

## DIETARY HABITS AND BEHAVIOUR PROBLEMS AT SCHOOL AMONG NORWEGIAN 14 YEAR OLDS

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**Abstract:** *This study examined the association between dietary habits and behavioural problems at school among adolescents in Norway. Participants in this study included 517 adolescents and 336 of their parents. Students attended schools in the south of Norway, where the study was conducted. In 2012, adolescents completed a food frequency questionnaire (FFQ) and a questionnaire regarding behavioural problems at school. Parents completed a questionnaire regarding socioeconomic status. All statistical analyses were carried out using SPSS. High intake of soda with sugar and frequent consumption of take-away food were significantly associated with increased behavioural problems at school in the adjusted analysis, while frequent consumption of fast food and frequent consumption of dinner (as opposed to skipping meals) were significantly associated with decreased odds of behavioural problems only in the crude analysis (i.e., unadjusted for age, BMI, and parental SES). The study shows an association between diet and behavioural problems at school, even when adjusting for parental SES. The study underlines the importance of a healthy diet in adolescence and the importance of promoting both cooking skills and nutritional knowledge among adolescents at school.*

**Keywords:** diet, adolescent, behavioural problems, unhealthy eating habits, meal patterns

### Introduction

A healthy diet in childhood and adolescence is important for both physical and mental health (Laska, Murray, Lytle, & Harnack, 2012; O'Neil et al., 2014) as well as for school performance (Florence, Asbridge, & Veugelers, 2008). For example, Rampersaud, Pereira, Girard, Adams, and Metz (2005) found an association between nutrition and cognitive and academic performance where a diet with an appropriate amount of fat and a high intake of fruits and vegetables is associated with better school performance. Conversely, adolescents with low quality diets that include a high intake of junk food are more likely to be hyperactive with age (Wiles, Northstone, Emmett, & Lewis, 2009). Although some observational studies show that sugar intake is related to hyperactivity, controlled experimental studies have found no correlation between sugar intake and hyperactivity (Millichap & Yee, 2012). Among the few studies to have considered the relationship between

diet quality and general behavioural problems are two cross-sectional studies that showed that a high intake of unhealthy foods, such as soft drinks sweetened with sugar and sweets, is associated not only with hyperactivity, but increased behavioural problems in general (Lien, Lien, Heyerdahl, Thoresen, & Bjertness, 2006; Øverby & Høigaard, 2012). Behavioural problems at school can range from shouting in class to having to leave the classroom because of bullying.

In addition to dietary quality, meal patterns are an important element of the diet. Varied meal patterns and skipped meals are increasing trends among adolescents, although this may have stabilized among Norwegian children (Øverby, Stea, Vik, Klepp, & Bere, 2011). Some studies have concluded that not eating breakfast may be related to psychological distress (Lien, 2007) and is associated with increased behavioural problems at school (Øverby & Høigaard, 2012). Breakfast can increase concentration and motivation to learn,

which may contribute to improved behaviour (Wesnes, Pincock, & Scholey, 2012).

Behaviour at school is especially important because student behaviour can affect learning and the social environment at school. Although some research has suggested that adolescents experience poor health and diet in Norway (Øverby & Andersen, 2002) and indicates an association between diet and behavioural problems among Norwegian adolescents (Øverby & Høigaard, 2012), studies are limited. Moreover, few of these studies include socioeconomic data, which is highly related to diet trends among Norwegian adolescents (Fismen et al., 2016) and behaviour (Tremblay, 1999). This study aimed to address this gap in the literature. It examined the associations between dietary habits and behavioural problems at school among adolescents in the southern part of Norway adjusting for parental socioeconomic status.

## Materials and Methods

### Participants

This study was conducted during autumn of 2012 and used two questionnaires. A total of 742 ninth grade adolescents and their parents or guardians (hereafter called parents) from 15 secondary schools in four different municipalities in Vest-Agder County, Norway were invited to participate. Of those invited, 517 adolescents completed the questionnaires resulting in a participation rate of 69.7%. All 517 adolescents (232 boys and 285 girls) were included in the statistical analysis. Of the 308 parents who completed the questionnaire (60% participation rate), 50% of fathers and 58% of mothers had higher education.

This study was conducted according to the guidelines of the Declaration of Helsinki and all procedures involving human

subjects were approved by the Norwegian Social Data Services (NSD). Students and parents involved in the study provided written and informed consent.

