

## FULL-LENGTH ORIGINAL RESEARCH

# Young people with epilepsy have an increased risk of eating disorder and poor quality diet

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## SUMMARY

**Objective:** To investigate whether adolescents with epilepsy are at increased risk of having self-reported eating disorder symptoms and poor quality diet compared to young people from the general population.

**Methods:** We used data from the Health Profile for Children and Youth in Akershus Study, a cross-sectional population-based study based on a voluntary self-reported questionnaire. There were 19,995 participants (response rate 85%) aged 13–19 years; 247 (1.2%) reported a lifetime diagnosis of epilepsy. Odds ratios (OR) and 95% confidence intervals (CI) for eating disorders, unhealthy diet, dieting, satisfaction with looks, and participation in sports were estimated by using a logistic regression model. All estimates were adjusted for single parents and poor family economy.

**Results:** Children and adolescents with epilepsy had more eating disorders than their peers (OR 1.8, CI 1.0–3.0,  $p = 0.03$ ). They were less satisfied with their own appearance (OR 0.7, CI 0.5–0.9,  $p = 0.02$ ), and they eat more unhealthily (OR 1.7, CI 1.3–2.2,  $p = 0.001$ ). Males with epilepsy were more likely to have been dieting (OR 3.1, CI 1.2–7.9,  $p = 0.02$ ) and less satisfied with their own appearance (OR 0.4, CI 0.3–0.7,  $p < 0.001$ ). Females with epilepsy were more likely to eat unhealthily (OR 1.7, CI 1.1–2.5,  $p = 0.01$ ).

**Significance:** Adolescents with epilepsy are at increased risk of having eating disorder symptoms. They eat less healthily and are less satisfied with their looks. Health workers should be aware of this and bring diet and lifestyle into the dialogue with young people with epilepsy.

**KEY WORDS:** Epileptic, Psychiatric, Adolescents, Overweight, Children.



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Epilepsy is a common neurological disorder with a prevalence of 0.6–1.2%.<sup>1–3</sup> Epilepsy in adolescents is associated with comorbid disorders such as depression, anxiety, attention-deficit/hyperactivity disorder (ADHD), and low self-

esteem.<sup>4–7</sup> Boys with epilepsy are prone to risk-taking behavior.<sup>8</sup> The relation between epilepsy and eating disorders has been scarcely studied, and not at all in adolescents. A population-based study from England found an increase in risk of eating disorders among people with epilepsy in general.<sup>3</sup> Pregnant women with epilepsy in Norway also more frequently reported an eating disorder than other women, especially binge eating disorder.<sup>9,10</sup> The prevalence of eating disorders among adolescents continues to increase<sup>11</sup> and is a predictor of negative outcome in terms of mental health disorders, substance abuse, deliberate self-harm, and overweight or underweight.<sup>12,13</sup> Thus, there is a demand for further knowledge within this field. Our aim was to investigate whether adolescents with epilepsy more often than their peers had eating disorder symptoms and eating-associated problems such as frequent dieting and

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## KEY POINTS

- Adolescents with epilepsy are at an elevated risk of suffering from eating disorder symptoms
- They eat less healthily and are less satisfied with their looks
- Referral to a nutritionist should be considered in young people with epilepsy at the time of diagnosis

negative feelings toward their own appearance. We also wanted to study quality of diet in adolescents with epilepsy.

## METHODS

We used data from the Health Profile for Children and Youth in Akershus Study.<sup>14</sup> This cross-sectional population-based study was based on a voluntary self-reported questionnaire. The relevant questions for this investigation are listed in the Appendix. The study was conducted by the Norwegian Health Services Research Centre in 2002. Random school classes from all municipalities in Akershus County were selected, and all pupils aged 13–19 years in the selected classes were invited to participate. Their parents were informed and gave consent. A total of 19,995 adolescents answered, yielding an 85% response rate; 0.4% of pupils in Norway attended special schools in 2002 and were excluded from this study.<sup>15</sup> Special schools are for children and adolescents with disabilities such as mental retardation. The questionnaire comprised 110 questions grouped under the main topics: sociodemographic conditions, social network and school, smoking, alcohol, drug abuse, nutrition and attitude concerning body, physical health, psychosocial health, mental health, use of health services.<sup>16</sup> The questionnaires were completed during a classroom session and were all anonymous.

