Influence of parental socio-economic status on diet quality of European adolescents: results from the HELENA study

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Abstract
Diet quality is influenced by socio-economic and geographical factors. The present study sought to assess whether adolescents’ diet quality is affected by their parents’ socio-economic status and whether the relationship between these factors is similar in northern and southern Europe. Data collected in the Healthy Lifestyle in Europe by Nutrition in Adolescence (HELENA) study in eight European countries were analysed. Dietary intake data were recorded via repeated 24 h recalls (using specifically developed HELENA Dietary Intake Assessment Tool software) and converted into an adolescent-specific Diet Quality Index (DQI-AM). Socio-economic status was estimated through parental educational level (Par-Educ-Lev) and parental occupation level (Par-Occ-Lev) as reported by the adolescents in a specific questionnaire. The DQI-AM data were then analysed as a function of Par-Educ-Lev and Par-Occ-Lev in northern European countries (Austria, Belgium, France, Germany and Sweden) and southern European countries (Greece, Italy and Spain). We studied a total of 1768 adolescents (age 14·7 (SD 1·3) years; percentage of girls: 52·8 %; 1135 and 633 subjects from northern and southern Europe, respectively). On average, the DQI-AM score was higher in southern Europe than in northern Europe (69·1 (SD 0·1) v. 60·4 (SD 2·8), respectively; P<0·001; Δ = 12·6 %). The DQI was positively correlated with both paternal and maternal Par-Educ-Lev. However, this association was more pronounced in northern Europe than in southern Europe (P interaction = 0·004 for the mother and 0·06 for the father). The DQI was also positively correlated with Par-Occ-Lev (all P trends <0·01), but this correlation was independent of the geographical area (P interaction = 0·51 for the mother and 0·50 for the father). In conclusion, Par-Educ-Lev and Par-Occ-Lev are associated with diet quality in adolescents in Europe. However, this association differs between northern Europe and southern Europe.

Key words: Diet Quality Index; Adolescence; Educational level

Abbreviations: DQI, Diet Quality Index; DQI-AM, Diet Quality Index for Adolescents with a specific Meal index; FBDG, food-based dietary guidelines; HELENA, Healthy Lifestyle in Europe by Nutrition in Adolescence; HELENA-DIAT, Healthy Lifestyle in Europe by Nutrition in Adolescence Dietary Intake Assessment Tool; ISCED, International Standard Classification of Education; Par-Educ-Lev, parental educational level; Par-Occ-Lev, parental occupation level.

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† See the Appendix for a full list of the HELENA study group members.
A well-balanced diet has an important role in the maintenance of good health during different periods of life\(^1\). During childhood and adolescence, in particular, the diet should meet specific needs, such as provision of an adequate energy and nutrient supply for optimal development and growth and high levels of physical activity\(^2\). Adolescence is also a period when individuals have increasing control over their food choices\(^3\) and develop dietary habits that continue into adulthood\(^4-6\). Dietary habits are habitual decisions that a person makes when choosing what foods to eat. Dietary habits could be assessed using a large variety of methodologies such as FFQ, food choice questionnaires, and quantitative and qualitative dietary records. Data obtained using the last methodology (i.e. dietary records) could be computed/translated into a predefined diet quality score\(^7\), such as the Diet Quality Index (DQI) used in the Healthy Lifestyle in Europe by Nutrition in Adolescence (HELENA) study\(^8\).

Dietary habits are influenced by personal factors (individual food choice decision, food choice motivations, religious adherence, craving, etc.) and social/environmental context\(^9\). It has been clearly established that dietary habits are strongly influenced by socio-economic status\(^10-13\). Several studies have particularly focused on certain foods and nutrients such as fruit and vegetables, fibre and SFA\(^14-18\). Dietary habits are also influenced by cultural traditions, which differ from one country (or indeed region) to another\(^19\). Although contemporary lifestyles tend to dissipate traditional habits, there are still major differences in dietary habits between European countries\(^19,20\).