### Procedure

Data were collected between September and November 2012. All secondary schools in the communities of Kristiansand, Søgne, Mandal, and Vennesla, representing both urban and rural municipalities, were invited to participate. Researchers (Western and Skaardal) contacted the principals at the different schools to request participation. Out of the 15 schools invited to join, nine agreed to participate: five schools from Kristiansand, two from Søgne, one from Mandal, and one from Vennesla (see Skardal, Western, Ask, & Øverby, 2014).

The researchers were available at the schools to provide oral and written information about the project. All parents received a consent form with clear and concise written information about the project's aims and methods. Some schools informed parents about the study and consent form through mobile messaging and in lesson plans that were sent home with students each week. The consent form was completed through the project's website, where parents entered their ID numbers. The ID numbers were designed to match the pupils and the parents.

The adolescents' questionnaire responses were considered confidential. Each student was provided with an ID number to match with their parents' questionnaire. Students completed the questionnaire on a computer during a designated school lesson. Two researchers were available while students completed the questionnaires and remained after students finished to answer any questions that may have arisen during the survey. Students were asked to think about their usual habits when filling in the food-frequency

section. Parents also completed a short (5 minute) online questionnaire about the adolescent's family situation.

### Data Collection Tools

**Diet.** We use the term diet to refer to the food and drinks that are consumed by individuals, which yields energy and nutrients for growth, development and nourishment (Willett & Sampson, 2013). Diet also includes meal patterns.

**Behavioural Problems.** This study drew on Ogden's (2009) definition of behavioural problems at school: "Behavioral problems at school is pupil conduct that breaks the school rules, norms, and expectations. This conduct prevents teaching and teaching activities and thereby impedes pupils' learning and development, and it makes positive interactions with others difficult" (p. 18). Ogden explicitly discussed that it is important to distinguish between normal behaviour and problem behaviour, where the frequency and intensity determines whether it is a behavioural problem. If the behaviour is disruptive then it is classified as a behavioural problem.

**Socioeconomic Status (SES).** According to Baker (2014), SES is a measure of individuals' economic and social status and tends to be positively associated with health. Generally, there are three common measures of SES: education, income, and occupation. In this paper, we only measured parental education as this is the factor that is most highly related to diet (Skardal et al., 2014).

**Overweight.** Self-reported weight and height were used to calculate body mass index ( $BMI = kg/m^2$ ). The international cut-off points for BMI were used to estimate the prevalence of overweight adolescents (Cole, Bellizzi, Flegal, & Dietz, 2000).

**Adolescent Questionnaire.** Adolescents completed one questionnaire. The questionnaire asked adolescents to respond to questions about their meal patterns, school environments, learning experiences, and behaviour at school. The questionnaire also included a food frequency questionnaire (FFQ), assessing adolescents' diet. Questions in the FFQ included the following categories of food habits: beverages, yoghurt, breads and cereals, spreads, fruits and vegetables, desserts, and snacks. Each category contained 4-26 related foods. For each category, participants answered the question, *How often do you eat/drink...?* The frequency intervals ranged from *never* to *more than three times a day*. The adolescents could indicate their answers in *units per day*, *units per week*, and *units per month*. The questionnaire was tested for reliability and validated against 24-hour recall and biological markers as vitamin D and fatty acids (Øverby, Johannesen, Jensen, Skjævesland, & Haugen, 2014). Participants could indicate whether they frequently or seldom consumed food/drinks. Frequent consumption of soda with sugar was defined as drinking more than two bottles (1 bottle = 0.5 litres) per week. A high intake of fruits and vegetables was defined as eating 10.5 or more servings of fruit per week and 12 or more servings of vegetables per week. Frequent consumption of unhealthy food such as fast food and take-away was defined as having it one or more times per week. Meal frequency was ascertained by the question *How often do you eat breakfast each week?* with the same question asked for lunch, dinner, and supper (evening meals). In Norway dinners are often eaten at 5 in the afternoon and supper is eaten before bed time. Response alternatives ranged from never or seldom to 7 days a week, and were collapsed into dichotomized categories: having a meal frequently (defined as every day) and having meals

infrequently (defined as less than every day).

To measure the adolescents' behavioural problems at school, four self-reported questions were adapted from Roland (1998): (a) *Do you make so much noise in class that the teachers yell at you?*, (b) *Are you expelled from class because you make too much noise?*, (c) *Does your teacher write down your name because of bad behaviour?*, and (d) *Do you disturb the class to such an extent that other pupils in your class can't pay attention?* The questions had five response categories, ranging from 1 to 5: *never, seldom, sometimes, often, and very often*. The score of these questions yielded a sum from 4–20, where higher rates indicated more problems. The scores were collapsed into dichotomized categories: those not having behavioural problems at school (score: 4–9) and those having behavioural problems at school (score: 10–20).

