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ORIGINAL ARTICLE

Nutritional status and lifestyles of adolescents from a public health perspective. The HELENA Project—Healthy Lifestyle in Europe by Nutrition in Adolescence

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Abstract The HELENA Project—*Healthy Lifestyle in Europe by Nutrition in Adolescence*—is a European, collaborative research project financed by the EU Sixth Framework Programme in the area of nutrition-related adolescent health. The basic objective of the HELENA project is to obtain reliable and comparable data from a

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random sample of European adolescents (boys and girls aged 13–16 years) on a broad battery of relevant nutrition and health-related parameters: dietary intake, food choices and preferences, anthropometry, serum indicators of lipid metabolism and glucose metabolism, vitamin and mineral status, immunological markers, physical activity, fitness and genetic markers. The HELENA project is conceived as a scientific construction with four complementary sub-studies that are elaborated through 14 well-defined work packages. Sub-studies are focused, respectively, on "a cross-sectional description of lifestyles and indicators of nutritional status (HELENA-CSS)", "a lifestyle education intervention programme (HELENA-LSEI), "a metabolic study with cross-over design (HELENA-COMS)" and a "study on behaviour, food preferences and food development" (HELENA-BEFO). The project unites 20 research centres from 10 European countries. In addition, the consortium comprises five SMEs (small and medium-sized enterprises) that are actively involved in the research activities. The core of the HELENA project study material is an overall European cohort of 3,000 adolescents, equally recruited in ten cities from nine countries. Standardization of methods among partners is a key issue in the project and is obtained through the development of standard protocols, training sessions, validation sub-studies and pilot projects. Health-related problems have a tendency to evolve in cycles, with ever new problems emerging in ever new contexts that call for appropriate and tailored actions. The HELENA project is expected to offer essential elements for use in the overall machinery of required public health nutrition cycles. It is of the greatest importance for its results to prove useful that it can communicate with other initiatives on the level of science and society.

Keywords Public health · Nutrition · Lifestyle · Adolescents · Europe

Introduction

In many Western countries, children and adolescents increasingly seem to adopt lifestyles that negatively affect their nutritional and health status and therefore substantially increase their risk for premature development of chronic diseases like cardiovascular diseases, diabetes, metabolic syndrome, osteoporosis and certain cancers. Particularly poor dietary habits, sedentary leisure time spending and a lack of physical activity are lifestyles that—once installed—have a strong tendency to track from childhood into adulthood and then become extremely resistant to modification (Lobstein and Frelut 2003; Koplan et al. 2005).

Of major concern are the growing trends in excessive body fatness in youth, increasingly leading to unusually early appearance of morbidities like metabolic syndrome and disturbed glucose metabolism already at a young age (Moreno et al. 2000; Dietz 1998; Ogden et al. 2002; Weiss et al. 2003; Cook et al. 2003; Lobstein and Frelut 2003).

Obviously, if not reversed, the public health burden resulting from these evolutions in health behaviour are likely to be huge, both in terms of social consequences and on the health economic level.

International expert organisations active in the field of health and health-related lifestyles have repeatedly uttered the need for intensified and concerted actions on a supranational level for the purpose of safeguarding the health and high quality life expectancy of current and future generations (see e.g. the European Health Report 2005 by WHO Europe at http://www.euro.who.int/ehr2005/, the WHO Global Strategy on Diet, Physical Activity and Health at http://www.who.int/dietphysicalactivity/ or the International Association for the Study of Obesity at http://www.preventionalliance.net/).

It thereby becomes increasingly clear that efforts aimed at modifying health-related behaviour should be undertaken as early in life as possible.

This type of health crisis in the population at large is a multi-dimensional challenge for the science and practice of public health. Public health can be seen as an umbrella of activities and phenomena that are situated at the interface of science and society. Science offers the evidence on associations between risk determinants and health outcomes; society sets the priorities for using this evidence and translating it into action and structural changes, wherever necessary.

