Integrated community-based approaches to prevent childhood overweight and obesity

From appraising complex programmes to tackling health inequalities

Krystallia Mantziki

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Integrated community-based approaches to prevent childhood overweight and obesity

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Krystallia Mantziki

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promotor: prof.dr.ir. J.C. Seidell
copromotor: dr. C.M. Renders

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It turns out in the new biology that evolution is based on cooperation. Until we understand that, we keep competing with each other, struggling and destroying the planet without recognizing that our survival is in cooperation and that our continued competition is the death knell of human civilization.

Bruce Lipton, *The Wisdom of Your Cells: How Your Beliefs Control Your Biology*.

Chapter 1

General introduction

NON-COMMUNICABLE DISEASES (NCDs) AND ASSOCIATED RISK FACTORS IN EUROPE

Non-communicable diseases (NCDs) are the leading causes of death worldwide. The highest NCD burden is observed in the European region [1]. In this region, the four main NCDs – namely cardiovascular diseases, cancers, respiratory diseases and diabetes – account for 77% of the disease burden and for about 86% of premature mortality [1]. Risk factors commonly associated with NCDs are related to lifestyle behaviours such as diet, physical activity, excessive alcohol consumption and smoking [2]. High blood pressure, high blood cholesterol, overweight and obesity are the most prevalent NCD risk factors and are particularly stimulated by physical inactivity and unhealthy diet [1, 3, 4]. Unhealthy dietary patterns include high consumption of saturated fat, trans fat, sugar and salt and low consumption of fruit and vegetables. As healthier lifestyles have been associated with reduced risk of NCDs and a lower NCD burden [5], it is evident that the main NCD risk factors and the respective burden are largely preventable [1, 6]. However, prevention is very difficult, as NCD risk factors and related unhealthy lifestyles are highly influenced by upstream, social determinants related to distribution of power, money and resources. Consequently, this results in health inequalities related to the conditions in which people are born, grow, live, work and age [7, 8]. Firm recommendations, aimed at tackling the social determinants of health in order to tackle NCDs, have stressed the importance of prevention efforts that lead to a reduction of social inequalities in health. Such recommendations are increasingly included in national health plans and/or development strategies of the WHO Member States [1].

OBESITY TRENDS AND DEVELOPMENT

Obesity trends

Obesity is one of the major preventable causes of NCDs. Overweight and obesity are therefore considered to be major public health concerns in the European region [9]. Obesity has been characterised as an epidemic disease over the last two decades with dramatic increases being reported since the 1970s [10]. According to the latest estimates, overweight and obesity have affected approximately 15-25% of the adult population [1] and 25-31% of the child population [11] in the WHO European Region. The current obesity trend in children is 10 times higher compared to estimates in the 1970s and it has been steadily increasing every year since then [1]. Therefore, public health entities have called for immediate action to tackle the public health problem, especially in the child population [12]. Childhood overweight and obesity are not only important risk factors for developing numerous serious metabolic diseases as well as psychosocial disorders during childhood [13], but obesity and its consequences are very likely to continue into adulthood [8, 10, 13-15]. Moreover, adulthood obesity is strongly associated with comorbidities responsible for developing cardiovascular diseases and diabetes [16].

Obesity development

In simple terms, overweight and obesity are the results of prolonged positive imbalance of energy intake and energy expenditure. Energy intake and expenditure are both determined by a number of factors (which interact with each other) stimulated by biological, environmental

and behavioural processes [10]. It is generally accepted that the current rapid increases in overweight and obesity rates are largely attributed to environmental and behavioural changes and not to genetic changes, considering that biological changes require much more time to occur [10, 14, 17]. Environmental determinants affect dietary and physical activity behaviour. This often leads to unhealthy choices and, thus, energy regulation may be disturbed in the long term [10, 14].

CHILDHOOD OBESITY: ENVIRONMENTAL, INDIVIDUAL AND SOCIO-ECONOMIC DETERMINANTS

Environmental and individual determinants: interaction and influence on lifestyle behaviours

Energy balance in children is influenced by several behaviours. Such behaviours – also referred to as energy-balance related behaviours – are low consumption of fruit and vegetables, unhealthy snacking and diet (high in sugar and/or fat content), physical inactivity, high screen time and short sleep duration [18-20]. Globalisation and urbanisation have allowed the perpetuation of such unhealthy lifestyle behaviours through the creation of obesogenic environments. Obesogenic environments are known to be major drivers of the obesity epidemic [6, 10, 12, 21]. Children are exposed to a vast variety of nutrient-poor foods that are ultra-processed, high in fat and sugar, easily accessible, and in low prices [12, 22]. Furthermore, the urban settings provide limited opportunities for physical activity and/or play, resulting in increased indoor activities, which are usually screen-based and sedentary [12, 22].

Aside from these macro-environmental influences, on the micro level, the family environment is very important in influencing the child's energy-balance related behaviours as well. This is justified by the fact that the children depend to a large extent on their parents' choices and the home environment their parents have created. Several studies have demonstrated that inadequate parenting practices and health-related behaviours and/or insufficient rules were associated to children's weight status and related behaviours [18, 22-26]. Therefore, parenting skills, styles and practices are crucial targets for shaping and improving lifestyle behaviours in children.

Parental decisions that impact health-related behaviours are influenced by behavioural intention. And behavioural intention is determined by the individual's attitudes, subjective norms and self-efficacy [27]. These individual determinants are shaped in a broad range of social and experiential contexts placed in the physical, political, economic and sociocultural environments [28]. In turn, these environments affect one's behavioural intention and, consequently, their health-related decisions [29]. Moreover, health-related decisions are sensitive to changes, which either arise from the relentless alterations occurring within the various social contexts or are related to the individual's perspectives (e.g. health status, disposable income) [29]. The socio-economic literature has used several behavioural models to explain health-related decisions, highlighting *utility maximisation*[1] among other concepts. According to these models, "individuals make decisions about

1: Economics concept that, when making a purchase decision, a consumer attempts to get the greatest value possible from expenditure of least amount of money. His or her objective is to maximise the total value derived from the available money. [http://www.businessdictionary.com/definition/utility-maximization.html]

diet, physical activity, time allocation and weight to maximise their utility subject to constraints, such as time, resources, genetic pre-disposition and biological factors" [22]. Typical examples of utility maximisation decisions are the decreased meal preparation time by working mothers and the purchase of cheaper food products, especially in low-income households [30]. Thus, looking beyond the health-related decisions of parents and children and, instead, considering a more comprehensive approach that tackles "the causes of the causes" is of great importance for the prevention of obesity and consequently NCDs [31].

Socio-economic determinants

It is currently well-documented that unhealthy behaviours, as well as overweight and obesity rates, are more prevalent in populations with relatively low socio-economic status, as defined by occupational class, educational level and/or income [32-37]. The phenomenon is apparent between and within countries in Europe [33]. Socio-economic inequalities concerning obesity may develop in early childhood and last throughout the later stages of life [8, 15, 16]. Upstream causes that lead to health inequalities result from the unequal distribution of social determinants of health, namely access to health care, living and working conditions, macro-policies, income and assets, and their consequences [30]. Based on these facts, Dove and Lambert (2016) claim that "failure to recognize the complex and iterative nature of these influencers, at the individual, community, and policy levels, with respect to local context, will undermine efforts to prevent and manage the burden of disease" [29].