**Parent Questionnaire.** The parent questionnaire included questions about parents' educational attainment, marital status, residential area, income, age, ethnicity, and family structure. To measure socioeconomic status, parents were asked about their educational attainment. The response alternatives were *9-year primary school or less; high school; college or technical school; college or university education equal to or less than 4 years; and college or university education equal to or more than 4 years*. These were collapsed into dichotomized categories: those with shorter periods of education (primary and secondary education) and those with longer periods of education (college or university education). We did not include questions regarding income or occupation.

### Data Analysis

All statistical analyses were carried out

using SPSS version 19. Descriptive analyses were performed to present the characteristics of the participants with means and standard deviations. Independent sample *t*-tests and chi-square tests were used to explore differences across gender. Variables such as behavioural problems at school and consumption of take-away and fast food were not normally distributed. Thus, logistic regression was used to explore the association between behavioural problems at school and meal patterns and the other food groups. Behavioural problems were the dependent variable and meal patterns and dietary variables were chosen as independent variables. Odds ratios (OR) with confidence intervals (CI 95%) were given for each variable. Both crude (unadjusted) and adjusted (for sex, BMI, parental education) ORs are presented.

### Results

Tables 1 and 2 show the characteristics of the participants and their dietary habits respectively. Of the 517 pupils who completed the questionnaire, 232 (44.9%) were identified as male and 285 (55.1%) were identified as female. An approximately equal distribution of boys and girls were classified as overweight (14% vs. 11% respectively;  $p = 0.360$ ). More boys than girls had behavioural problems at school (13% vs. 2% respectively;  $p \leq 0.001$ ). There were sex differences related to meal patterns and food consumption. More girls than boys ate breakfast frequently (79% vs. 69%,  $p = 0.019$  respectively) and had evening meals frequently (49% vs. 36%,  $p = 0.004$  respectively). More girls than boys ate vegetables frequently (54% vs. 44% respectively;  $p = 0.017$ ). Boys drank soda with sugar more frequently compared with girls (43% vs. 19% respectively;  $p \leq 0.001$ ). Boys' intake of unhealthy food such as fast food ( $p = 0.026$ ) and take-away ( $p \leq 0.001$ ) were higher than the girls' for both food groups.

Table 1  
*Characteristics of Adolescent Participants*

Characteristic	N	All	Boys	Girls	p <sup>a</sup>
Age (year), mean (SD)	517	13.9 (0.3)	13.9 (0.3)	13.9 (0.3)	0.898
Weight (kg), mean (SD)	501	55.8 (10.3)	58.4 (11.6)	53.7 (8.6)	≤0.001
Height (cm), mean (SD)	510	167.3 (7.9)	170.7 (8.1)	164.4 (6.6)	≤0.001
Overweight*, N (%)	499	64 (12.8)	32 (14.3)	32 (11.6)	0.360
Behaviour problems, N (%)	509	37 (13.1)	30 (12.9)	7 (2.5)	≤0.001

Notes. <sup>a</sup> = Independent sample t-test continuous variables and chi-square for categorical variables;

\* = Overweight calculations defined by Cole et al. (2000)

Table 2  
*Dietary Habits of Adolescent Participants*

Characteristic	N	Total N(%)	Boys N(%)	Girls N(%)	p <sup>f</sup>
Breakfast <sup>a</sup>	514	382 (74.3)	184 (79.3)	198 (70.2)	0.019
Lunch <sup>a</sup>	514	282 (54.9)	127 (54.7)	155 (55.0)	0.960
Dinner <sup>a</sup>	514	425 (82.7)	193 (83.2)	232 (82.3)	0.784
Supper <sup>a</sup>	514	215 (41.8)	113 (48.7)	102 (36.2)	0.004
Fruits <sup>b</sup>	516	259 (50.2)	106 (45.7)	153 (53.9)	0.064
Vegetables <sup>c</sup>	515	254 (49.3)	101 (43.5)	153 (54.1)	0.017
Soda with sugar <sup>d</sup>	517	155 (30.0)	101 (43.5)	54 (18.9)	≤0.001
Fast food <sup>e</sup>	513	54 (10.5)	32 (13.9)	22 (7.8)	0.026
Take-away <sup>e</sup>	513	38 (7.4)	28 (12.1)	10 (3.5)	≤0.001

Notes. <sup>a</sup> = Having meals every day; <sup>b</sup> = Having fruits 10.5 or more times a week frequently; <sup>c</sup> = Having vegetables 12 or more times a week frequently; <sup>d</sup> = Drinking more than two bottles per week. 1 bottle = 0.5 litres; <sup>e</sup> = Having unhealthy food one or more times per week; <sup>f</sup> = *p* values for Chi-square

Table 3 shows the associations between behavioural problems and dietary habits

(both crude and adjusted for sex, BMI, and parents' educational attainment).