Public health is often depicted as a cycle chain of complementary actions, in which identification and extensive description of health problems needs to be followed by the development and implementation of health promotional strategies, which in turn need to be evaluated for impact and effectiveness. This overall public health model can operate successfully only if all ingredients are treated on an equal level of importance and communicate with each other in a logical, sequential and timely way.

The European collaborative project described in this paper—*HELENA: Healthy Lifestyle in Europe by Nutrition in Adolescence*—fits nicely into this overall picture of the public health cycle. It represents an ambitious European concerted effort to establish an instantaneous cross-sectional picture of the health of European adolescents, with particular emphasis on the nutritional status in this age group. It thereby makes use of the most up-to-date scientific methods for measuring relevant lifestyles and bio-clinical parameters with the purpose of integrating many aspects of nutrition and nutritional status. Never before has a European project covered such a broad portfolio of examinations in one collaborative effort in this age group.

By offering a European population level "diagnosis" of the nutritional status and lifestyles of a representative cohort of adolescents, it should enable scientists and policy makers to identify priorities and key issues for further action and research in view of the promotion of health in the current and future generations.

HELENA project objectives

The basic objective of the HELENA project is to obtain reliable and comparable data from a random sample of European adolescents (boys and girls aged 13–16 years) on a broad battery of nutrition and health-related parameters: dietary intake, food choices and preferences, anthropometry, serum indicators of lipid metabolism and glucose metabolism, vitamin and mineral status, immunological markers, physical activity, fitness and genetic markers.

This general objective is broken down into a number of more concrete study action plans as follows:

- To develop and harmonise innovative methods for the assessment of *lifestyle habits* of adolescents across Europe with special focus on *diet, nutrition and physical activity*
- To assess *dietary and physical activity patterns* as well as *nutritional status* among European adolescents
- To assess young people's *knowledge and attitudes* vis-à-vis nutrition and physical activity and to get a basic understanding of the determinants of their *food choices and preferences*
- To establish an overall *European cross-cultural picture on lifestyles* and health-related parameters in adolescents and to explore regional, social, cultural and genetic determinants of differences in this picture
- To quantify the prevalence in European adolescents of particular *high priority health problems*, especially eating disorders, dyslipidaemia, obesity and type 2 diabetes
- To develop a number of *healthy foods* and identify *marketing strategies* that can contribute to the adoption of a healthy diet among adolescents
- To develop a *Lifestyle Education Programme* and test its effectiveness for improving adolescents' health

Structure and management of the HELENA project

The HELENA project is operating according to the concept of a so-called specific targeted research project (STREP) within the broad context of the Sixth Framework Programme of the European Commission. The project unites 20 research centres from 10 European countries. In addition, the consortium comprises five small and medium-sized enterprises (SMEs) that are actively involved in the research activities. The Appendix gives a general overview of the HELENA participants and structure.

The project has established liaisons with several other ongoing European projects, especially with the IDEFICS (Identification and Prevention of Dietary- and Lifestyle-induced Health Effects in Children and Infants—http://www.ideficsstudy.eu) and the EUROFIR (European Food Information Resources Network of Excellence—http://www.eurofir.net) projects.

A website has been developed that serves both as a medium for internal communication among the partners involved and as a tool for dissemination of relevant material from the project to a scientific readership and to the interested public in general (see http://www.helenastudy.com).

The overall concept of the project is mainly cross-sectional and descriptive although some minor longitudinal dimensions are also included.

The HELENA project essentially covers four main studies:

1. The HELENA *cross-sectional study (CSS)* focuses on clinical assessment, diet, physical activity, body composition, blood analyses and genetics.
2. The HELENA study on *behaviour and development of new foods (BEFO)* deals with food choices and preferences in adolescents and explores the development of new foods that are perceived as attractive by this age group.
3. The HELENA *lifestyle education intervention study (LSEI)* aims at developing and testing a new approach of lifestyle intervention.
4. The HELENA *cross-over multi-centre study (COMS)* examines the metabolic, endocrine and behavioural effects of diets with varying degrees of glycaemic index.

Table 1 shows the participating centres and their involvement in the respective HELENA sub-studies.