OBESITY PREVENTION: FROM A SOCIOECOLOGICAL APPROACH TO THE EPODE MODEL

To date, a large number of efforts – policies, programmes, interventions – have been implemented to reverse the increasing obesity trends in all ages. So far, some of these have resulted in a levelling off in some cities and/or countries, and, at the same time, an increased social gap in prevalence of obesity [38]. Roberto et *al*. (2015) attributed the limited success to: i) a lack of policy actions or of actual implementation of existing policies (excluding the education-related programmes); ii) the preponderance of behaviour change initiatives over environmental ones; iii) failure to adequately engage the food industry in promoting healthier lifestyles [38]. Therefore, in an emerging consensus based on research and practice, the need of a multisectoral approach to a) address individual, environmental and policy levels *simultaneously* and b) aim at lifestyle, environmental and socio-economic determinants is recognized, in order to sustainably deal with the obesity epidemic. This so-called *socio-ecological approach* implies that, in the context of childhood obesity prevention, interventions should target various settings that influence the children's diet, physical activity and weight (e.g. health care, schools, home and family environment, community environment) as well as the related upstream factors mentioned in the previous section of this thesis. As very clearly stated in the WHO report titled *Ending childhood obesity* – and supported by notable scientific studies – "this requires government commitment and leadership, long-term investment and engagement of the whole of society to protect the rights of children to good health and well-being" [12, 38, 39].

The EPODE approach

Based on the socio-ecological approach, integrated community-based approaches (ICBAs) have been developed. They are composed of a cluster of strategies, which are implemented in a community setting and have been designed for individual behavioural change towards a healthier lifestyle by means of involving and influencing various institutions, organisations and local stakeholders [40, 41]. An integrated community-based approach that showed promising effects in reducing childhood obesity prevalence in France – the Fleurbaix-Laventie study – gave rise to the EPODE (which stands for 'Ensemble Prévenons l'Obésité Des Enfants' and translates to 'Together let's prevent childhood obesity') model, established in 2008 [43]. EPODE is a capacity-building approach aimed at decreasing the prevalence of childhood obesity through involving and influencing community actors, local environments, childhood settings and family norms towards facilitating healthier lifestyles for children. To achieve this, the EPODE approach acts on four critical areas (also mentioned as the four EPODE pillars): (i) political commitment, (ii) social marketing techniques to trigger behavioural change, (iii) public and private partnerships and (iv) scientific monitoring, evaluation and dissemination of the programme [41, 43].

Van Koperen et *al*. (2011; 2013) constructed the EPODE programme theory, in which the EPODE pillars are integrated in a logic model [40, 44]. Consequently, four levels of action are distinguished, as illustrated in figure 1. Starting from the left side, the first level is the *central organisation*, which ensures the overall management of the programme. The second level is the *local organisation*, supported by

the central organisation in order to establish political commitment, public and private partnerships and social marketing principles. The second level provides input for the next level, the *community*. At this level, activities concerning advocacy, community capacity-building and nutritional and physical activity are taking place. As a result, at the *child* level, children's behavioural change is anticipated to be attained and healthy weight to be established [44].

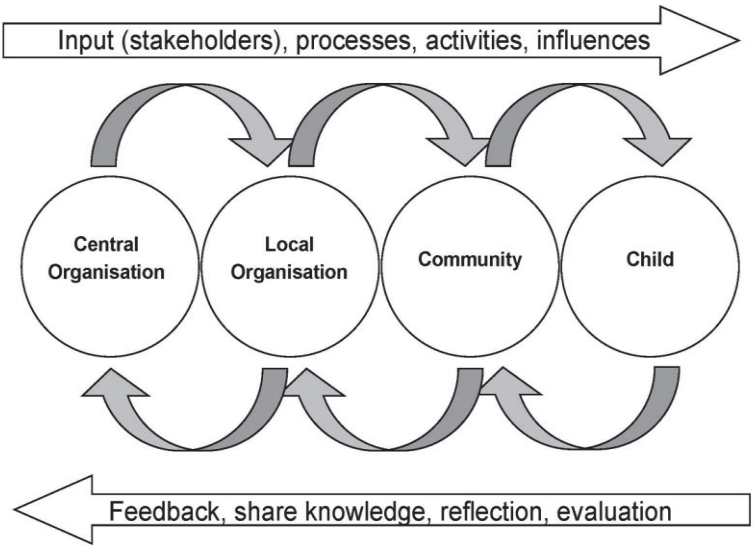

Figure 1. Levels of the EPODE approach [44].

The EPODE is currently implemented in 43 EPODE-like community-based programmes worldwide, 18 of which are placed in Europe [45]. The strategies are always adjusted to meet each country's particularities as well as local specificities and dynamics.

From EPODE to European projects

The long term follow-up of the Fleurbaix-Laventie study (1992-2007) showed a 2.6% decrease in obesity prevalence in 12-year-olds, which was more apparent in children of middle and low socio-economic status [42]. Based on these promising results, two European projects emerged, co-funded by the European Commission. Firstly, in 2012, the 'EPODE for the promotion of Health Equity' (EPHE) project was launched, to analyse the added value of the implementation of the EPODE approach for the reduction of socio-economic inequalities in health related behaviours of children aged 6 to 12 and their families, living in seven different European communities. Secondly, in 2014, the Obesity Prevention through European Network (OPEN) project was launched, aiming at improving the methods of community-wide approaches through experience sharing and capacity-building training based on the EPODE approach. This thesis is based on both projects (EPHE and OPEN).

AIM OF THE THESIS

For the purposes of this thesis, the EPODE approach and its programme theory are considered in a three-level analysis. Firstly, the programme level is assessed by systematic appraisal of ICBAs for preventing childhood obesity across the European region. Secondly, the effectiveness of the EPODE approach in tackling socio-economic inequalities in childhood lifestyle patterns, as shaped by behaviours and related determinants, is assessed on the population level. Thirdly, due to the scarcity of evidence regarding the influence of the family environment on the water intake of children, the association between

parenting practices towards sugary beverages and the child's water consumption is illustrated, on the individuals' level. Consequently, the **research questions** of this thesis are:

a. Is it possible to identify strengths and weaknesses of integrated community-based approaches targeting childhood obesity prevention by means of their systematic appraisal through the OPEN tool and the Good Practice Appraisal Tool (chapter 2)?

b. Is the EPODE approach able to improve and sustain improvements in energy-balance related behaviours, particularly in the groups of relatively low socio-economic status (chapters 3, 4 and 5)?

c. Is there an association between parenting practices regarding the consumption of sugary beverages and children's water consumption (chapter 6)?

OUTLINE OF THE THESIS

In the **second chapter** of this thesis we present strengths and weaknesses of the ICBAs, which were analysed in a systematic way through the use of two different appraisal tools, in addition to the strengths and weaknesses of the two appraisal tools we used initially. In **chapter 3**, we describe the design and methodology of the effect evaluation of the EPHE project, in order to assess the outcomes of the selected EPHE community-based programmes. Further, the baseline differences in energy-balance related behaviours and associated family-environmental determinants, as deduced through comparison between high and low status socio-economic groups in cities across seven

European countries, are presented in **chapter 4**. Consequently, changes in these behaviours and determinants within the high as well as the low education groups, as deduced through comparison between baseline (T_0) and measurements after interventions of a nine-month period (T_1), are described in **chapter 5**. In the same chapter, the sustainability of the identified changes is assessed by comparing the intermediate (T_1) to the final measurements (T_2) obtained one year later. Finally, **chapter 6** explores the association between parenting practices towards beverages and the child's water consumption.