The epilepsy diagnosis was self-reported. The participants answered the simple question of whether they had or had had epilepsy. This question could be answered by “yes,” “no,” or “don’t know.” The answer “yes” counted as having epilepsy, and “no” and “don’t know” counted as not having epilepsy. Two hundred forty-seven individuals (1.2%) reported a diagnosis of epilepsy. In an exploratory analysis those who answered “don’t know” were excluded. All other participants constructed the reference group. Questions concerning asthma were asked in the same way as for epilepsy. All individuals reporting this diagnosis formed a control group of chronic disease ( $n = 3,320$ ). This group was also a part of the total reference group ( $n = 19,748$ ).

### Outcome variables

For the purposes of this investigation, reporting having sought help from health personnel for an eating disorder was used as a proxy for a diagnosis of an eating disorder. Participants reported whether they had visited a school

nurse or other health personnel with an eating disorder as the main issue. Participants’ diet was investigated. An unhealthy diet was defined prestudy by nutritionists as eating or drinking candy, potato chips, french fries, or sugar-containing soda daily. The participants reported whether they were or previously had been on a diet to reduce weight. They also noted whether they were satisfied with their own body appearance (yes/no) and whether they wanted to improve their looks (yes/no). Finally, the level of physical exercise was recorded. Participants reported how often they were physically active, and the alternatives were (1) never, (2) less than once a month, (3) once a month, (4) once a week, (5) 2–3 times a week, (6) 4–6 times a week, and (7) every day. A dichotomous variable was constructed where the cut-off was set at being physically active two or more times a week. Mean age of menarche was calculated for female participants.

### Covariates

Perceived low family income, living with a single parent, and depressive symptoms were used as covariates. Depressive symptoms were assessed using SDQ-S (Strength and Difficulty Questionnaire), a tool frequently used to screen for psychiatric symptoms with good psychometric properties.<sup>16,17</sup> These data has been reported for this population previously.<sup>8</sup> The appropriate questions are listed in the Appendix.

### Statistics

For statistical analysis we used SPSS version 22. Chi-square tests (Fisher exact test for an expected cell count  $<5$ ) and  $t$  test were used to investigate group differences, and odds ratios with 95% confidence intervals were obtained using logistic regression. The logistic regression models were adjusted for reported low family income and living with a single parent. Both logistic univariate and multivariable analyses were performed to investigate associations between variables. Eating disorder was set as the dependent factor and dieting, unhealthy diet, satisfaction with own body appearance, desire to change looks, depressive symptoms, and age, sex, overweight, family economy, single parent, and smoking as independent factors within the epilepsy group. The independent factors were first tested separately in univariate analyses. Criterion for variables to enter the multivariate analysis was set at  $p < 0.1$ . Satisfaction with own body appearance and desire to change looks were not included in the same multivariate analysis owing to collinearity with dieting.

The study was approved by the regional ethics committee (REK, ref. 40-02022).

## RESULTS

Background information is provided in Table 1. Mean age and mean height were similar in the epilepsy and reference populations as well as for the group with other chronic

Table 1. Background data

	Epilepsy n = 247	Reference n = 19,995	Males with epilepsy n = 137	Male controls n = 10,180	Females with epilepsy n = 108	Female controls n = 9,703	Asthma n = 3,320
Age (SD)	16.1 (1.4)	16.2 (1.5)	16.1 (1.4)	16.2 (1.5)	16.1 (1.4)	16.2 (1.5)	16.2 (1.5)
Height in cm (SD)	174.7 (9.4)	173.8 (9.0)	180.5 (7.5)	179.8 (7.1)	167.5 (6.5)	167.4 (6.0)	173.3 (9.2)
Weight in kg (SD)	67.5 (11.8)*	65.4 (11.7)	72.8 (11.4)	71.3 (11.1)	60.9 (9.0)	59.1 (8.8)	66.2 (12.1)**
Smoking (%)	78 (32.9%)**	4,180 (24.2%)	45 (34.4%***)	1,877 (21.4%)	33 (31.4%)	2,278 (27.0%)	913 (28.0%***)
Overweight BMI >25 n (%)	13 (13.0%)	1,047 (12.6%)	8 (13.8%)	677 (15.7%)	5 (11.9%)	364 (9.2%)	246 (15.9%***)
Obesity BMI >30 n (%)	2 (2.0%)	172 (2.1%)	1 (1.7%)	102 (2.4%)	1 (2.4%)	69 (1.7%)	45 (2.9%*)

BMI, body mass index; SD, standard deviation.