Summary of methods

The central basis of this collaborative epidemiological effort is a cohort of European adolescents aged 13.00–16.99 years, who are intended to be representative for the respective regions they are selected from (see also Table 1). This age range has been chosen as the typical period of adolescence, during which the familial bonds that have been present during childhood are becoming less and less restricting and individual lifestyle habits are fully established. Each partner will recruit 300 adolescents on the basis of a random selection procedure via schools, yielding a total sample of 3,000 individuals.

Table 1 HELENA participating countries (cities) and SMEs in the different sub-studies

HELENA partner	HELENA-CSS	HELENA-LSEI	HELENA-COMS	HELENA-BEFO
Research institutes				
Athens (Greece)	X	X	X	
Birmingham (UK)	X	–	–	
Dortmund (Germany)	X	X	–	
Ghent (Belgium)	X	X	–	
Heraklion (Greece)	X	X	–	
Lille (France)	X	–	–	
Madrid (Spain)	–	–	X	
Naples (Italy)	–	–	X	
Pecs (Hungary)	X	–	X	
Rome (Italy)	X	–	–	
Stockholm (Sweden)	X	X	–	
Vienna (Austria)	X	X	–	
Zaragoza (Spain)	X	–	–	
Granada (Spain)	Responsible for standardization and evaluation of fitness tests			
Bonn (Germany)	Responsible for standardization of blood collection and dispatching			
Food technology institutes				
Asociación de Investigación de la Industria Agroalimentaria (Spain)				X
Campden & Chorleywood Food Research Association (UK)				X
SIK—Institutet foer livsmedel och bioteknik (Sweden)				X
Meurice Recherche & Developpement asbl (Belgium)				X
Campden & Chorleywood Food Development Institute (Hungary)				X
Industry partners—SMEs				
Productos aditivos SA (Spain)				X
Carnicas Serrano SL (Spain)				X
Cederroth International AB (Sweden)				X
Lantmännen (Sweden)				X

See the Appendix for more detailed information on the HELENA partners. The European Food Information Council (EUFIC) contributes to the dissemination of the HELENA project's achievements and activities

This sample size has been calculated as the necessary basis for establishing distributions of relevant study variables, mainly focusing on anthropometric outcomes of interest. The sampling of classes in the schools has been done centrally for all partners. Unless ineligible on the basis of one of the exclusion criteria, all students in a selected class are invited to take part in the study. Criteria for a priori exclusion ("ineligibles") are limited to those children who are not able to speak the local language or cases of severe medical constraint. For students refusing to participate, a so-called non-responder questionnaire has been developed in order to compare non-participants with participants on a number of socio-demographic characteristics.

A broad battery of measurements (details below) is implemented in the same way in all centres. For all measurements, standard operational protocols have been developed. All field workers from all centres have been involved in central training sessions and the whole machinery of measurements and tests and the necessary logistics were evaluated in a pilot setting in the spring of 2006. The pilot study gave satisfactory results for all study dimensions, including tests for intra- and inter-observer variability studies for all measurements.

All questionnaires and important material for tests have been translated into eight local languages of all partners involved. Correctness of translations has been evaluated on the basis of a procedure of independent external checking of back translations.

Data on hard copy from all centres are transferred to one central processing unit for scanning and storage in a central database.

Major research dimensions in the HELENA project

Dietary habits in adolescents

The importance of monitoring the diet in adolescents is obvious. Dietary habits have a tendency to change substantially during the transitional phase from primary school age into adolescence, due to increased individual freedom and independence from parents, increased access to food resources different from those available at home, increased social interactions and the sub-cultural importance of specific foods.

Europe has a very interesting heterogeneous palette of people and cultures, which is also reflected in large

differences in eating cultures and meal preparation traditions. However, major inadequacies in the food consumption patterns of adolescents have been identified over the past decades: low consumption of fruits and vegetables, frequent snacking, with snack foods generally of a high fat/high sugar content (Hoglund et al. 1998; Alexy et al. 2002; Lambert et al. 2004). Another common finding in adolescents is frequent skipping of meals, particularly breakfast (Hoglund et al. 1998).