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Chapter 2

Systematic appraisal of integrated community-based approaches to prevent childhood obesity. Do we have the tools?

Mantziki K, Renders CM, Westerman MJ, Mayer J, Borys JM, Seidell JC.

Submitted

Abstract

Traditional evaluation and monitoring methods are often unable to identify crucial elements of success or failure of integrated community-based approaches aiming to tackle childhood overweight and obesity, yet difficult to determine in complex programmes. Therefore, we aimed to systematically appraise strengths and weaknesses of such programmes and to assess the usefulness of the appraisal tools used. To identify strengths and weaknesses of the integrated community-based approaches two tools were used: the *Good Practice Appraisal tool for obesity prevention programmes, projects, initiatives and intervention (GPAT)*, a self-administered questionnaire developed by the WHO; and the *OPEN tool*, a structured list of questions based on the EPODE theory, to assist face-to-face interviews with the principle programme coordinators. The strengths and weaknesses of these tools were assessed with regard to practicalities, quality of data acquired and the appraisal process, criteria and scoring. Several strengths and weaknesses were identified in all the assessed integrated community-based approaches, different for each of them. The *GPAT* provided information mostly on intervention elements whereas through the *OPEN tool* information on both the programme and intervention levels were acquired. Large variability between integrated community-based approaches preventing childhood obesity in the European region was identified and therefore each of them has different needs. Both tools in combination used seem to facilitate comprehensive assessment of integrated community-based approaches in a systematic manner, which is rarely conducted. Nonetheless, the tools should be improved in line to their limitations as recommended in this manuscript.

Introduction

Overweight and obesity are nowadays characterised as a major public health problem in Europe and are therefore highly prioritised on the European public health agenda [1]. The causal pathways that drive the increase of obesity prevalence are complex and predominately associated with lifestyle behaviours such as low levels of physical activity, sedentary lifestyles and unhealthy dietary habits. These lifestyles are influenced by societal, cultural, economic, organizational and environmental conditions [1-5]. This implies the need for integrating multiple sectors and targeting multiple levels of influence of unhealthy dietary and physical activity habits simultaneously [1, 5-7]. Therefore, a socio-ecological approach for interventions and programs has been proposed [5, 6, 8, 9] which involves a range of factors that affect individual behaviour, reflected at the interpersonal, organisational, community and policy levels [3, 6, 8, 9].

Based on a socio-ecological approach, integrated community-based approaches arise as considered to be the most promising in tackling overweight and obesity [1]. They are composed of a cluster of strategies performed in a community, designed for individual behavioural change towards a healthier lifestyle by means of involving various institutions, organizations and local stakeholders [10]. Although there is mounting evidence that such programmes are promising [8, 11, 12], it is still unclear what are the effective elements of such integrated community-based approaches and how implementation can be improved, as only a few process evaluations have been carried out to provide insight [9, 13].

One of the few promising integrated community-based approaches that have provided some insights is based on the EPODE ('Ensemble Prévenons l'Obésité Des Enfants' or 'Together let's prevent childhood obesity') approach, which depends on four main pillars: (i) political commitment, (ii) supporting services for design and implementation of interventions and campaigns (or social marketing), (iii) public and private partnerships (PPPs) and (iv) scientific monitoring, evaluation and dissemination of the programme [13, 14]. The strong political commitment refers to the official involvement of political representatives, who are in key positions for influencing local or national policies, as well as influencing relevant environmental factors that affect weight-related behaviours. Social marketing is comprised of applying marketing strategies, to achieve behavioural goals that promote health. Its messages are included into strategies, targeting the children, families and their local microenvironment, aiming at the same time to mobilise local stakeholders (teachers, catering services etc). The PPPs are established as collaboration between the academic world, the public sector-agencies and governmental institutions- and the for-profit sector, ensuring mutual respect, trust for each party and common goals. The scientific evaluation of the EPODE program includes four levels: the central organisation, the local organisation, the action at settings and the effect on the child. Consequently, the evaluation includes monitoring of process, as well as outcome indicators at all levels. The term dissemination refers to the use of evidence acquired from various sources to evaluate the implementation of EPODE and to facilitate the process evaluation. Detailed information about the EPODE philosophy and pillars can be found elsewhere [13, 14].

The OPEN project

As an innovative framework in the field of integrated community-based approaches for the prevention of childhood obesity, the EPODE approach has been widely adapted by integrated community-based programmes across Europe and elsewhere, adjusted to the country's specificities and dynamics (http://epode-international-network.com/members/programmes). In 2014 a European network of integrated community-based approaches targeting childhood obesity prevention-called the OPEN (Obesity Prevention through European Network) project- was initiated with financial support of the European Union. The purpose was to improve the methods of community-based approaches by building capacity through experience sharing and training according to the EPODE approach, besides learning from their own strengths and limitations. The many integrated community-based approaches aiming to tackle and/or prevent childhood overweight and obesity across Europe share obstacles challenging their effectiveness. The lack of effectiveness could also be attributed to unsuitable evaluation and monitoring methods, unable to identify crucial elements of success or failure, yet difficult to determine in complex programmes [7, 15, 16]. A systematic appraisal of the programmes' strengths and weaknesses would potentially enhance understanding of important programme components to be improved or to be paradigmatic.

Therefore the aims of this study were:

1. To appraise the methods of the integrated community-based approaches in a systematic way.
2. To describe the strengths and weaknesses of the appraisal tools used to achieve the first aim.

Methods and materials

For the first aim, two different tools were used to identify strengths and weaknesses of the integrated community-based approaches (referred as "programme-level"). The tools are the "Good Practice Appraisal tool for obesity prevention programmes, projects, initiatives and interventions" (GPAT; Appendix 1) (WHO, 2011), a self-administered questionnaire of the World Health Organization and the OPEN tool (Appendix 2), a structured list of questions based on the EPODE theory, aimed to assist face-to-face interviews with the principle programme coordinators and project managers. For the second aim, the strengths and weaknesses of these tools were assessed, based on the experience of the research team in using them to appraise integrated community-based approaches, with regard to:

i. The practicalities (time, cost and burden of data collection method).
ii. The quality of acquired data (complete, clear).
iii. The appraisal process, criteria and scoring.

Recruitment of integrated community-based approaches

We selected integrated community-based approaches programmes, initiatives and public organizations (the terms "programmes" and "integrated community-based/wide approaches" are used alternately further in this article), which implement integrated community-based interventions, in this case to prevent childhood obesity. Inclusion criteria for the current study were that they are based in the European Union and that they were on-going programmes at the time of data

collection. There was no intention to include all the existing on-going programmes of the European Union.

Two different networks of integrated community-based approaches (EPODE International Network and IDEFICS) were approached. Eight programmes that were members of the EPODE International Network and three from the IDEFICS network which fulfilled the inclusion criteria were approached and accepted to participate to the OPEN project. One of the IDEFICS sites (Delmenhorst) proved not to be on-going at the time of data collection (June-September 2014) and it was therefore excluded from this analysis. Two other appropriate programmes took the initiative to participate. Thus twelve programmes were finally included into this study.