Table 3

*Crude (unadjusted) and Adjusted Odds Ratio (OR) for Behaviour Problems at School in Relation to Meal Patterns and Food Consumption*

	Crude (unadjusted) OR (95 % CI)	p	Adjusted OR <sup>f</sup> (95 % CI)	p
Breakfast <sup>a</sup>	0.69 (0.34-1.43)	0.320	0.45 (0.06-3.11)	0.418
Lunch <sup>a</sup>	0.86 (0.44-1.68)	0.661	0.73 (0.16-3.24)	0.681
Dinner <sup>a</sup>	0.39 (0.19-0.82)	0.012	1.98 (0.22-17.59)	0.539
Supper <sup>a</sup>	1.18 (0.60-2.30)	0.636	0.72 (0.16-3.18)	0.539
Fruits <sup>b</sup>	0.73 (0.38-1.46)	0.388	1.78 (0.42-7.62)	0.437
Vegetables <sup>c</sup>	1.56 (0.79-3.07)	0.203	2.37 (0.53-10.56)	0.256
Soda with sugar <sup>d</sup>	3.86 (1.94-7.67)	≤0.001	5.49 (1.03-29.37)	0.046
Fast food <sup>e</sup>	4.33 (2.00-9.38)	≤0.001	4.29 (0.82-22.41)	0.084
Take-away food <sup>e</sup>	8.23 (3.72-18.21)	≤0.001	10.17 (1.55-66.73)	0.016

*Notes.* <sup>a</sup> = Having meals every day, <sup>b</sup> = Having fruits 10.5 or more times a week, <sup>c</sup> = Having vegetables 12 or more times a week, <sup>d</sup> = Drinking more than two, 0.5 litre bottles per week, <sup>e</sup> = Having unhealthy food one or more times per week, <sup>f</sup> = Adjusted for sex, BMI, and parents' levels of education

The crude (unadjusted) results show that adolescents who reported drinking soda with sugar frequently, OR: 3.86 [1.94–7.67],  $p \leq 0.001$ , had significantly higher odds of having behavioural problems at school compared with those who seldom drank soda with sugar. Frequent consumption of fast food, OR: 4.33 [2.00–9.38]  $p \leq 0.001$ , and take-away food, OR: 8.23 [3.72–18.21],  $p \leq 0.001$ , were significantly associated with increased odds of behavioural problems at school. Furthermore, regular consumption of dinner was significantly associated with decreased odds of behavioural problems at school, OR: 0.39 [0.19–0.82],  $p = 0.01$ .

Table 3 also presents the association adjusted for sex, BMI, and parents' educational attainment. Drinking soda with sugar, OR: 5.49 [1.03–29.37],  $p = 0.046$ , and eating take-away frequently,

OR: 10.17 [1.55–66.73],  $p = 0.016$ , remained significantly associated with increased odds of behavioural problems at school after adjustment. Eating fast food frequently, OR: 4.29 [0.82–22.41],  $p = 0.084$ , and dinner frequently, OR: 1.98 [0.22–17.59],  $p = 0.539$ , were not significant predictors for behavioural problems at school when the adjustments were made.

## Discussion

This study showed that a high intake of soda with sugar and consumption of take-away and fast food were associated with increased odds of behavioural problems among adolescents at school. The findings support a previous Norwegian study which found that a high intake of sugar-sweetened soft drinks was significantly

associated with increased odds of behavioural problems at school among adolescents (Øverby & Høigaard, 2012). However, our study adjusted for parental education as an indicator of socioeconomic status, unlike the previous study. Furthermore, another study from Norway demonstrated that a high intake of sugar may lead to attention and conduct problems in children and that there is a dose-response relationship between hyperactivity scores and the number of soft drinks consumed (Lien et al., 2006). Given the additional negative impact sugar-sweetened beverages may have on diet quality (Øverby, Lillegaard, Johansson, & Andersen, 2004), the high intake of sugar among adolescents is of concern (Øverby et al., 2004). Although Norway offers food-based dietary guidelines that specifically focus on the reduction of sugar sweetened beverages (Norwegian National Council of Nutrition, 2011), age specific guidelines and a more rigorous focus on health promotion in school is warranted.