On the whole, data on diet in adolescents are however mostly fragmentary in Europe. This was also one of the main conclusions of the ILSI-Europe workshop "Nutrition in Children and Adolescents in Europe: What is the Scientific Basis?", held in Rome, 14–16 May 2003. Existing data moreover suffer from lack of comparability mainly due to differences in methodology, differences in the use of food composition databases and differences in publication formats (Lambert et al. 2004).

For the purpose of monitoring dietary habits in youth, there is a need for attractive, easy-to-use and inexpensive tools that are methodologically sound, though sufficiently flexible for valid use in a cross-cultural comparative context (Rockett et al. 2003; Moreno et al. 2005). The European Fifth Framework Project on harmonisation of dietary assessment methods for monitoring purposes—European Food Consumption Survey Method (EFCOSUM)—has set a series of recommendations and recommends the use of the 24-h recall format as a standard method (Biro et al. 2002).

A self-administered computer program for a 24-h recall, called YANA-C, was recently developed and validated in Flemish adolescents (Vereecken et al. 2005). This innovative tool uses special techniques to support and enhance the respondent's memory and allows a very detailed description and quantification of foods and recipes to be obtained.

Within the HELENA-CSS group, all partners have contributed to upgrading this tool to a European level by completing the original food list with additional local dishes and by providing pictures and series of portion sizes of these dishes. In collaboration with the EUROFIR project, the calculation of nutrients will be based on the best available food composition tables in Europe.

With this tool, the HELENA project will for the first time in Europe provide standardised comparable data on the diet of European adolescents.

In addition, HELENA has both adapted (Diehl 1999a, b) and developed new questionnaires for the purpose of measuring nutritional knowledge and attitudes among European adolescents.

Nutritional status

The HELENA project examines the nutritional status of adolescents from a multi-dimensional perspective. Extensive efforts are undertaken to measure in a standardised way *body fatness*, *cardiovascular* risk factors, *micronutrient* status and *immunological* indicators of malnutrition.

As such, a broad battery of variables related to nutritional status will become available for the study of associations both with lifestyles and genetic markers (see below).

Excessive *body fatness*, overweight and obesity are considered to be major public health issues for the current and upcoming generations.

The widespread installation of a sophisticated high technology way of living—often summarised as the "obesogenic" environment—seems to be the intuitive and at the same time most plausible explanation for the gradually increasing difficulties human physiology faces in its subtle and still largely unravelled mechanisms to maintain a stable energy balance and body fatness.

Already at a very young age, children are affected by the pressure of such an environment and their behaviour and physiological machinery can therefore easily be imprinted and disrupted by all sorts of influences, leading to a very broad spectrum of observed behaviour at the level of drives to eat, food choices and a broad inter-individual variability in deliberate body movements.

At present, representative data are lacking on body fatness and obesity prevalence in European adolescents. Moreover, the existing reports on this issue suffer from a lack of comparability due to differences at the level of measurement methods and at the level of definitions for categorisation of body dimensions. Nevertheless, the available evidence strongly suggests a dramatic increase in the prevalence of overweight and obesity in European adolescents in the last decade, with noticeable gender and socio-economic status differences (Lobstein and Frelut 2003; Moreno et al. 2001; Lissau et al. 2004; Ogden et al. 2002; Fisberg et al. 2004; Lobstein et al. 2004; Pietrobelli and Steinbek 2004; Wärnberg et al. 2004).

In the HELENA project, circumstantial ways of standardised measuring of body fatness are being implemented. In all centres, combinations of height and weight measurement, skinfold measurements at different sites and bioelectrical impedance technology are being combined (Weststrate and Deurenberg 1989). In addition, some centres are making extra efforts for adiposity description by including BodPod and dual-energy X-ray absorptiometry (DXA) technology (Rodríguez et al. 2000). Skinfold thickness (mm) will be measured at the left side of the body to the nearest 0.1 mm with a skinfold caliper (Holtain, Crymych, UK, range 0–40 mm). The measurements will be taken at the following sites: "triceps", halfway between the acromion process and the olecranon process at the back side of the arm; "biceps", at the same level as the triceps skinfold, directly above the centre of the cubital fossa; "subscapular" about 20 mm below the tip of the scapula, at

an angle of 45° to the lateral side of the body; "suprailiac", about 20 mm above the iliac crest and 20 mm towards the medial line; "thigh" in the midline of the anterior aspect of the thigh, midway between the inguinal crease and the proximal border of the patella; and "calf", at the level of maximum calf circumference, on the medial aspect of the calf.