\*p < 0.05, \*\*p < 0.01, \*\*\*p < 0.001 compared to the reference group.

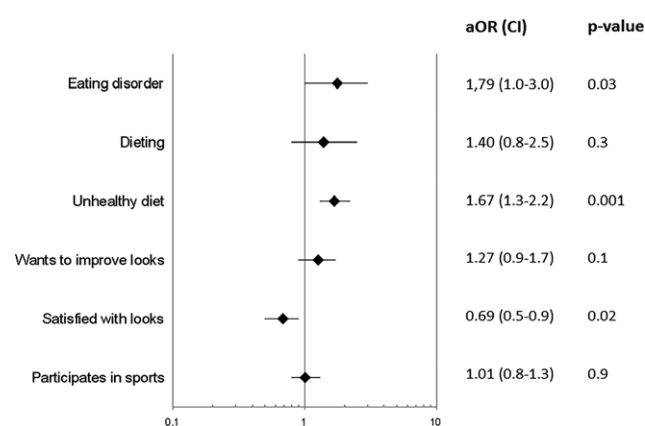


Figure 1.

Eating-related factors in the epilepsy group (n = 247) vs. the reference group (n = 19748).

*Epilepsia Open* © ILAE

diseases. The epilepsy group and the group with other chronic disease were significantly heavier than the reference group and more often reported nicotine smoking.

People with epilepsy between 13 and 19 years more often reported having an eating disorder (OR 1.79, CI 1.0–3.0,  $p = 0.03$ ) and an unhealthy diet (OR 1.67, 1.3–2.2,  $p = 0.001$ ) than the reference group. Young people with epilepsy had a significant higher daily consumption of candy, sugar-containing soda, potato chips, and pommes frites than adolescents without epilepsy (Fig. 1). They were also significantly less satisfied with their own body appearance (OR 0.69, CI 0.5–0.9,  $p = 0.02$ ) (Table 2; Fig. 2). Results did not change when people who did not know whether they had epilepsy or not were excluded from the analysis.

Females with epilepsy were more prone to an unhealthy diet (OR 2.16, CI 1.5–3.2,  $p = 0.001$ ) compared to females in the reference group (Fig. 3). Males with epilepsy were more likely to be dieting (OR 3.12, 1.2–7.9,  $p < 0.02$ ) than their peers and reported being less satisfied with their body appearance (OR 0.44, 0.3–0.7,  $p < 0.001$ ) (Fig. 4). These differences were not as prominent in females with epilepsy

(Fig. 3). A group of adolescents with the chronic disease asthma scored in between the epilepsy group and the reference group for all variables (Table 2).

There was no difference in age of menarche in the epilepsy group (mean age 12.6, SD 1.4) and the reference group (mean age 12.6, SD 1.2).

In the univariate logistic regression analysis within the epilepsy group there was a significant inverse association between eating disorder and satisfaction with looks (OR 0.2, CI 0.06–0.58,  $p = 0.004$ ), between an eating disorder and a desire to change looks (OR 5.1, CI 1.8–15.1,  $p = 0.003$ ), and between seeking help for eating disorders and dieting (OR 89.3, CI 4.5–542.0,  $p < 0.001$ ), although CI for the latter analysis was wide. There was no significant association between eating disorder and depressive symptoms, with family economy, living with a single parent, or with being overweight (OR 1.44, CI 0.5–4.5,  $p = 0.53$ ). However, there was an association between satisfaction with looks and family economy (OR 3.58, CI 1.5–8.7,  $p = 0.005$ ). There was an inverse association in the epilepsy group between satisfaction with looks and dieting (OR 0.05, CI 0.01–0.2,  $p < 0.001$ ). Only dieting remained significantly associated with having an eating disorder in the multivariate model (OR 47.9, CI 4.5–511.9,  $p = 0.01$ ).