Previous studies have shown that diet quality in adulthood is differentially influenced by both socio-economic\(^21\) and geographical factors; for example, Roos et al.\(^22\) have demonstrated clear disparities in fruit and vegetable consumption between northern Europe and southern Europe. When studying the combined influence of socio-economic and geographical factors, Wyndels et al.\(^23\) found that socio-economic factors influenced diet quality in adulthood in France and that this influence varied from one region to another. An adolescent’s dietary habits and diet quality are strongly influenced by his/her parents’ behaviours\(^24\) and socio-economic status. In contrast, little is known about the relationships between parents’ socio-economic status and their adolescent child’s dietary habits in different geographical areas. The aim of the present study was to assess the influence of parental socio-economic factors on adolescents’ diet quality and whether the relationship between these factors differed between northern Europe and southern Europe.

### Subjects and methods

#### Sample

Data analysed in the present study were collected as part of the HELENA study, which was carried out between 2006 and 2007 in a number of cities in northern Europe (Vienna in Austria, Ghent in Belgium, Lille in France, Dortmund in Germany and Stockholm in Sweden) and southern Europe (Athens in Greece, Roma in Italy and Zaragoza in Spain (Fig. 1), as described previously\(^25\). Briefly, the HELENA study was designed to obtain reliable, comparable data on dietary habits, dietary patterns, body composition and physical activity levels and fitness of European adolescents aged 12.5–17.5 years. Details of the sampling procedures, field team preparation, pilot study and data reliability are reported elsewhere\(^26\). The study was carried out in accordance with the (1) ethical guidelines of the Declaration of Helsinki, (2) good clinical practice and (3) the legislation concerning clinical research in each of the participating countries. The protocol was approved by the appropriate independent ethics committee for each study centre, and written informed consent was obtained from both parents and adolescents\(^27\). In total, 3865 adolescents were enrolled through their schools, which were randomly selected according to a proportional cluster sampling methodology that took age and socio-economic status into account\(^28\). Fig. 1 shows the distribution of study population among the countries assessed in the HELENA study, with 1135 and 633 participants from northern and southern Europe, respectively. Table 1 summarises the mean age and mean BMI of the participants and the distribution of educational and occupation levels of the study population. The study population consisted of 1768 participants (proportion of females: 52·8 %); the mean age of the study population was 14·7 (SD 1·3) years (separately for the boys and girls). The mean BMI of the participants from southern Europe was slightly but significantly higher than that of the participants from northern Europe \(P<0·0001\). A high educational and occupational level was more frequent in mothers and fathers from northern countries than in those from southern countries \(P<0·0001\).

#### Assessment of diet quality

Dietary intake was assessed by two non-consecutive 24 h recalls\(^29\) carried out during any two convenient days in the week. As 24 h recalls could not be carried out at schools on Saturdays and Sundays, dietary intake data were not collected on Fridays and Saturdays. The 24 h recalls were recorded using a self-administered, computer-based HELENA Dietary...
Intake Assessment Tool (HELENA-DIAT) that has been validated in European adolescents\(^{(30)}\). The HELENA-DIAT is based on the assessment of dietary intakes during six meal occasions (breakfast, morning snacks, lunch, afternoon snacks, evening meal and evening snacks) on the previous day. Trained dietitians assisted the adolescents to complete the 24 h recalls when needed. The adolescents selected all the foods and beverages consumed at each meal occasion from a standardised food list. Items not present in the initial list could be added by the participants any time. To calculate energy and nutrient intakes, data from the HELENA-DIAT were linked to the German Food Code and Nutrient Database (Bundeslebensmittelschlüssel, version II.3.1)\(^{(31)}\). Given that nutrient contents in different national or regional food composition tables are determined using different laboratory techniques, intakes of only a few nutrient classes could be calculated on the basis of the local food composition tables. Therefore, we decided to include the German food composition table (which included a large number of nutrients and food items) for further nutrient intake assessments. The Multiple Source Method was used to estimate the usual energy, nutrient and food intakes. This statistical modelling technique takes into account the within-person and between-person variability and calculates usual intakes corrected for age, sex and study centre\(^{(32)}\).