Previous research also suggests, as does the present study, that intake of junk food may be related to behavioural problems, especially attention deficit hyperactivity disorder (Millichap & Yee, 2012; Park et al., 2012). This study did not specifically address ADHD, but explored general behaviour problems. There has been an increase in snacking and consumption of meals away from home and a shift toward higher consumption of fast food and processed foods (Lachat et al., 2012). Frequent dining in fast food restaurants also has been associated with higher energy and fat intake among adolescents (Sebastian, Wilkinson, & Goldman, 2009). Moreover, researchers have found that adolescents consume more servings of soft drinks, cheeseburgers, french fries and pizza, and fewer servings of fruits and vegetables (Øverby et al., 2004; Sebastian et al., 2009). The data suggest that an increased focus on healthy food preparation at home may counter the increase in fast food consumption. For

example, Lichtenstein and Ludwig (2010) argue that reinstating classic home economics courses that focus on food preparation skills could contribute to reductions in take-away food consumption and adolescent obesity. Our study indicated that take-away food is also associated with behavioural problems at school, which only adds to the importance of educating adolescents on food preparation.

The results of our study suggest that not only are particular foods associated with adolescent behaviour at school, but the regularity of meals may also be significant. Interestingly, our study found that having dinner frequently, (i.e., daily), was significantly associated with decreased odds of behavioural problems at school in the crude (unadjusted) analysis but not when adjusting for sex and parental socioeconomic background. Having family meals has been shown to reduce adolescents' levels of engagement in various risk behaviours (Skeer & Ballard, 2013). In addition to providing a healthier food option, regular family meals may help to prevent behavioural problems by allowing for more open communication between adolescents and parents about everyday issues and sensitive and difficult topics.

Behavioural problems at school affect not only the person involved, but whole classes of children. Addressing lifestyle behaviours that are associated with behavioural problems is now important for all school stakeholders. One important stakeholder is the home economics teacher who teaches pupils how to prepare healthy diets for themselves and their future families. Several countries do not offer this subject anymore, leading some to argue that the subject should be brought back to the school curriculum (Lichtenstein & Ludwig, 2010). This study's results, and previous results showing diet's effect on learning and health, underline the importance of home economics in schools. However, as a healthy diet is fundamental for development and an unhealthy diet is

associated with behaviour problems and poor learning, we suggest that all teachers, not just home economics teachers, emphasize the importance of a healthy diet in their respective courses in order to improve the broader food environment at school.

The present study has some limitations. Misreporting and especially underreporting is a major problem in dietary studies among adolescents (Lioret et al., 2011; Livingstone, Robson, & Wallace, 2004). Young people may have low motivation and interest in reporting what they are eating and drinking (Livingstone et al., 2004). Another limitation is the low response rate from parents. Several parents consented to their children participating but did not answer the questionnaire themselves. The reason for this may be that they simply did not want to participate or that they had not seen the survey link after consenting to participate. Another limitation of this study is the cross-sectional correlational design, which cannot indicate causality. To demonstrate the temporal sequence of the relationship and determine causality, further longitudinal research examining dietary habits and behavioural problems as well as intervention studies are needed.

Despite these potential limitations, this study has several methodological strengths. It was a population-based study with a relatively high sample size and response rate among adolescents, with data from both adolescents and their parents. The educational levels of the parents were comparable to the general population in this age group, especially for the mothers

(Statistics Norway, 2016). Further strengths were that every school in the four different municipalities in Vest-Agder County (except for the combined schools, which are schools including both primary and secondary grades) was invited to participate. The participating schools came from communities that represented both urban (greater than 50 000 inhabitants) and rural (less than 5000 inhabitants) contexts, which allowed for variation in the sample. Because Norway is generally a homogeneous country, the results may be generalizable for Norwegian adolescents.

### Conclusions and Implications

The current study demonstrated an association between diet and behavioural problems at school and identified specific dietary factors that contribute to this association. Frequent consumption of take-away food and sugar sweetened beverages yield higher odds of behavioural problems; having dinner frequently yields lower odds of behavioural problems at school. The study underlines the importance of a healthy diet in adolescence, not just for health, but for learning and social engagement in school. The study underlines the importance of improving adolescents' food preparation skills as part of nutrition education programs. We suggest a more rigorous focus on classical home economic teaching in school and additional research to explore the effects of home economic teaching on diet, health, and behaviour. In addition, we suggest that all teachers should have a minimum knowledge of healthy diets so that they can promote healthy living among their students.

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