## DISCUSSION

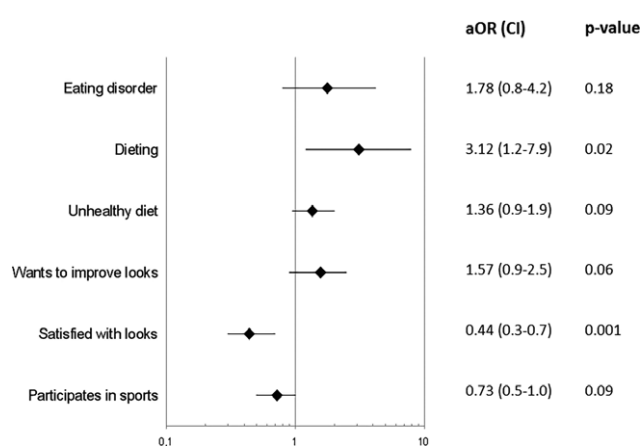
### Key findings

Our main finding is an increased rate of eating disorder symptoms in an unselected and population-based cohort of adolescents with epilepsy compared with a reference group. This is an important finding in a group that is known to be at risk of several psychiatric disorders.<sup>5,9,16,18</sup> Better knowledge should increase awareness and lead to a better holistic treatment of epilepsy. Apart from their immediate impact, eating disorders can result in physical problems later in life, such as impaired bone density, reduced skeletal function,<sup>19</sup> and impaired reproductive health in women.<sup>20</sup> Perhaps more importantly, however, eating disorders also represent a predictor of mental health disorders, substance abuse, and deliberate self-harm.<sup>12,13</sup> The presence of an eating disorder

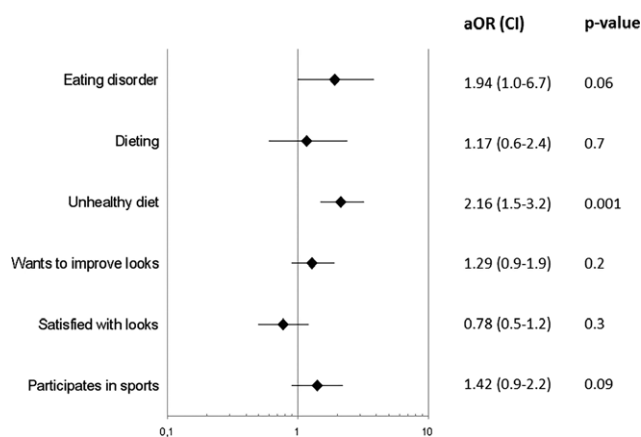
Table 2. Eating-related outcome

	Epilepsy (n = 245)	Reference (n = 19,995)	Males with epilepsy (n = 137)	Reference males (n = 10,180)	Epilepsy female (n = 108)	Reference female (n = 9,703)	Asthma (n = 3,320)
Eating disorder n (%)	8 (5.4%)**	210 (2.0%)	3 (4.3%)*	50 (1.1%)	5 (6.7%)*	159 (2.8%)	54 (2.7%)*
Dieting n (%)	13 (5.3%)	655 (3.7%)	5 (3.6%)**	94 (1.1%)	8 (7.4%)	559 (6.5%)	148 (4.5%)*
Unhealthy diet n (%)	119 (51.7%***)	6,718 (39.0%)	65 (52.8%)	3,919 (45.0%)	54 (54.9%***)	2,762 (32.7%)	1,481 (48.0%)**
Wants to improve looks n (%)	60 (24.3%)	3,490 (19.8%)	21 (15.3%)*	903 (10.1%)	39 (36.1%)	2,577 (30.1%)	657 (19.8%)
Satisfied with looks n (%)	174 (77.0%)*	14,258 (83.2%)	104 (83.9%***)	8,004 (92.6%)	70 (68.6%)	6,187 (73.5%)	2,589 (80.6%***)
Participates in sports n (%)	158 (66.7%)	11,636 (66.9%)	82 (63.6%)	6,292 (71.4%)	75 (70.1%)	5,285 (62.1%)	2,220 (67.8%)

\*p < 0.05, \*\*p < 0.01, \*\*\*p < 0.001 compared to the reference group.