To assess adolescents’ diet quality, data from the HELENA-DIAT were converted into the Diet Quality Index for Adolescents (DQI-AM)\(^{(33)}\). The DQI-AM is based on the Countrywide Integrated Non-communicable Disease Intervention Program pyramid developed by the WHO\(^{(36)}\). The latter are based on three basic principles for a healthy diet: quality; diversity; balance. Diet quality corresponds to whether adolescents made the optimal food choices within a food group with respect to quality and whether the food chosen was represented by a ‘preference group’ (e.g. fish, fresh fruit, cereal/brown bread), a ‘moderation group’ (e.g. white bread, minced meat) or a ‘low-nutrient, energy-dense group’ (e.g. chicken nuggets, soft drinks, sweet snacks). Dietary diversity corresponds to the degree of variation in the diet. This component was determined by awarding points (ranging from 0 to 9) when at least one serving of food from a recommended food group was consumed. Dietary

### Table 1. Comparison of the clinical and socio-economic characteristics of the study population in the North and South regions

<table>
<thead>
<tr>
<th></th>
<th>North</th>
<th>South</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>sd</td>
<td>Mean</td>
<td>sd</td>
<td>P</td>
</tr>
<tr>
<td>n</td>
<td>1135</td>
<td>52.7</td>
<td>633</td>
<td>52.9</td>
<td>0.92</td>
</tr>
<tr>
<td>Female (%)</td>
<td>52.7</td>
<td>52.9</td>
<td>52.7</td>
<td>52.9</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Age (years)</td>
<td>14.8</td>
<td>1.3</td>
<td>14.6</td>
<td>1.4</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>BMI (kg/m(^2))</td>
<td>20.2</td>
<td>3.0</td>
<td>21.3</td>
<td>3.6</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Educational level (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>34</td>
<td>36</td>
<td>26</td>
<td>31</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Medium</td>
<td>26</td>
<td>23</td>
<td>41</td>
<td>36</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>High</td>
<td>40</td>
<td>40</td>
<td>33</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>Occupation level (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>9</td>
<td>20</td>
<td>22</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>43</td>
<td>26</td>
<td>35</td>
<td>37</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>High</td>
<td>20</td>
<td>36</td>
<td>13</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Undefined/missing</td>
<td>28</td>
<td>17</td>
<td>30</td>
<td>18</td>
<td></td>
</tr>
</tbody>
</table>
balance was calculated as the difference between the adequacy component (the percentage of the minimum recommended intake for each of the main food groups) and the excess component (the percentage of intake exceeding the recommendation’s upper level). A meal occasion was scored 0 when no food was consumed and 1 when some food was consumed. The scores for the three occasions were summed and are expressed as a percentage; the possible scores were thus 0% (no consumption during any of the main meal occasions), 33% (consumption during only one main meal occasion), 66% (consumption during two main meal occasions) and 100% (consumption during all the three main meal occasions).

The four DQI-AM components are presented below as percentages. The quality component ranged from −100 to 100%, whereas the diversity, balance and meal components ranged from 0 to 100%. The DQI-AM was computed as the mean of the four components; hence, the DQI-AM ranged from −25 to 100%, with higher scores reflecting a higher-quality diet. The score was calculated for each day, and the mean daily score was taken as the individual’s overall index.

Assessment of parental educational level

Parental educational level (Par-Educ-Lev) data were collected using a specific questionnaire already described by Iliescu et al.26. In each country, Par-Educ-Lev were adapted from the International Standard Classification of Education (ISCED) (http://www.uis.unesco.org/Library/Documents/isced97-en.pdf, viewed on 27th August 2012). Par-Educ-lev as reported by the adolescents was categorised into four groups: primary education (ISCED level 0 or 1; score = 1); lower secondary education (ISCED level 2; score = 2); higher secondary education (ISCED level 3 or 4; score = 3); tertiary education (ISCED level 5 or 6; score = 4). For the purposes of the present study, we merged the two lower levels into one group (i.e. ‘primary education and lower secondary education’) and obtained three groups: low; medium; high. ‘Low’ was the lowest parental occupation level (Par-Occ-Lev) and ‘high’ was the highest Par-Occ-Lev). The original coding from the volunteering study was retained when calculating the P trend values.

Assessment of parental occupation level

Par-Occ-Lev data were collected as a surrogate marker of socio-economic status via completion of a specific questionnaire26. Par-Occ-Lev data were collected according to the International Standard Classification of Occupation (http://unstats.un.org/unsd/class/family/family2.asp?Cl = 224, viewed on 27th August 2012). The categories were scored from 1 (the highest level) to 9 (the lowest level). For the purposes of the present study, we merged the two highest levels (score 1 or 2); the medium levels (scores 3 to 5) and the lowest levels (scores 6 to 9) and obtained three groups: high; medium; low. Where ‘low’ was the lowest Par-Educ-Lev and ‘high’ was the highest Par-Educ-Lev. The original coding was retained when calculating the P trend values.

