

Exploring overweight, obesity and their behavioural correlates among children and adolescents: results from the Health-promotion through Obesity Prevention across Europe project

Johannes Brug^{1,*}, Nanna Lien², Knut-Inge Klepp² and Frank J van Lenthe³

¹The EMGO Institute for Health and Care Research, VU University Medical Center, Van der Boechorststraat 7, 1081 BT Amsterdam, The Netherlands: ²Department of Nutrition, Faculty of Medicine, University of Oslo, Blindern, Oslo, Norway: ³Department of Public Health, Erasmus University Medical Center, Rotterdam, The Netherlands

Submitted February 2009; Accepted May 2010

Abstract

Objectives: The Health-promotion through Obesity Prevention across Europe (HOPE) project aims to bring the European scientific knowledge on overweight, obesity and their determinants together and use the expertise of researchers across Europe to contribute to tackling the obesity epidemic.

Design/subjects/results: This special issue of *Public Health Nutrition* presents important results from one of the work packages of the HOPE project that aims at gaining and integrating knowledge on the determinants of nutrition, physical activity and obesity among schoolchildren and adolescents (aged 10–18 years) in different European regions. It includes contributions from Northern Europe (Norway), Central and Eastern Europe (Germany, Poland and the Czech Republic), Southern Europe (Greece) and Western Europe (Belgium and The Netherlands), as well as an overview of the availability of good-quality data on prevalence rates and trends in overweight (including obesity) among adolescents in European Union (EU) countries. The studies that are included report prevalence differences, data on relevant nutrition and physical activity behaviours, as well as potential physical and environmental behavioural determinants.

Conclusion: These papers provide further evidence on differences in obesity and overweight prevalence among different EU regions and countries, and contribute to the further exploration of risk factors that may or should be addressed in obesity prevention efforts for school-aged children and adolescents in EU countries.

Keywords
Obesity prevention
Adolescents
Overview

The background and aims of the Health-promotion through Obesity Prevention across Europe project

The prevalence of overweight and obesity in Europe has been steadily increasing, with rates doubling during recent decades in several countries. An increasing number of countries in the European Union (EU) have obesity levels exceeding 20% in the adult population, and more than 50% of the total European adult population is regarded as overweight. Up to 20% of children in several European countries are overweight^(1,2). Weight gain and subsequent overweight are a result of an imbalance between food intake and physical activity. However, insight into the more specific risk behaviours, sometimes referred to as 'obesogenic behaviours', and the underlying determinants of these obesogenic behaviours across Europe is limited. Subsequently, information about effective

obesity prevention interventions and policies is scattered. Systematic attempts are ongoing and necessary to increase knowledge of these determinants and interventions and to translate this knowledge into effective intervention strategies and policy measures. These attempts should take into account the great need for obesity prevention among the lower socio-economic groups.

The Health-promotion through Obesity Prevention across Europe (HOPE) project, funded by the European Commission's Sixth Framework Programme, is one such attempt that aims at supporting and advancing the development and implementation of systematic, evidence-based European national and regional policies effective for the prevention of obesity and its negative consequences on health and health inequalities. This is done by means of providing information and inventories of obesogenic nutrition and physical activity behaviours, important environmental correlates and predictors of these behaviours and

*Corresponding author: Email j.brug@vumc.nl

effective intervention approaches across Europe. HOPE also aims to assess the potential impact of interventions and policies directed at key determinants of obesity. Furthermore, the information reviewed and added will be used to develop evidence-based scenarios for overweight, obesity and its health consequences. These scenarios will be developed through epidemiological modelling. Different scenarios will be presented and based on existing trends and large-scale implementation of evidence-based prevention interventions and policies that may curb the obesity epidemic. In order to achieve these aims, epidemiologists and other health scientists, behavioural scientists and policy experts from all European regions have joined forces to endorse the HOPE agenda. The tasks are organized within work packages, which are described in more detail on the HOPE project website, www.hopeproject.eu, along with other information on the HOPE project.

We believe that HOPE has three distinct important characteristics that go a few steps beyond most other integrated research projects:

1. The Network of Networks that encompasses a wide range of European initiatives from all EU regions. The HOPE website, its frequent 'obesity in the news' service and the Network of Network meetings organized by the HOPE consortium linked to the European Congress on Obesity do bring important stakeholders together.
2. The focus on environmental determinants of relevant nutrition and physical activity behaviours. HOPE does not restrict its focus to the identification of the most proximal behavioural determinants of the risks of obesity. The focus of the HOPE project is on the more 'upstream' determinants of obesity risk and obesogenic behaviours, i.e. the physical, social and socio-economic obesogenic environments. For this purpose, HOPE project has adopted the Analysis Grid for Environments Linked to Obesity to classify and study possible environmental determinants of obesity^(3,4).
3. Information gathered within the project will be used to build evidence-based scenarios for the EU future regarding obesity prevalence and associated ill health.