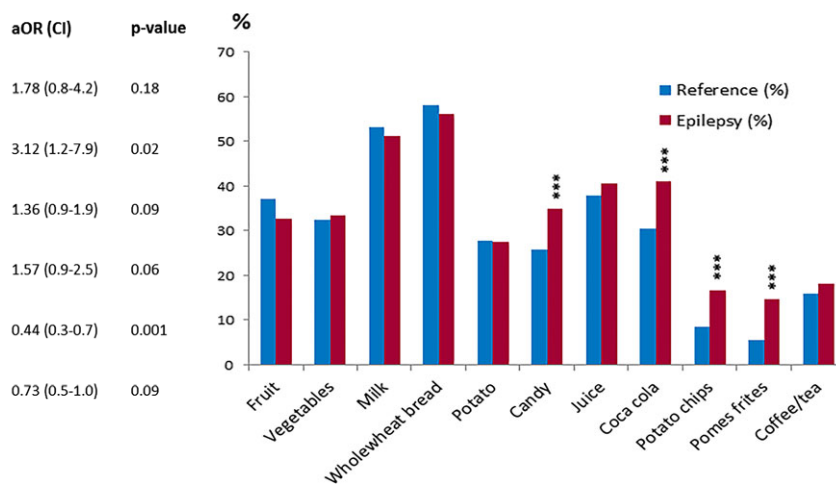


**Figure 2.** Eating-related factors in males with epilepsy (n = 137) vs. males in the reference group (n = 10180).  
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**Figure 3.** Eating-related factors in females with epilepsy (n = 108) vs. females in the reference group (n = 9703).  
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before pregnancy has been associated with a greater likelihood of pregnancy complications in patients with epilepsy.<sup>9</sup> This is also seen among the general population, where



**Figure 4.** Frequency (percent) of young people with a daily consumption of various food categories in the epilepsy (n = 247) vs. the reference group (n = 19748). \*\*\*p < 0.001 compared to the reference group.  
*Epilepsia Open* © ILAE

maternal eating disorders have been associated with impaired fetal growth and impaired growth in the children during their first year.<sup>21</sup> Furthermore, children of mothers with eating disorders have been shown to be at increased risk of psychiatric disease in childhood.<sup>22</sup> This highlights the importance of early detection and intervention regarding eating disorders, both in the general population, but especially among patients with epilepsy who may also have additional problems.

The etiology of eating disorders is largely unknown. Both genetic predisposition and environmental and sociocultural influences are thought to be relevant etiologic factors for eating disorders,<sup>23</sup> but none of these should be specific for epilepsy. However, some antiepileptic drugs (AEDs) contribute to a weight increase,<sup>24</sup> and eating disorders may arise as a response to these changes. Another contributing factor may be that failure to control seizures may prompt a need in patients with epilepsy to gain control over their body in a

different way. By focusing attention on weight, shape, and eating, epilepsy patients may feel that they are in a domain where control is possible.<sup>25</sup> Furthermore, people with epilepsy have a higher burden of psychiatric comorbidity, such as anxiety and depression,<sup>26</sup> and eating disorders could be associated with these conditions. Anxiety and depression are frequent comorbid conditions in people with eating disorders.<sup>13</sup> However, in our material there was no association between an eating disorder and depressive symptoms within the epilepsy group.

In our study, adolescents with epilepsy appeared to have a diet of poorer quality than their peers without epilepsy. An unhealthy diet is a growing concern and a major cause of morbidity and disability worldwide,<sup>27</sup> partly because it leads to overweight and obesity. These conditions are mainly concerns of developed countries and could also be seen as a socioeconomic problem.<sup>28</sup> However, despite the less healthy diet in the young people with epilepsy, we did not find an increased rate of overweight, although they were heavier. Increased frequency of overweight in patients with epilepsy has been reported in other cohorts.<sup>29</sup>

The chronic disease asthma scored in between the epilepsy group and the reference group in terms of risk of eating disorder, dieting, unhealthy diet, and dissatisfaction with own appearance. This emphasizes that young people with epilepsy are especially vulnerable in terms of developing bad eating habits and eating disorders.

A risk of eating disorders and poor diet quality should be evaluated in young people with epilepsy, and referral to a nutritionist at the time of diagnosis as well as when starting on AEDs should be considered. Exercise and a healthy lifestyle should be encouraged in all adolescents but particularly among those with epilepsy. In some cases exercise will help control seizure frequency.<sup>30</sup>

Dissatisfaction with own body appearance was more frequent in adolescents with epilepsy than in the reference group. This may reflect the stigma that many epilepsy patients feel influences their lives,<sup>31</sup> which affects their quality of life and leads to anxiety and depression. An increased rate of hyperactivity/inattention problems, anxiety, and depression has previously been reported also in our epilepsy cohort.<sup>5</sup> Dissatisfaction with own appearance was associated with dieting and a wish to improve looks. There was also an association between poor family economy and a dissatisfaction with own body appearance.