Statistical analysis

Descriptive characteristics are presented as mean values and standard deviations for continuous variables and as percentage for categorical variables. Statistical analysis was carried out using the SAS software (version 9.1, SAS Institute, Inc.). Pearson’s χ² tests and t tests were used to test between-sex differences for categorical and continuous variables, respectively.

North–south trends were calculated to estimate the statistical significance of putative associations between Par-Occ-Lev and Par-Educ-Lev, on the one hand, and those between the DQI-AM and its components, on the other hand. We calculated P interaction between Par-Occ-Lev or Par-Educ-Lev and region (north–south) to determine whether the associations were significantly stronger in one of the regions.

Linear, multilevel mixed models (the MIXED procedure in SAS) were used to account for multistratum sampling. The dependent variable (outcome) included in the MIXED model was the DQI-AM or its components. The independent variables were maternal or paternal Par-Occ-Lev or Par-Educ-Lev, region (north, south) and the interaction between the two variables. Centre, school and class were included as random-effect variables. P trend and P interaction were calculated using Par-Educ-Lev and Par-Educ-Lev as continuous variables (from 1 to 4 for Par-Occ-Lev and from 1 to 3 for Par-Educ-Lev).

Results

In Table 2, the dietary intakes of adolescents in northern and southern Europe are compared. The mean intakes of fruit and vegetable juice, starch roots, potatoes, bread and rolls, cereals, butter and animal fat, and yogurt were higher in northern

<table>
<thead>
<tr>
<th>Food intake (g/d)</th>
<th>Mean</th>
<th>SD</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>North</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>649</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Bread and cereals</td>
<td>157</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Grains and potatoes</td>
<td>75</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>87</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Fruit</td>
<td>144</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Milk products</td>
<td>301</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Cheese</td>
<td>30</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Meat, fish, eggs and substitutes</td>
<td>171</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>North</td>
<td>Mean</td>
<td>SD</td>
<td>P</td>
</tr>
<tr>
<td>Water</td>
<td>914</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>Bread and cereals</td>
<td>121</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Grains and potatoes</td>
<td>49</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>121</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Fruit</td>
<td>128</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Milk products</td>
<td>251</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Cheese</td>
<td>37</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Meat, fish, eggs and substitutes</td>
<td>237</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>North</td>
<td>Mean</td>
<td>SD</td>
<td>P</td>
</tr>
<tr>
<td>Water</td>
<td>914</td>
<td>22</td>
<td></td>
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<tr>
<td>Bread and cereals</td>
<td>121</td>
<td>4</td>
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<tr>
<td>Grains and potatoes</td>
<td>49</td>
<td>3</td>
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<tr>
<td>Vegetables</td>
<td>121</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Fruit</td>
<td>128</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Milk products</td>
<td>251</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Cheese</td>
<td>37</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Meat, fish, eggs and substitutes</td>
<td>237</td>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Comparison of the food intake characteristics of the study population in the North and South regions (Mean values and standard deviations)
Europe than in southern Europe, whereas those of fruit and vegetables, pulses, meat, eggs, milk and buttermilk, and fish were higher in southern Europe than in northern Europe (all $P<0.05$). The mean overall DQI-AM score and the scores of all its components were higher in southern Europe than in northern Europe ($P<0.001$), with the exception of that of the DQI meal component (Table 2).

The mean DQI-AM scores by Par-Educ-Lev and Par-Occ-Lev groups are shown for each region in Fig. 2. In a model adjusted for sex, age and energy intake, the interaction between region and maternal educational level was statistically significant ($P<0.004$). The average DQI-AM score was higher in southern Europe than in northern Europe (60.4 (SD 2.8) v. 69.1 (SD 0.1), respectively; $P<0.001$; $\Delta = 12.6\%$) and was associated with maternal educational level ($P$ trend $<0.001$) in northern Europe but not in southern Europe ($P$ trend $=0.1$). Similarly, the interaction between region and paternal educational level was borderline significant ($P=0.06$). In a similar model adjusted for sex, age and energy intake, the interactions between region and maternal and paternal occupation levels were not statistically significant ($P=0.50$). Both maternal and paternal Par-Occ-Lev were associated with the DQI-AM in southern and northern Europe.