We aimed to collect information by interviewing principal coordinators and/or project managers (at the national and /or local level). The programmes varied in type. Some were programmes that used a more integrated approach involving various stakeholders, networks and settings and running for longer term; whereas others were strategies or even initiatives implementing more simple interventions or campaigns. As illustrated in table 1, eight out of the twelve programmes were organized at the national level (i.e. in some, but not necessarily all, cities of the country), including central and local (city level) coordination with one exemption. Five were EPODE-like programmes. Another three were organized at the regional level and one of them included a central coordination team as well as a local team. One programme was organized at the local level. The programmes range from 1 to 62 communities and from school to whole-community approaches, resulting in a range of 7.000 to 300.000 children and families to be targeted/reached.

Table 1. Descriptive characteristics of the OPEN programmes.

Programme, *country*	**Programme range (region/city)**	**Year of initiation**	**Final target group (s)**	**Communities/ schools reached**	**People reached/targeted**
Child Health Programme, *Cyprus* [1]	Regional (Nicosia)	1995	Children and their families	8 communities	4.500 children and families
Salud Madrid, *Spain*	Regional (Madrid) [5]	N/A	0-17 year olds	179 communities	1.185.156 children and adolescents
EPODE Flandre Lys, *France* [2]	Regional (Flanders - Lys)	2004	0-11 years olds	8 communities	34.000 people (7000 children)
JOGG (Youngsters at a Healthy Weight), *The Netherlands* [2]	National	2010	Families with 0-19 year olds	62 communities	1.000.000 (300.000 children)
Keep fit, *Poland*	National, School-based	2006	13-15 year olds	60% of the country's secondary schools	700.000 adolescents/year

Table 1. Descriptive characteristics of the OPEN programmes (*continued*).

Programme, *country*	**Programme range (region/city)**	**Year of initiation**	**Final target group (s)**	**Communities/ schools reached**	**People reached/targeted**
HELP (Healthy Eating Lifestyle Plan) initiative, *Malta* [3]	National	2007	Families with 5-16 year olds	The whole country	Whole population and at-risk population
MUNSI, *Portugal*	National	2007	Children and teachers	1 community	1600 children
PAIDEIATROFI, *Greece* [2]	National	2008	Families with 6-12 year olds	6 communities	N/A
Good Health Partille, *Sweden* [1]	Local (Partille)	New	2-10 year olds	1 community	7.000 children

Table 1. Descriptive characteristics of the OPEN programmes (*continued*).

Programme, *country*	Programme range (region/city)	Year of initiation	Final target group (s)	Communities/ schools reached	People reached/targeted
SETS movement, *Romania* [2]	National	2011	6-12 year olds	3 communities	190.000 children and families
Sporttube, *Slovakia*	National [4]	2009	6-19 year olds	200 schools	53.000 children
VIASANO, *Belgium* [2]	National	2007	Families with 3-12 year olds	18 communities	700.000 inhabitants

1: Programmes included in the IDEFICS network and continues carrying out prevention activities independently.
2: Programmes using the EPODE approach for their realisation
3: HELP is a multi-level initiative running under the Health Promotion and Disease Directorate, Ministry of Energy and Health, Malta
4: The campaigns of the programme are implemented in different regions of Slovakia; no local coordination team involved.
5: Although the programme is regional, it is coordinated by a central team and the actual implementation is conducted by

Development and content of the tools

A. *Good Practice Appraisal Tool*

The tool was developed under a work package of the WHO/EC DG SANCO project "Monitoring progress on improving nutrition and physical activity and preventing obesity in the EU" (2008–2010). It is an open-ended questionnaire for the systematic assessment of the quality of programmes in order to identify good practices, which could be paradigmatic for future interventions targeting obesity prevention. The GPAT was developed on the basis of outcomes from a literature review regarding evaluation criteria and assessment tools that define an intervention as effective. For pilot testing, seven programmes completed the questionnaire and provided feedback and several experts pilot tested the appraisal form by assessing independently one of the programmes, while they provided additional feedback on the tool (Appendix 1).

The questionnaire is comprised of 43 questions which cover three domains:

1. Main intervention characteristics,

2. Monitoring and evaluation of the interventions,

3. Implementation of the interventions.

An appraisal form is also included to calculate the score achieved for each of the items and domains assessed. Detailed information about the aim and development of the tool and the tool itself can be found elsewhere (Appendix 1).

B. *OPEN tool*

For the interviews the OPEN tool was developed, a structured list of questions related to the EPODE pillars, flexible to additional information. The aims were:

1. To get insight into the way the programme was realised.
2. To identify barriers in implementation of the programmes.

The development of the OPEN tool was assisted by experts in the evaluation of integrated community-based programmes and experts from the EPODE International Network (JM and JMB). In line with their consultations, two semi-structured interview guides that have been previously used to describe the approach of EPODE-like programmes were used as a basis; the "EPODE Interview Guide" developed by Van Koperen et *al* [13] and the "Preliminary interview guide for the transfer of the EPODE approach", developed by the EPODE International Network.

After thorough assessment of and discussion about the topics of the two interview guides, the expert group-comprised by health professionals/researchers in obesity prevention and management (JCS and CR), an expert in qualitative studies (MW), professionals in development and implementation of integrated community-based interventions (JMB and JM) and a researcher of community-based interventions (KM)- developed the OPEN tool (Appendix 2). The OPEN tool is composed of 56 questions (excluding sub-questions) exploring the four pillars of EPODE:

a. The involvement and commitment of political structures and political physical persons in the programme.

b. The type of public and private partnerships, if any, and their involvement in the programme.

c. The methods used to design and implement interventions- including the tools, means and expertise to reach the target groups.

d. The involvement of scientific expertise and methods to monitor and evaluate the programme.

Overall, the questions assess programme components either at the national and/or local level (Appendix 3). Moreover, questions regarding the interventions (n=10) are included, reflecting the methods used by the programme team.

Data collection

The principal programme coordinators and/or project managers were the main respondents to both the GPAT questionnaire and the in-person interviews. Their profession was either in disciplines of health or communication and marketing. Similarly, the profession of the other interviewees was either in health (e.g. public health specialist, clinical psychologist, paediatrician, nutritionist) or in marketing and communication.

A. *Good Practice Appraisal Tool*

The GPAT was disseminated to the principal programme coordinators through e-mail. The data collectors (i.e. the coordinators of the dissemination; KM and JM) indicated that when questions refer to interventions they should select only one in case they had multiple interventions. The completed questionnaires were reviewed on completeness and clarity. In order to ensure high quality data the data

collectors (KM and JM) discussed potential queries/misinterpretations of the questions from the GPAT face-to-face with the respondents, before the interviews through the OPEN tool were carried out. Additional information was asked (including programme documentation) and provided when necessary. Finally, verbal feedback was given from the respondents regarding the questionnaire.

B. *OPEN tool*

Face-to-face interviews with the principal programme coordinators and/or programme managers were conducted at the national or regional level (nine programmes), the local level (one programme) or both-the national and local level (two programmes). The number of the interviewees per interview ranged from 1 to 4. The same protocol was used for all programmes: the interviewers (JM and KM) visited the principal programme coordinators in their office, in English language and they audio-recorded the interviews. In one case the interviewee did not speak English, thus a colleague translated the information. In addition, all questions were asked following the OPEN tool in most of the cases, whereas otherwise, the interviewers assured that all the topics had been discussed by the end of the interview. In the cases of missing or unclear information, short-term, supplementary, face-to-face interviews were conducted (n=11) and additional information was asked via e-mail (n=4 out of the 11 supplementary interviews).