This special issue

The present special issue reports on some of the results of work package 4 of the HOPE project, entitled 'Obesity Prevention among Children and Adolescents'. This work package aims to describe differences in prevalence and trends in overweight and obesity, and to explore specific behavioural patterns of obesogenic nutrition and physical activity patterns in childhood and early adolescence. Furthermore, it explores environmental determinants of obesity and obesogenic behaviours in adolescents

across Europe. The overall aim of this work package is to integrate this knowledge and to identify entry points for effective policies and interventions to prevent obesity at this early stage of life. School age and adolescence are a period of grave importance for obesity prevention, since it is associated with greater behavioural independence, changes in nutrition and physical activity behaviours and with increases in overweight and obesity prevalence. Furthermore, the prevalence of overweight and obesity among adolescents has increased over the past decades. Next to the secondary analyses presented in this special issue, the HOPE project will also systematically review the literature on school-based behavioural nutrition and physical activity interventions^(5,6) and their associations with obesity prevention. These data will be used as input for the HOPE epidemiological model to describe future scenarios for adolescents' overweight, obesity and their health consequences.

This special issue includes nine analyses of empirical studies based on data from Northern Europe (Norway), Central and Eastern Europe (Germany, Poland and the Czech Republic), Southern Europe (Greece) and Western Europe (Belgium and The Netherlands). The studies that are included are examples of analyses of existing data sets available across Europe that enable reporting of prevalence differences, data on relevant nutrition and physical activity behaviours, as well as potential physical and environmental behavioural determinants for regions of Europe for which such research is not readily available. The papers are mostly explorative, since cross-sectional and longitudinal observational data are presented. Furthermore, although in four of the six papers objectively measured anthropometrics are reported, most of the studies described in this special issue also use self-reports and not always formally validated measurement instruments for the assessment of behaviours and potential determinants. Furthermore, two studies were not able to use multilevel analytical methods where this may have been appropriate. In addition, the evidence base for the association of some of the behaviours addressed in this special issue with overweight and obesity is not very strong, such as fruit and vegetable intake and sports participation, but all behaviours are considered as part of a healthy lifestyle, which may contribute to the prevention of unnecessary weight gain.

The review on availability of good-quality data to describe prevalence and trend in overweight (including obesity) among adolescents from the EU countries by Lien *et al.*⁽⁷⁾ confirms the geographical variation and increase in prevalence of overweight among adolescents in the EU countries over the past few decades. However, there is still large heterogeneity in the quality and comparability of the data available for comparing prevalence and trends of overweight among adolescents in Europe.

Three studies from Eastern and Southern Europe presented new prevalence data based on measured weight and height and investigated their association with

various types of correlates cross-sectionally. The paper by Jodkowska *et al.*⁽⁸⁾ presents data on overweight and obesity among 13–15-year-olds from different regions of Poland. The study shows that the overweight prevalence in this age group was 12.5%, and was similar for boys and girls. Furthermore, it provides evidence for regional differences across Poland, but no urban/rural differences in prevalence of overweight were found. Moschonis *et al.*⁽⁹⁾ present preliminary data from the Grow Healthy Study with a special focus on social, economic and demographic correlates of overweight in their urban sample of 10–12-year-olds from Athens, Greece. They found 29.6% overweight and 11.1% obesity in this representative sample. Low family income was associated with higher odds of overweight, indicating the importance of socio-economic position among the young. De Gouw *et al.*⁽¹⁰⁾ used data from a nationwide survey among 10–18-year-olds conducted in the Czech Republic. Overweight prevalence rates varied from 6.1% to 16.7% between 18-year-old girls and 12-year-old boys, with marked age and sex differences in prevalence rates. The authors further present evidence that physical activity and specific eating habits, such as skipping meals and being on a diet, were associated with higher odds of being overweight.