The relationships between DQI scores and Par-Educ-Lev or Par-Occ-Lev in northern and southern Europe are summarised in Table 3. Par-Educ-Lev was more strongly correlated with all the DQI-AM components (namely diversity, quality, balance and meal index) in northern Europe than in southern Europe (all the interactions with maternal educational level were significant, except for the meal component). The increase in the DQI component $Z$-score for an increment of one category in maternal educational level ranged from 0.10 to 0.21 in northern Europe and from 0.02 to 0.06 in southern Europe. All but one of the $P$ trends (paternal educational level/meal component) were significant in northern Europe, whereas only the association with dietary balance achieved significance in southern Europe. Graphical representations of each of the DQI-AM components and their interactions with maternal and paternal Par-Educ-Lev or Par-Occ-Lev are shown by region in Supplementary Figs. 1 and 2 (available online).

**Discussion**

Diet quality is strongly influenced by socio-economic factors; however, little is known about the relationship between them in adolescence$^{(39-40)}$. The aim of the present study was to assess the influence of parental socio-economic status on adolescents’ diet quality and establish whether the relationship between these factors differs between northern Europe and southern Europe.

The results of the HELENA study indicate that the relationship between adolescents’ diet quality (as assessed by the DQI-AM) and Par-Educ-Lev differs between northern and southern regions, namely the quality of adolescents’ diet was positively correlated with Par-Educ-Lev in northern Europe but not in southern Europe. This suggests that cultural and geographical factors (which affect diet quality) could attenuate the relationship between Par-Educ-Lev and adolescents’ diet quality – in countries where the diet is generally healthy (such as in southern Europe). In contrast, Par-Occ-Lev (which is related to family’s wealth) was found to be positively associated with adolescents’ diet quality in both northern and southern Europe, suggesting that parents’ economic constraints may have an impact on adolescents’ diet quality independently of the geographical area.

**Fig. 2.** Mean scores of the Diet Quality Index for Adolescents with a specific Meal index (DQI-AM) by region according to parents’ educational level ((a) mother, (b) father) and parents’ occupation level ((c) mother, (d) father). □ Low; ■ medium; ▪ high.
The positive correlation between Par-Educ-Lev and the DQI-AM score observed in northern Europe could be related to the fact that well-educated people (1) make more reasoned healthy food choices for their adolescent children because they better understand nutritional messages\(^{(41)}\), (2) adopt healthy dietary habits more easily and more quickly than less-educated people\(^{(21,22,42–44)}\), (3) have better nutritional knowledge, which may be translated into healthier food choices/messages for the entire family (including adolescents)\(^{(45–47)}\), and (4) live in a healthy environment providing more opportunities for better-quality foodstuff purchase and consumption than neighbourhood low-cost supermarkets used by less-educated people\(^{(48)}\).

In southern Europe (in the Mediterranean), the more favourable nutritional environment tends to homogenise adolescents’ dietary habits in a favourable manner and thus attenuates the influence of Par-Educ-Lev on diet quality\(^{(49,50)}\).

In contrast, the association between Par-Occ-Lev (a proxy of family’s wealth) and adolescents’ diet quality did not depend on the geographical area — suggesting that financial constraints are an important determinant of food choice, independently of cultural factors\(^{(51)}\). This is supported by the observation that food cost represents a barrier to the adoption of dietary advice by low-income people all over the world\(^{(21,52)}\). In multivariate models that included both Par-Educ-Lev and Par-Occ-Lev\(^{(53)}\), the latter indicators were still independently associated with diet quality; this suggests that the contribution of Par-Educ-Lev to diet quality is independent of Par-Occ-Lev (and vice versa).

In the present study, diet quality was assessed by the DQI-AM\(^{(8)}\), which is a composite of diversity, quality, balance and meal index subscores. Consistent associations of similar strength were observed between Par-Educ-Lev and the scores of all the DQI-AM components in northern Europe, and no or weak association was observed in southern Europe. This suggests that cultural and geographical factors have a broad impact on the components of diet quality related to Par-Educ-Lev.