Data analysis

Appraisal of programmes' methods by the GPAT and the OPEN tool

A. *Good Practice Appraisal Tool*

The GPAT questionnaires were appraised through the provided appraisal form (Appendix 1), which scores the items of each of the three domains of the questionnaire using a binary rating scale 0 (not included element) or 1 (included element). Given that it was often difficult to decide between extreme scores, we included an intermediate scale equal to 0.5 (partly included element). After calculating the score of each section, this was divided by the maximum section score, resulting in a score of 1 or less. The score refers to "good practice" if 0.8 or higher, to "acceptable practice" when it is 0.6-0.8, to "marginal practice" when it ranges between 0.4-0.6 and to "weak practice" when it is lower than 0.4. Finally, the average score of all three sections was calculated to appraise the programme as a whole. In line with the instructions of the Good Practice Appraisal Tool (Appendix 1), the data were appraised by two independent researchers. Firstly, KM made the initial appraisal. Secondly, equivocal information was thoroughly discussed with CR in order to agree on the final score of each item.

B. *OPEN tool*

The interviews were transcribed by one researcher (KM). Due to the lengthy interviews and limited time, the expert committee decided to transcribe only the answers to all questions of the structured question list instead of conducting verbatim transcription. This task was carefully undertaken in order to ensure transcription of all core information. In

order to appraise the realisation of each of the programmes, criteria for each of the four EPODE pillars were developed along with their scoring scales. The criteria were based on the logic model of EPODE [13] and the experience of the expert team on the critical elements of the EPODE pillars. During the appraisal process, the rating scales were adapted and criteria were added, depending on the information gathered by the programmes. This resulted in the OPEN tool analysis framework, composed by 101 items (Appendix 3). Thereafter, the information of each of the programmes was organised based on this framework, resulting in an overview of the programmes realisation (information matrix). The appraisal criteria of the analysis framework were assigned to a scoring scale from 0-2. A score of (0) stands for none existing element or poor quality. A score of 1 was given for existing element of moderate quality or a partly existing element and a score of 2 was given to existing elements of good quality. The reference criteria for the quality of the elements for each of the pillars, are derived by existing literature on the EPODE framework [13, 14, 17]. Three researchers (KM, CR and JM) reviewed and scored the information of each programme independently. Disagreements in the scoring of both tools were resolved by consensus of the expert group. Then a total score was calculated for each of the EPODE pillars. In many cases there were questions that did not apply to some of the programmes (labelled as "not applicable"), which were scored as 0.

During the appraisal of both sets of information, the evaluators encountered difficulties in scoring, due to essential differences in the integrated approach used by each of the programmes. Thus, interpretation of scores is dependent on the different contexts. An example is the scoring of the item about evaluation of the actions in the

setting (F4biii; Appendix 2); for a local programme the score depended on whether the majority of the actions have been evaluated, but for a national programme, if the majority of the communities evaluated their actions was considered.

Assessment of strengths and weaknesses of the appraisal tools

In order to clarify the strengths and weaknesses of the two tools to assess integrated community-based approaches, the expert team discussed thoroughly the experience of the data collectors and evaluators in using the tools. Specifically, practical aspects of the data collection were discussed, namely the burden of the data collection method, the time and the costs needed. In addition, considering the importance of acquiring high quality data, the information collected via both tools were compared in terms of being complete and clear. Moreover, the time needed for and ease of the appraisal process were discussed, along with the appraisal criteria and scoring.

Results

Appraisal of the programme's methods

A. *Good Practice Appraisal Tool*

The assessment of the programmes through the GPAT showed that their practices, covering all three domains assessed, was characterized as acceptable for the 27% (3/11 programmes) of them, as "marginal" for 54.5% (6/11 programmes) and as "weak" for 18% (2/11 programme) (Table 2). The majority of the programmes (n=10) had scores below 0.60 in elements of "monitoring and evaluation" (Table 2). In the "implementation" domain most scores were between 0.18 and

Table 2. Scores of the programmes on the each of the GPAT's domains.

Section / Programme, *Country*	Main Intervention Characteristics [a]	Monitoring and evaluation [b]	Implemen-tation [c]	Total [d]
Child health Programme, *Cyprus*	0.66	0.31	0.41	0.45
Salud Madrid, *Spain*	0.76	0.54	0.59	0.63
EPODE Falndre Lys, *France*	0.41	0.31	0.45	0.41
JOGG, *The Netherlands*	0.95	0.61	0.41	0.66
Keep fit, *Poland*	-	-	-	-
HELP initiative, *Malta*	0.75	0	0.45	0.40
MUNSI, *Portugal*	0.81	0.50	0.54	0.61
PAIDEIATROFI, *Greece*	0.71	0.38	0.45	0.51
Good Health Partille, *Sweden*	0.71	0	0.27	0.37
SETS movement, *Romania*	0.66	0.61	0.41	0.56
Sporttube, *Slovakia* [i]	0.39	0	0.27	0.22
VIASANO, *Belgium*	0.6	0.54	0.18	0.44
Max score	1	1	1	1
Items scored (#)	19	13	11	43

a:The domain assesses the following elements: targets, relevance, sustainability, target group, partners and cooperation and planning

b:The domain assesses the following elements: indicators and monitoring, measurements, statistical methods, result assessment, stakeholders and communication.

c:The domain assesses the following elements: performance, partners and cooperation, communication and documentation, target group participation and achievement of intervention objectives.

d:Characterization of the programme practice according to the score achieved: >0.8="Good practice", 0.6-0.8= "Acceptable practice" , 0.4-0.6= "Marginal practice", <0.4="Weak practice"

Table 3. Scores of the on each of the four EPODE pillars.

Pillar / **Programme, *Country***	**Political commitment** *Score (%)*	**PPPs** *Score (%)*	**Social Marketing** ^ *Score (%)*	**Scientific evaluation and dissemination** *Score (%)*
Child health Programme, *Cyprus*	16 (61.5)	2 (25) *a*	35 (67)	27 (67.5) *a*
Salud Madrid, *Spain*	11 (42)	7 (39)	31 (60)	22 (55)
EPODE Falndre Lys, *France*	24 (92)	12 (67)	35 (67)	16 (40)
JOGG, *The Netherlands*	22 (85)	17 (94)	42 (81) [a]	26 (65)
Keep fit, *Poland*	20 (77)	14 (78)	27 (52) [a]	23 (57.5)
HELP initiative, *Malta*	21 (81)	10 (55.5)	40 (77)	26 (65)
MUNSI, *Portugal*	17 (71) *a*	5 (28) *a*	25 (48)	28 (70)
PAIDEIATROFI, *Greece*	20 (77)	17 (94)	37 (71)	22 (55) *a*
Good Health Partille, *Sweden*	26 (100)	8 (44)	33 (63)	6 (15) *a*
SETS movement, *Romania*	15 (58)	16 (89)	38 (73)	21 (52.5)
Sporttube, *Slovakia* [i]	3 (19) *a*	5 (42) *a*	21 (40) *a*	1 (2.5) *a*
VIASANO, *Belgium*	18 (69)	13 (78)	37 (71)	18 (45)
Maximum score (%)	26 (100)	18 (100)	52 (100)	40 (100)
Number of items scored	13	9	26	23

a: Not all items were scored; there were questions that could not be answered, because they did not apply to the programme during the appraisal.
¡: The initiative consists mainly of sporadic physical activity events.