The following three papers explored behavioural patterns and their relationship with weight development longitudinally in early adolescence (age: 10–15 years). Landsberg *et al.*⁽¹¹⁾ explore the association of lifestyle clusters at 14 years of age with development of overweight and obesity from 10 to 14 years of age based on data from the Kiel Obesity Prevention Study. They found that healthy lifestyle behaviours do not seem to cluster in the present study population, but that an active lifestyle is associated with reduced incidence of obesity. Using a different technique, van der Sluis *et al.*⁽¹²⁾ also studied patterning of different potentially obesogenic behaviours, and how such combinations of risk behaviours are associated with overweight and obesity. Data from the Norwegian Fruit and Vegetable Make the Marks project were used for these longitudinal analyses from 11 to 15 years of age. The results indicate that a combination of engagement in frequent snacking, soda intake and sedentary behaviour was associated with overweight and obesity. Finally, Haerens *et al.*⁽¹³⁾ used data from the Longitudinal Eating and Activity (LEA) study conducted in Flanders, Belgium, to study the association between physical activity, dietary habits and BMI from 10 to 13 years of age. Their longitudinal analyses indicate that decreases in fruit intake, sport participation and hours of physical education over time were associated with larger weight gains.

The last three papers do not have anthropometric measures as an outcome, but focus on exploring potential determinants of energy balance-related behaviours. Vereecken *et al.*⁽¹⁴⁾ also report on data from the LEA study. The study consisted of a school-based baseline survey among 10-year-old schoolchildren and matching parental

reports and four follow-up measurements in consecutive years. In this paper, the home food environment as a presumed important physical and social environmental influence on children's dietary behaviour is explored. The data show that parents' behaviour appears to be an important predictor of the children's fruit and vegetable intake at follow-up. Home availability of snack foods was negatively associated with fruit and vegetable intake, and parents' permissiveness at baseline predicted snack food consumption at follow-up. Wind *et al.*⁽¹⁵⁾ used data from 11-year-old children from nine European countries collected within the Pro Children Study to explore potential environmental and personal determinants of children's fruit intake. It has been argued that obesogenic environments may directly or indirectly influence nutrition and physical activity behaviours⁽¹⁶⁾. The indirect route presumes that children observe their environments and that obesogenic environments may, for example, negatively influence the children's personal attitudes and confidence (self-efficacy) regarding healthful eating and physical activity. Wind *et al.*⁽¹⁵⁾ explored this mediating pathway and found that the association between school availability of fruit (i.e. a physical environmental factor) and fruit intake was significantly mediated by fruit attitudes and liking. However, no evidence for complete mediation was found, suggesting that a more direct influence of environment on eating behaviour may also occur. Van de Horst *et al.*⁽¹⁷⁾ further explored these mediating pathways between environment and behaviour with a focus on adolescents' sport participation. Data from the Environmental Determinants of Obesity in Rotterdam Schoolchildren study⁽¹⁸⁾ were analysed, based on a school-based survey among 12–15-year-old students from secondary schools in Rotterdam, the Netherlands. The study indicates that availability of sports equipment at home and parental support were significantly associated with adolescents' sport participation, and that attitudes and intentions towards sport participation partly mediated the associations.

In addition to these nine papers, two other papers published in other journals resulted from the writing workshop organized to facilitate the analyses and writing of this special issue. Based on self-reported data from the cross-sectional Health Behaviour in School-aged Children study, Haug *et al.*⁽¹⁹⁾ described the prevalence of overweight and obesity, as well as dietary behaviours, physical activity and sedentary behaviour among the 11-, 13- and 15-year-olds in forty-one countries. In addition to variation in the prevalence of overweight and obesity by country and gender, they found that overweight was consistently negatively associated with eating breakfast daily and being moderate to vigorously physically active for 1 h in ≥ 5 d/week. Lastly, Kleiser *et al.*⁽²⁰⁾ found that parental overweight and low socio-economic status showed the strongest associations with obesity in 3–17-year-olds in the national representative German Health Interview and Examination Survey for Children and Adolescents (KiGGS).

These papers provide further evidence on differences in obesity and overweight prevalence among different EU regions and countries, and contribute to the further exploration of the risk factors that may or should be addressed in obesity prevention efforts for school-aged children and adolescents in EU countries. Combined with the systematic reviews of the literature within the HOPE project, these studies will be used to develop evidence-informed policy recommendations for obesity prevention among children and adolescents.

Acknowledgements

The present paper is part of a project being carried out with financial support from the Commission of the European Communities, SP5A-CT-2006-044128, 'Health-promotion through Obesity Prevention across Europe (HOPE)' – an integrated analysis to support European health policy'. The study does not necessarily reflect the Commission's views and in no way anticipates the Commission's future policy in this area. None of the authors have any conflict of interest to declare. J.B. and F.J.v.L. planned and coordinated the project; N.L. and K-I.K. led the work package supporting this special issue. J.B. drafted the manuscript and received input from all co-authors.