Circumferences will be measured with an unelastic tape, precision 0.1 cm, range 0–150 cm, with the subject in a standing position. The measurements will be taken at the following five sites: "arm circumference relaxed": the subjects stands relaxed with his/her side to the observer, the arm hanging freely at the side; the tape is passed around the arm at the level halfway between the acromion process and the olecranon process of the upper arm; "upper arm circumference flexed (biceps circumference)": the subject contracts the muscle biceps as much as possible, the tape is passed around the arm at the same point as with the arm relaxed, so that it touches the skin surrounding the maximum circumference, in the case that the maximum circumference does not coincide with the point halfway between the acromion process and the olecranon process, the measure is taken at the maximum circumference of the flexed muscle; "waist circumference": the tape is applied horizontally midway between the lowest rib margin and the iliac crest about the level of the umbilicus, at the end of gentle expiration; "hip circumference": at the point yielding the maximum circumference over the buttocks, with the tape held in a horizontal plane; "proximal thigh" is measured just below the gluteal fold and perpendicular to its long axis; the subject stands straight with the feet slightly apart and the body mass evenly distributed between both legs.

As is the case for many other health-related data in adolescents, systematic standardised data on serum indicators of *cardiovascular risk* and *micronutrient status* are generally lacking, despite their importance for monitoring purposes.

It is today generally agreed that atherosclerotic lesions start to appear already during childhood and adolescence and are considered silent and asymptomatic precursors of later potential development of premature forms of cardiovascular diseases.

Similar reasoning can be made for micronutrient status in adolescents. Amidst the unlimited availability of a variety of foods, micronutrient deficiencies have been reported for adolescents. Nutrients that deserve special attention in this context are iron, folate, calcium and vitamin D (McNulty et al. 1996; González-Gross et al. 2002; Bergström et al. 1995).

In HELENA, a very broad battery of serum markers of cardiovascular risk and micronutrient status will be measured. Table 2 shows a complete overview of all blood parameters that are considered core variables. Blood sampling is done in a subset of fasting adolescents, 100 in each centre. All blood analyses are done in central laboratories, subject to rigid protocols of quality assurance.

In a similar way, a number of *immunological markers* will be measured in a central laboratory (see also Table 2). Poor nutritional status has been shown to be associated with alterations in the immune response and even sub-clinical deficiencies can cause an impaired immune response. This phenomenon makes immune parameters interesting sensitive biomarkers of nutritional status (Marcos et al. 2003; Nova et al. 2002).

In HELENA, the impact of diet on immune status will be studied, adjusting for other relevant variables like genetic background, physical activity and body composition. Main key parameters for the immunological evaluation of nutritional balance will be included, i.e. indicators of cell-mediated, humoral and non-specific immunity.

Physical activity, fitness and leisure time spending

As is the case for diet, a systematic lack of comparable data on physical activity and physical fitness in adolescents hampers the understanding of the complex relationship between these characteristics and health outcomes. HELENA aims to contribute to this understanding by providing, for the first time, harmonised and standardised data from random samples of adolescents in ten European cities. It can be foreseen that the results of these tests and their associations with other health indicators may help to prioritise the modalities for monitoring physical activity and fitness in the future.

Physical activity is a multi-dimensional human behaviour. It is defined as any bodily movement produced by the skeletal muscles that result in energy expenditure (Caspersen et al. 1985). The activity can be expressed in terms of its intensity, duration, frequency and mode.