### Strengths and limitations

A large sample size and very high response rate (85%) are the main strengths of this study. A major strength is also the population-based nature of the study. Because a large proportion of the invited youths participated, we avoided the overestimation of adverse outcomes that often occurs in clinical materials. Randomization of selected school classes was performed, and, because of the organization of the Norwegian school system with

almost all children (>96% in 2015) attending ordinary state-funded schools, an accurate representation of the population was obtained. Our reference group consisted of youths who were representative of the general population and not only healthy individuals; hence we avoided inflation of the rates of adverse outcomes in the epilepsy group. We were also able to compare the epilepsy group with a relevant control group with a nonneurological chronic disease and to assess the relationship between epilepsy, eating disorders, diet, and socioeconomic status. The main limitation of this study is the lack of clinical information, such as type of eating disorder, type of epilepsy, seizure frequency, and treatment. In addition, we were not able to classify the types of eating disorder. Adolescents with severe disabilities, including severe mental retardation, were excluded from this study if they were not attending general public schools (0.4% of pupils in Norway in 2002).<sup>15</sup> This means that we have possibly excluded people with the most disabling epilepsy but also we have excluded those with similar disabilities who are not epileptic. It might be assumed that our findings would be even more pronounced if only people with active epilepsy and using AEDs had been included.

### Significance

Both female and male adolescents with epilepsy are at an elevated risk of suffering from eating disorder symptoms. They eat less healthily than their peers without epilepsy and are less satisfied with their own appearance. Health workers should be aware of these associations between epilepsy, eating disorders, and diet and introduce diet and lifestyle into their dialogues with young people with epilepsy. Referral to a nutritionist should be considered in young people with epilepsy at the time of diagnosis as well as when initiating antiepileptic medication.

## CONFLICT OF INTEREST

N.E.G. has received speaker's honoraria from Merck-Serono, Baxter, and Octapharma. M.H.B. has received lecture honoraria from GlaxoSmith-Kline and congress travel support from UCB pharma. M.L. has received lecture honoraria from Eisai and UCB pharma. The remaining authors have no conflicts of interest. We confirm that we have read the Journal's position on issues involved in ethical publication and affirm that this report is consistent with those guidelines.

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## APPENDIX ITEMS FROM QUESTIONNAIRE USED IN THE PAPER:

- 1 Are you male or female?
- 2 In what year were you born?
- 3 Do you live with your mother, father, or both?
- 4 How much do you weigh?
- 5 How tall are you?
- 6 Do you have or have you had asthma, diabetes, or epilepsy? (yes/no)
- 7 Do you smoke? (yes/no)
- 8 How often do you smoke? (1. Not at all. 2. Less than once a week. 3. Every week. 4. Every day.)
- 9 How often do you participate in sports? (1. Not at all. 2. Less than once a month. 3. Once a month. 4. Once a week. 5. 2–3 times a week. 6. Every day.)
- 10 How often do you eat/drink fruit, vegetables, whole-wheat bread, dairy products, potatoes, candy, juice, sugar-containing soda, potato chips, hamburger, and sausages? (1. seldom/never. 2. Less than once a week. 3. Once a week. 4. Several times a week. 5. Every day. 6. Several times a day.)
- 11 Have you ever tried dieting to lose weight? (yes/no)
- 12 Are you satisfied with your appearance? (yes/no)
- 13 Do you want to change your appearance? (yes/no)
- 14 How old were you when you first had your period?
- 15 Have you ever sought help of health personnel because of an eating disorder? (yes/no)

**From Fig. 1:** Analyses where the epilepsy group is compared to a reference group that denied having epilepsy. Those who answered “don’t know” are excluded.

	OR (CI)	p-value
Eating disorder	1.82 (1.1–3.1)	0.02
Dieting	1.48 (0.8–2.6)	0.2
Unhealthy diet	1.47 (1.1–1.9)	0.005
Wants to improve looks	1.08 (0.8–1.4)	0.5
Satisfied with looks	0.67 (0.5–0.9)	0.01
Participates in sports	1.2 (0.8–1.7)	0.2