0.59 (Table 2), whereas the "main intervention characteristics" domain was of moderate quality in many of the programmes (n=7; table 2).

B. *OPEN tool*

The appraisal based on the four EPODE pillars showed that achievement in "political commitment" ranged from 19% to 100%, from 25% to 89% in "public-private partnerships", from 40% to 84% in "supporting services for implementation of interventions and campaigns" and from 2.5% to 70% in "scientific evaluation and dissemination" (Table 3). The results denoted several potential areas of improvement in the programmes' approach in each of the pillars, however different for each one of them.

Strengths and weakness of the Good Practice Appraisal Tool

i. *Practicalities in data collection*

From the researchers' viewpoint, the data collection through the GPAT was relatively inexpensive and time-effective, accounting for about eight man-hours (i.e. send all the questionnaires via e-mail, review their quality of information and ask clarifications). All respondents found the questionnaire too lengthy - the time to complete it ranged from 4 hours to a few days - and the formulation of some questions appeared to be unclear.

ii. *Quality of data*

Eleven out of the twelve programmes returned the completed questionnaire to the researchers. Five respondents mixed answers referring to the programme with those to the intervention level, whereas six responders focused on only one level (programme or intervention). In addition, seven respondents misinterpreted the terminology of items in the domain of "evaluation and monitoring" (21-23, 27-28; Appendix 1). Furthermore, the data collectors required the

programme documentation to get insight in the context, but this was often absent or not available in English for all the programmes.

iii. *Appraisal process, criteria and scoring*

The evaluators spent 1-2 hours for the data appraisal per programme and the process was difficult given the confusing information retrieved, as described above. One of the appraisal criteria did not correspond to the question asked (40). The criteria of five items (9, 13, 15, 16, 36) were vaguely defined (Appendix 1), leading to difficulties in scoring. Therefore, the evaluators appraised them often as "partly included element" (0.5). Another observation was that the appraisal of item 7 depended on the response of item 6, which in many cases was either replied inconsistently for the (intervention/programme) level (n=2) or not specified (n=2) or was missing/not conducted (n=1/n=3). Furthermore, the appraisal criteria were not formulated or suitable for the programme level.

Strengths and weakness of the OPEN Tool

i. *Practicalities of data collection*

Twelve face-to-face interviews were conducted. The data collection included considerable costs for the transportation/accommodation of the data collectors in twelve countries. Approximately 6-8 hours of transportation (with return) per visit, additionally to 1,5-4 hours for conducting the interviews were spent per data collector. The interviewees spent much of their time as well for the interview. Their burden decreased given the structured topic list, which facilitated clear questions and their immediate clarification by the interviewers when needed. The transcription lasted from 5-10 hours per interview.

ii. *Quality of data*

We obtained clear and complete information on the programme and intervention level, especially after the complementary requested information (i.e. supplementary interviews, e-mails). The questions asked and responses given during the interviews were clarified when necessary, avoiding misinterpretation by the interviewees and allowing better understanding for the interviewers.

iii. *Appraisal process, criteria and scoring*

The average time of appraisal per programme was 8 hours. The appraising of the programme elements was difficult, due to the amount of information, large variability of the programmes in terms of complexity and the level of independence of the communities on their national coordination. The OPEN analysis framework was developed using criteria related to the EPODE pillars and scoring categories. These criteria and rating scales were being further specified during the analysis, resulting in a framework accounting for the programmes' variability.

Discussion

Appraisal of integrated community-based approaches' methods

Several strengths and weaknesses were found in all programmes, different for each of them. It is noteworthy that the quality of the programmes' methods used differed per domain/pillar assessed, therefore a higher score does not imply that one programme was better than another one with a lower score. Nevertheless, the methods per domain are comparable between the programmes, when taking

into account their variable contexts; namely: a. the level of action (national, local, or both) and the actions themselves, b. the number of settings in which the EPODE approach was implemented within a community (one setting VS multiple settings targeted), c the number of people targeted, d. the number of communities involved and e. the level of these communities' dependence on the central coordination in order to be able to run their actions. It was very important to identify the strengths and weaknesses of the programme level in its specific context, in order to detect areas for improvement as regards the processes of the programme.

Strengths and weaknesses of the appraisal tools

The OPEN tool mainly enabled the identification of strengths and weaknesses of integrated community-based approaches. The OPEN tool detected key information on both programme and intervention levels of all study objects; and thus more insight was provided than with the GPAT which provided information regarding only the intervention level. In most cases the latter information set (from the GPAT) overlapped with or was complemented by the data yielded by the OPEN tool. The GPAT proved to be suitable to identify strengths and weaknesses of more simple interventions. It is well-known that traditional evaluation criteria of interventions examine its overall effectiveness, which is not suitable for complex community-based approaches [16]. Instead, evaluation methods should be sensitive in capturing the dynamics of complex approaches, which operate through multi-dimensional causal pathways, and account for the different roles that various people delivering interventions have and the choices they make [18-20].

The pillar of "scientific monitoring, evaluation and dissemination" of the OPEN tool included the most objective assessment elements compared to the other pillars, questioning-among others- the (type of) monitoring of processes, as well as the evaluation of effects. Such assessment is supported by evidence indicating that, besides assessing the programme's effectiveness, an insightful process evaluation is needed to answer questions for the conceptualisation, planning and performance of the programme [13, 16, 21, 22].

Strengths and limitations of the study

This is one of the few studies that appraised community-based approaches targeting obesity prevention, including the EPODE-like programmes, which have not been assessed before in a systematic way. Our innovative methodological framework combined two methods for conducting in-depth assessment of such approaches. On the one hand, face-to face interviews, using a structured list and criteria related to the EPODE pillars, successfully provided insight into crucial elements of community-based approaches, reflecting the quality of involvement of community, political, private and scientific stakeholders and of social marketing principles. This method enhanced our understanding in how complex prevention programmes could be monitored and evaluated. On the other hand, this is the first documentation on the use of the GPAT, while its applicability in appraising integrated community-based approaches is described. Furthermore, two and three researchers were in charge of conducting the appraisal through the GPAT and the OPEN tool respectively, which decreased-but not eliminated- the subjectivity of the programme appraisal.

Nevertheless, the appraisal relied on self-reported information from the programmes. Therefore information bias is possible, as widely observed in survey research, attributed to the respondent's comprehension, recalling ability from long-term memory, judgement of the retrieved information from his/her memory and selection of an answer [23]. Another limitation of our study was that the qualitative information was reduced to simple scores. This quantification proved to be inadequate as it led to loss of information and made it difficult for the evaluators to interpret the programmes' processes without additional context information. For instance, in the cases of scoring into the category "partly included element", this ranged from "almost not" to "almost yes". Moreover, considering the weaknesses of the appraisal tools used in this study, all the crucial elements of an integrated community-based approach have not been assessed. Finally, the included integrated community-based approaches were selected through networking and therefore they are indicative rather than representative of such approaches in the European region.