In northern Europe, adolescents’ diet quality was significantly better when maternal educational level was high. A similar (but less pronounced) association was observed for paternal educational level. This finding suggests that maternal educational level is a strong determinant of diet quality. In agreement with this hypothesis, communication between parents and their adolescent children is an important issue in children’s nutritional behaviour\(^{(47)}\). It is known that within a family, mother–child communication is more effective than father–child communication\(^{(54)}\). In the HELENA study, this conclusion is supported by results from the Healthy Eating Questionnaire showing that mother is the family member most likely to promote healthy dietary habits\(^{(26)}\). In contrast, the relationships between parental socio-economic status and adolescents’ diet quality were similar for boys and girls (Table S2, available online). Other determinants related to diet and environment could explain the difference observed between northern Europe and southern Europe, such as school rhythms between the two regions. During school period, the majority of adolescents

### Table 3. Relationship between the Diet Quality Index (DQI) scores and parental educational or occupation levels in the North and South regions

<table>
<thead>
<tr>
<th></th>
<th>Mother</th>
<th>Father</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>North</td>
<td>South</td>
</tr>
<tr>
<td></td>
<td>β</td>
<td>SEM</td>
</tr>
<tr>
<td>Educational level</td>
<td>0.21</td>
<td>0.03</td>
</tr>
<tr>
<td>DQI-AM</td>
<td>0.16</td>
<td>0.03</td>
</tr>
<tr>
<td>DQI diversity</td>
<td>0.10</td>
<td>0.03</td>
</tr>
<tr>
<td>DQI quality</td>
<td>0.14</td>
<td>0.05</td>
</tr>
<tr>
<td>DQI equilibrium</td>
<td>0.10</td>
<td>0.03</td>
</tr>
<tr>
<td>DQI meal</td>
<td>0.10</td>
<td>0.03</td>
</tr>
</tbody>
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DQI-AM, Diet Quality Index for Adolescents with a specific Meal index.
from southern Europe have no lessons in the afternoon (data not published) and may probably go to their homes for lunch (60.0 v. 49.6% of the adolescents lunch at home in southern v. northern Europe; P<0.0001; Table S3, available online). In contrast, adolescents from northern Europe preferably lunch at school restaurant/canteen compared with southern adolescents (27.6 v. 6.4%, respectively; P<0.0001; Table S4, available online). It is well recognised that school meals promote healthy dietary habits(55–57); however, this may not be sufficient to counteract the relationship with parents’ educational level. Furthermore, although adolescents from northern Europe declared more often to have access to healthy food at school compared with adolescents from southern Europe (57.8 v. 28.2%, respectively; P<0.0001; Table S3, available online), the same trend was observed for non-healthy food (biscuits, chips or sugar beverages). Adolescents from northern Europe declared to have less access to non-healthy food compared with adolescents from southern Europe (67.0 v. 78.1%, respectively; P<0.0001; Table S3, available online). These observations suggest that other determinants, especially school environment or dietary habits of adolescents, may affect the relationship between Par-Educ-Lev and adolescents’ diet quality.

The present study has a number of strengths, including the large sample size and the use of a common methodology and standardised procedures across all the study centres. The tools used to collect data on diet quality, Par-Educ-Lev and Par-Occ-Lev have been tested and validated in European populations(20,30). In contrast, the locations of the study centres (i.e. large cities) are not ideal representatives of north v. south lifestyle differences and thus the present results will have to be confirmed in different datasets. Furthermore, public health programmes and government initiatives aiming at promoting healthy dietary habits (Table S1, available online) are essentially focused at the country level. Therefore, it is difficult to take into account these issues in our analyses. Lastly, the cross-sectional design of the HELENA study prevents inferring causal relationships.

In conclusion, we found that Par-Educ-Lev had an impact on the diet quality of European adolescents. However, the relationship between these factors differed when comparing northern Europe with southern Europe. This finding has implications for educational and public health policies. The presence of education-related differences suggests that there is a need for appropriate, locally delivered nutritional education programmes(54), whereas welfare policies could be applied across the country as a whole(42). Furthermore, programmes for adolescents should be adapted as a function of Par-Educ-Lev and adolescents’ geographical location(58). Further research should assess the impact of public health programmes and state initiatives promoting healthy dietary habits in adolescents and in other populations.

Supplementary material

To view supplementary material for this article, please visit http://dx.doi.org/10.1017/S0007114513003796

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None of the authors has any conflicts of interest to declare.

References


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