Because of its complex nature, physical activity is difficult to assess accurately and precisely under free-living conditions. Intensity, duration and frequency of physical activity can be measured using either subjective methods, such as questionnaires, or objective methods, such as motion sensors or heart rate monitors (Sjöström et al. 2004).

In the HELENA study, a questionnaire to measure physical activity in adolescents was developed based on the long self-report version of the International Physical Activity Questionnaire (IPAQ, see http://www.ipaq.ki.se). In addition, uniaxial accelerometers (MTI Actigraph) will be used in all adolescents.

Physical fitness is a set of attributes that people have or achieve that relates to the ability to perform physical activity. Health-related physical fitness involves cardiorespiratory fitness, muscle strength, speed-agility, coordination, flexibility and body composition.

Given the many aspects of health-related physical fitness no single method is available to quantify all dimensions.

Therefore many different tests have been developed for the different dimensions of fitness status. In HELENA, a combination of such tests are being used—based on the EUROFIT battery—to assess the broad perspective of physical fitness.

In addition to physical activity and fitness, leisure time spending is measured via a newly developed questionnaire. This questionnaire is exploring differences in the use of leisure in European adolescents and will be used also for studying associations with other lifestyle variables (like diet and physical activity) and with other health outcomes (e.g. body composition).

Genetic markers

Individual physiological responses to dietary and lifestyle influences vary substantially in the population and are related to different genetic backgrounds. Also from a public health perspective, a better understanding of gene-environment interactions in pathways of diet-related ill-health is important for the purpose of developing better targeted interventions.

The HELENA project will explore the importance of a number of single nucleotide polymorphisms (SNP) located in several genes. A total of 40 SNP previously identified as being associated with nutritionally related phenotypes involving genes of lipid metabolism, energy balance regulation and bone structure will be examined. Some candidate genes involved in energy metabolism regulation and food intake such PPARγ, UCP-1,2,3, β3-adrenergic receptor gene, LEPR, CART, MC4R as well as genes involved in lipid metabolism such those of apolipoprotein, lipoprotein lipase, CETP, LDL receptor, VLDL receptor will be analysed. Some polymorphisms will also be studied by PTE. Polymorphisms within these genes have shown some degree of interaction with nutritional habits and lifestyle.

Interactions between these SNPs as well as lifestyles and disease-promoting factors will be studied extensively.

Food preferences—development of new foods

A thorough understanding of how food preferences vary across European adolescents and how this affects their overall diet is a key issue for the development of strategies aimed at influencing dietary behaviour. Likewise, a basic insight into the mechanisms behind (un)successful communication on (un)healthy foods in this age group can make the difference in the balance between more and less effective intervention strategies.

Table 2 Blood parameters measured in the HELENA project in different laboratories

Bonn	Rome	Madrid	Lille	In situ
Insulin	Ferritin	Adhesion molecules	Genetic phenotypes	Peripheral blood counts
Vitamin A, E and ß-carotene (RBP)	AGP	Cytokines: IL-2/4/6/10, IFN-γ, TNF-α, TGF-β		
Vitamin C	CRP	Inflammatory proteins—CRP		
Vitamin D	Soluble transferring receptor (sTfR)	Lymphocyte subpopulations: CD2, 3, 4, 8, 16/56		
TEAC		Ceruloplasmin C3, C4		
Fatty acids		IgA, IgM, IgG, IgE		
Vitamin B_{12}				
Total homocysteine				
Serum and RBC				
Folate				
Holo-transcobalamin				
Vitamin B_6				
Adiponectin, leptin, cortisol				
Albumin				
Creatinine				
Glucose				
Uric acid				
Lipoprotein (a)				
ApoA, apoB				
Cholesterol, HDL, LDL, triacylglycerols				
GGT, GOT, GPT				

RBP retinol-binding protein, *AGP* α_1-acid glycoprotein, *IL* interleukin, *IFN* interferon, *TNF* tumour necrosis factor, *TGF* transforming growth factor, *CRP* C-reactive protein, *TEAC* trolox equivalent antioxidant capacity, *apo* apolipoprotein, *HDL* high-density lipoprotein, *LDL* low-density lipoprotein, *GGT* gamma-glutamyltransferase, *GOT* glutamic-oxaloacetic transaminase, *GPT* glutamic-pyruvic transaminase

The HELENA project will combine techniques of qualitative research and quantitative research to examine these issues. In a first phase, qualitative research is applied to identify key items in the context of food preferences and their determinants in adolescents by means of focus group research in a subgroup of the HELENA participating centres. In a next phase, these key items are compiled into a questionnaire for use in a quantitative setting in all HELENA participants.