Conclusions

There is large variability between integrated community-based approaches preventing childhood obesity in the European region-even if they follow a similar approach (i.e. EPODE-like programmes)- and therefore each of them has different needs. Both tools we used seem to facilitate comprehensive assessment of integrated community-based approaches in a systematic manner, which is rarely conducted. Nevertheless, the tools should be improved in line to their limitations as presented in this manuscript.

Recommendations

Based on our conclusions we suggest, firstly the creation of programme documentation, which shall be available also in English, in order to be communicated more easily among stakeholders, other programmes and experts in the field of evaluation from different countries. Secondly, improving the formulation of the GPAT's questions will increase its applicability to the programme level. These two steps would give an overview of an integrated community-based approach. As a third step, in-person interviews through the OPEN tool shall complement unclear/missing information by the GPAT and the programme documentation, while they will enhance the assessment of the programme's methods. Consequently, the programmes will potentially be improved, while public health practice and the involved stakeholders will be better informed.

List of abbreviations

EPODE: Together let's prevent childhood obesity.

JOGG: Youngsters at a healthy weight.

HELP: Healthy eating lifestyle plan.

SETS: I live healthy too.

OPEN: Obesity Prevention through European Network.

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Appendices

Appendix 1. Good practice appraisal tool for obesity prevention programmes, projects, initiatives and interventions (amended layout).

Good Practice Appraisal Tool

for obesity prevention programmes, projects, initiatives and interventions

WHO/EC Project on monitoring progress on improving nutrition and physical activity and preventing obesity in the European Union

ABSTRACT

The World Health Organization Regional Office for Europe and the Directorate-General for Health and Consumers of the European Commission have established a joint three-year project to monitor progress in improving nutrition and physical activity and preventing obesity in the European Union.

As part of this project, a good practice appraisal tool was developed to assess good practice elements of design, monitoring, evaluation and implementation of preventive programmes, projects, initiatives and interventions that aim to counteract obesity and improve nutrition and physical activity. This report gives a description of the good practice tool for obesity prevention programmes and describes its development and use.

Keywords

BENCHMARKING
PRACTICE GUIDELINES
OBESITY - prevention and control
PROGRAM EVALUATION - methods
EUROPE

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List of abbreviations

The following abbreviations are used in this report.

DALY	disability-adjusted life years
DG SANCO	Directorate-General for Health and Consumers (EC)
EC	European Commission
EPODE	Ensemble prévenons l'obésité des enfants (Together let's prevent childhood obesity)
EU	European Union
NOPA	Nutrition, Obesity and Physical Activity (database)
QALY	quality-adjusted life years
RIVM	Dutch National Institute for Public Health and the Environment
WHO	World Health Organization

Acknowledgements

This document is a deliverable of work package 3 of the three-year collaborative project between the World Health Organization (WHO) and the Directorate-General for Health and Consumers (DG SANCO) of the European Commission (EC), which began in January 2008 (2007WHO02) under the title "*Monitoring progress on improving nutrition and physical activity and preventing obesity in the European Union (EU)*". A draft of the tool was discussed at a meeting on community initiatives to improve nutrition and physical activity, convened on 21–22 February 2008 in Berlin, Germany. WHO would like to express sincere appreciation to the participants of this workshop for their valuable contributions. WHO also wishes to thank the programmes' stakeholders that took part in the pilot testing rounds of the tool. WHO is most grateful to the experts that pilot tested the appraisal component of the tool to evaluate the good practice elements of the programmes: Wanda Bemelmans, Roos Gun, Tim Lobstein, Susanne Løgstrup, Alessanra Suglia and Joop van Raaij. Special thanks are due to the members of the project's Advisory Group (Michele Cecchini, Barbara Legowski and Jean-Michel Oppert) for critically reviewing the tool and to the Dutch National Institute for Public Health and the Environment (RIVM) for its technical input throughout the development of the tool. Grateful thanks are extended to Katerina Vrtikapa, former intern at the WHO Regional Office for Europe, Copenhagen and Sonja Kahlmeier, Institute for Social and Preventive Medicine, Zurich for their technical input to the development of the tool; to Lideke Middelbeek, WHO Regional Office for Europe, Copenhagen for refinement of the tool and for writing this document; to Trudy Wijnhoven, WHO Regional Office for Europe, Copenhagen for her technical input and overall coordination; to Philippe Roux, DG SANCO, Luxembourg City for his feedback; and to Frank Theakston for the text editing.

Introduction

A three-year joint WHO/EC DG SANCO project covering the period 2008–2010, entitled "*Monitoring progress on improving nutrition and physical activity and preventing obesity in the EU*" was established to evaluate the status of country development and implementation of policies and actions in the area of nutrition, physical activity and obesity prevention. The main outcome of the project is a database on these areas (the NOPA database), which includes surveillance data, country policy documents, policy implementation tools and information on good practices. Work package of this project concerns the collection of existing public health programmes, projects, initiatives and interventions[1] designed to improve nutrition and physical activity or prevent obesity of the general population. Another important component is the development of a good practice appraisal tool to review and assess the quality of the identified programmes by independent experts. Both a summary of the programmes and an indication of good practice will be made available through the NOPA database.

This report describes the development of the appraisal tool, presents its three components and gives instructions on how the Regional Office will use it.

Background

Overweight and obesity are serious public health challenges in the WHO European Region *(1)*. Many local and national programmes aim at counteracting the increasing obesity levels by promoting healthy eating and physical activity *(2)*. Some of these programmes have shown to be more successful than others in preventing obesity and thus can serve as good examples for programme planners and decision-makers in order to facilitate their choice of interventions to adopt. To identify good practice, a tool has been developed to evaluate good practice elements of the planning, monitoring, evaluation and implementation of programmes that can target children, adolescents or adults as well as be nationally, regionally or locally initiated in community, school or workplace settings.

[1] Hereinafter, the term programmes refers to programmes, projects, initiatives and interventions.

Aim of the tool

The purpose of the tool is to systematically assess the quality of programmes. Using a set of predefined criteria, the tool aims to identify programmes that can be considered good practice and can serve as an example for future initiatives that aim to improve nutrition and physical activity or prevent obesity. The tool can be used to monitor and document the aspects of the programmes that are known to contribute to the effectiveness of an intervention and to identify points for improvement. The tool generates a good practice score for three different programme components (planning, monitoring and evaluation, and implementation) as well as for the intervention as a whole.

Development of the tool

The following methods were employed in developing the tool.

