comenius University in Bratislava and received her master degree in psychology in 2011. Her diploma thesis (Impact of parenting style on adolescent risk behaviour) was based on HBSC (Health Behaviors in School-aged Children) data as she participated as an administrator in data collection in 2010. During her study she was working in the non-profit sector with focus on children and adolescents living mainly in risky and socially disadvantaged environment. She participated in creation and implementation of various projects oriented on prevention, education and supporting healthy development of young people.

At present time, she is the researcher at the Department of Health Psychology, Faculty of Medicine at Pavol Jozef Safarik University in Kosice. She is focused on research of health related behaviour in adolescents - especially the topic of soft drinks and energy drinks consumption in adolescents and its association with negative health and behavioural outcomes. Moreover, she is participating in several in several national and international projects (7RP HEALTH, SOPHIE, APVV). Since 2012 she is a member of the HBSC national team and a member of HBSC Violence and Injury Prevention focus group. Since 2016 she is a member of editorial board of International Journal of Public Health.



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