The obtained information on preferences will also be used to guide the development of healthy new food products. In particular, special attention will be given to sensory aspects of the newly developed food products.

Although still under debate, the glycaemic index seems to be a useful new nutritional concept, providing additional insights into the relationship between foods and chronic disease (Jimenez-Cruz et al. 2005). Observational studies suggest that diets with a high glycaemic load are independently associated with increased risk of type 2 diabetes and cardiovascular diseases (Brand-Miller 2003). Some evidence suggests that a low glycaemic index diet may also protect against obesity, colon cancer and breast cancer.

In the HELENA project, short- and long-term effects of snacks with different glycaemic index on metabolic, endocrine and behavioural changes will be tested in a metabolic study setting with repeated blood samplings and satiety tests as a function of diets with different glycaemic indices. These metabolic studies will be done in four HELENA centres in small groups of slightly overweight adolescents using a cross-over design.

A tailored lifestyle intervention

It is now generally agreed that health promotion and intervention efforts should be based on an ecological model. In the ecological approach, the increase of the prevalence of non-communicable diseases and their risk factors is regarded as a normal response to an abnormal environment, rather than vice versa (Egger and Swinburn 1997). An ecological model assumes that health and well-being are affected by dynamic interactions between biology (metabolic and genetic factors), behaviour and the environment.

Within this general framework, different options can be taken to address lifestyles through group-level or individual-level interventions. Most studies on nutritional status and physical activity in European adolescents conclude that lifestyle interventions on both these axes are strongly needed (Contento et al. 1995; De Bourdeaudhuij et al. 2002).

Adolescence is a very unique period in life with a number of very specific contextual sociological phenomena. In the context of dietary lifestyle, adolescents need a food culture based on “foods to eat” rather than “foods to avoid” (Nowak 1998).

In HELENA, a new approach of individualised lifestyle intervention will be further explored. Computer-tailored nutrition and physical activity education is an innovative, promising and cost-effective tool to motivate people to make healthy dietary and physical activity changes (Bakker et al. 2003). It provides respondents with individualised feedback about their behaviour in such a way that an appropriate individual response is facilitated and consolidated.

The available evidence indicates that computer-tailored education is more effective in motivating people to make changes than general nutritional and physical activity education (Brug et al. 2003). However, further targeted research in this context is needed.

In the HELENA project, a new computerised tailored lifestyle intervention programme will be developed and evaluated in over 2,000 adolescents in six HELENA centres.

Discussion

Public health seems to be bound to evolve in cycles of ever new health challenges emerging, which need to be identified and understood in order to shape the actions that are capable of tackling them.

Modern society produces new health-related problems, both on the individual level and on the level of the environment. Understanding these problems and their underlying mechanisms is crucial for the purpose of developing the best strategies for achieving behavioural changes in lifestyles and for creating an environment that facilitates the adoption of healthy lifestyles. Such a challenge requires a multi-disciplinary approach and collaboration at different levels of society.

A first and decisive step in such a public health process is establishing a reliable picture of the problem in a multi-dimensional way. In other words, quantify how lifestyles and other health determinants are distributed in a given population and how they interact with each other. This is the core idea of what the HELENA project aims to do for European adolescents.

The HELENA project is only one relatively small—though essential—element in the overall machinery of required public health nutrition cycles. It is of the greatest importance for its results to prove useful that other necessary dimensions are being elaborated as well within the overall finality of optimisation and promotion of the health of the current and future generations. May it contribute to a reversal of the current trends towards ill-health.

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Appendix

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