References

- Jackson-Leach R & Lobstein T (2006) Burden of paediatric disease in Europe: 1. The increase in prevalence is itself increasing. *Int J Pediatr Obes* **1**, 26–32.
- Lobstein T & Jackson-Leach R (2006) Burden of paediatric disease in Europe: 2. Numbers of children with indicators of obesity-related disease. *Int J Pediatr Obes* **1**, 33–41.
- Swinburn B, Egger G & Raza F (1999) Dissecting obesogenic environments: the development and application of a framework for identifying and prioritizing environmental interventions for obesity. *Prev Med* **29**, 563–570.
- Brug J, Kremers SPJ, Lenthe F *et al.* (2008) Environmental determinants of healthy eating: in need of theory and evidence. *Proc Nutr Soc* **67**, 307–316.
- Cauwenberghe E, Maes L, Spittaels H *et al.* (2010) Effectiveness of school based interventions in Europe to promote healthy nutrition in children and adolescents: systematic review of published and 'grey' literature. *Br J Nutr* **103**, 781–797.
- De Bourdeaudhuij I, Van Cauwenberghe E, Spittaels H *et al.* (2010) School-based interventions promoting both physical activity and healthy eating in Europe: a systematic review within the HOPE project. *Obes Rev* (Epublication ahead of print version).
- Lien N, Henriksen HB, Nymoer LL *et al.* (2010) Availability of data assessing the prevalence and trends of overweight and obesity among European adolescents. *Public Health Nutr* **13**, 1680–1687.
- Jodkowska M, Oblacinska A & Tabak I (2010) Overweight and obesity among adolescents in Poland: gender and regional differences. *Public Health Nutr* **13**, 1688–1692.
- Moschonis G, Tanagra S, Vandorou A *et al.* (2010) Social, economic and demographic correlates of overweight and obesity in primary-school children: preliminary data from the Healthy Growth Study. *Public Health Nutr* **13**, 1693–1700.
- de Gouw L, Klepp K-I, Vignerová J *et al.* (2010) Associations between diet and (in)activity behaviours with overweight and obesity among 10–18-year-old Czech Republic adolescents. *Public Health Nutr* **13**, 1701–1707.
- Landsberg B, Plachta-Danielzik S, Lange D *et al.* (2010) Clustering of lifestyle factors and association with overweight in adolescents of the Kiel Obesity Prevention Study (KOPS). *Public Health Nutr* **13**, 1708–1715.
- van der Sluis ME, Lien N, Twisk JWR *et al.* (2010) Longitudinal associations of energy balance-related behaviors and cross-sectional associations of clusters and BMI in Norwegian adolescents. *Public Health Nutr* **13**, 1716–1721.
- Haerens L, Vereecken C, Maes L *et al.* (2010) Relationship of physical activity and dietary habits with BMI in the transition from childhood to adolescence: a 4-year longitudinal study. *Public Health Nutr* **13**, 1722–1728.
- Vereecken C, Haerens L, de Bourdeaudhuij I *et al.* (2010) The relationship between children's home food environment and dietary patterns in childhood and adolescence. *Public Health Nutr* **13**, 1729–1735.
- Wind M, te Velde SJ, Brug J *et al.* (2010) Direct and indirect association between environmental factors and fruit intake, mediation by psychosocial factors: the Pro Children study. *Public Health Nutr* **13**, 1736–1745.
- Kremers SP, De Buijn GJ, Visscher TL *et al.* (2006) Environmental influences on energy balance-rated behaviors: a dual-process view. *Int J Behav Nutr Phys Act* **3**, 9.
- van der Horst K, Oenema A, te Velde SJ *et al.* (2010) Do individual cognitions mediate the association of socio-cultural and physical environmental factors with adolescent sports participation? *Public Health Nutr* **13**, 1746–1754.
- van der Horst K, Oenema A, van de Looij-Jansen PM *et al.* (2008) The ENDORSE study: research into environmental determinants of obesity related behaviors in Rotterdam schoolchildren. *BMC Public Health* **8**, 142.
- Haug E, Rasmussen M, Samdal O *et al.* (2009) Overweight in school-aged children and its relationship with demographic and lifestyle factors: results from the WHO-collaborative Health Behaviour in School-aged Children (HBSC) Study. *Int J Public Health* **54**, S1–S13.
- Kleiser C, Schaffrath Rosario A, Mensink GB *et al.* (2009) Potential determinants of obesity among children and adolescents in Germany: results from the cross-sectional KiGGS Study. *BMC Public Health* **9**, 46.