1. A literature review was carried out on evaluation criteria for determining the effectiveness of interventions, assessment tools for obesity and public health interventions and scoring systems *(3-15)*. The outcome of this review resulted in a first set of quality criteria that may be regarded as predictors of good practice and in a first draft of the tool.
2. In February 2008, the Regional Office organized a meeting on community interventions to improve nutrition and physical activity, which was hosted by the German Federal Ministry of Health *(2)*. During the meeting, a consultation round was organized to discuss different elements of community interventions and to get feedback on the first draft of the tool. The received comments were used to further refine the tool. In addition, some experts were consulted individually.
3. To identify gaps and to review feasibility, user friendliness and relevance, the tool was pilot tested through three pilot rounds between 2007 and 2009. Eleven programmes were approached to complete the questionnaire (first component of the tool), provide relevant reference material and give feedback on the questions included. Feedback was received from seven:

- "Albiate in forma – a project promoting a healthier lifestyle and habits" from Italy (http://www.piedibus.it/upl/biblioteca/1152783714_ALBIATE%20IN%20FORMA.pdf, accessed 21 December 2010);
- "Bike It – a school cycling project" from the United Kingdom (http://www.sustrans.org.uk/what-we-do/bike-it, accessed 21 December 2010);
- "Community Food Cooperatives – a project to supply fruit and vegetables from locally produced sources" from Wales, United Kingdom (http://www.physicalactivityandnutritionwales.org.uk/page.cfm?orgid=740&pid=29570, accessed 21 December 2010);
- "EPODE France – Together let's prevent childhood obesity – a community-based intervention to prevent childhood obesity with local stakeholders" implemented in various European countries (http://www.epode.org/, accessed 21 December 2010);
- "Happy Body – a project to enhance fitness of the Belgian population via the promotion of healthy nutrition and physical activity" from Belgium (http://www.happybodytoyou.be/, accessed 21 December 2010);
- "Healthy School Canteen – a programme to establish healthy school canteens in secondary schools" from the Netherlands (http://www.degezondeschoolkantine.nl, accessed 21 December 2010); and
- "Programme on nutrition prevention and health of children adolescents in Aquitaine – a programme that was initiated to stabilize the prevalence of childhood obesity" (http://www.nutritionenfantaquitaine.fr/, accessed 21 December 2010).

4. The appraisal form (second component of the tool) was pilot tested by various experts, who were asked to independently appraise one of the seven programmes and to make comments on the tool.

The tool components

The tool consists of three parts.

1. **The questionnaire** serves as the information-gathering form for the tool. Programme managers are asked to answer 43 questions and provide relevant reference materials, such as a programme description, internet links, evaluation report, overview of budget and time-line. The questionnaire comprises the following three sections.

- *Main intervention characteristics.* This consists of questions related to the general design and planning of a programme, such as the main objectives, planned activities, target group and involved stakeholders.
- *Monitoring and evaluation.* This consists of questions related to the monitoring and evaluation process and thus addresses indicators, statistics and measurements.
- *Implementation.* This consists of questions related to the implementation stage of the intervention and refers to performance, programme management and target group participation.

2. **The appraisal** form, with 43 criteria statements, serves as a check list for reviewers to assess the information gathered in the questionnaire.

3. **A scoring** sheet allows one to calculate a good practice score for each of the three sections as well as for the programme as a whole.

Scoring of good practice

An indication of good practice is obtained for each section as well as for the intervention as a whole. This makes it possible to highlight programmes that may, for example, have a very good design but poor evaluation and implementation, or programmes that are well-evaluated but struggle with design and implementation, or programmes that are not well-designed and evaluated but nevertheless have an excellent implementation. For ongoing programmes, only the first section of the questionnaire and appraisal form can be completed.

First, a total score is obtained for each section. This is divided by the maximum section score, leading to section scores less than or equal to unity. A score of 0.8 or higher in a section certifies a programme as "good practice" in the respective section, a score of 0.6–0.8 refers to acceptable practice, a score of 0.4–0.6 indicates marginal practice and a score below 0.4 refers to weak practice. Then, based on the outcome of the three section scores, an average good practice score for the programme is calculated.

For the calculation of the scores, a distinction is made between core questions and general questions. A higher weighting is given to core questions than to general questions, as these are considered to be more crucial in quality assessment. Core questions are therefore multiplied by a factor of 3 and general questions are given one mark.

Assessment of programmes

The Regional Office will apply the following steps for the assessment of good practice elements of public health programmes that aim to improve nutrition and physical activity or prevent obesity in the general population.

Step 1. **Completion of questionnaire by coordinator.** The programme coordinator is asked to answer the 43 questions of the questionnaire and provide relevant reference materials, such as a programme description, internet links, evaluation report, overview of budget and time-line. After completion, the coordinator is requested to send the questionnaire back to the Regional Office.

Step 2. **Assessment of good practice using the appraisal form.** The Regional Office has established a roster of experts to assist in the appraisal of programmes. Each programme will be reviewed independently by two of these experts. For each programme, experts will be asked to complete the appraisal form, depending on their expertise or area of work within the programme to be appraised.

Step 3. **Scoring.** On the basis of the two completed appraisal forms, a good practice score is calculated for each section as well as for the whole programme.

Step 4. **Inclusion in database.** A description of the programme and the obtained score are incorporated into the NOPA database (http://data.euro.who.int/nopa, accessed 19 May 2011).

Questionnaire to gather information on obesity prevention programmes

Instructions

We kindly ask the coordinator to complete the questionnaire and provide any relevant reference material/programme documentation, e.g. general programme description, report on the outcomes, programme evaluation, scientific publications, links to web sites, etc.

The information provided will be treated confidentially. Only final scores from each section, the programme description provided by you and information from marked areas will be included in the database.

You may need to consult your colleagues before completing certain questions.

General programme information

✓ Name of the programme:

✓ Country and region (if applicable) where the programme is based:

✓ Web site (if existing):

✓ Time and period (start and end dates):

✓ Funding sources:

✓ Time period covered by the funding:

✓ Number of staff (both paid and unpaid) invlolved:

✓ Give a short description of the programme (maximum of about 300 words)

Contact details of programme

✓ Name and job title:

✓ Organization:

✓ E-mail address:

✓ Postal address and telephone number:

I. Main intervention characteristics

1. Describe the overall aim(s) of the intervention.

2. Indicate which of the following components are addressed by the intervention.

- ☐ Healthy eating
- ☐ Physical activity
- ☐ Other

Please specify:

3. List the objective of the intervention.

4. Is the intervention based on current scientific knowledge and/or theoretical models and/or previous experience from other projects?

- ☐ Yes, current scientific knowledge
- ☐ Yes, current theoretical models
- ☐ Yes, previous experience
- ☐ No

Please provide further details about your answer option:

5. Were existing (inter)national diet and physical activity guidelines taken into account during the development of the intervention?

- ☐ Yes

Please specify the guidelines, the publisher and the publication date:

- ☐ No

Please explain why not:

6. Has a needs assessment been carried out?

- ☐ Yes

Please specify the results of the needs assessment:

- ☐ No

Please explain why not:

7. Describe the planned key activities.

8. Does the intervention also address environmental factors (i.e. factors beyond individual control)?

- ☐ Yes

Please specify which factors are addressed and how:

- ☐ No

Please explain why not:

9. Is the approach of the intervention designed to have a lasting effect on the risk factors?

☐ Yes

Please provide further details:

☐ No

Please explain why not:

10. Describe the structures within which the intervention was carried out.

☐ Existing structures (e.g. part of the administration, nongovernmental organization, etc.)
☐ Newly created structure that will continue to exist after the intervention is concluded
☐ Newly created structure that will not continue to exist after the intervention is concluded
☐ No specific structure (e.g. project team)

Please provide further details about the indicated answer option:

11. Describe the target group(s) of the intervention.

12. Does the intervention have a special focus on vulnerable groups (socioeconomically disadvantaged people, ethnic minorities, children, elderly people, etc.)?

☐ Yes

Please specify the vulnerable groups:

☐ No

Please explain why not:

13. Does the intervention aim to empower the target group(s)?

☐ Yes

Please specify:

☐ No

Please explain why not:

14. Was/were the target group(s) involved in setting the objectives and designing the intervention?

☐ Yes

Please specify:

☐ No

Please explain why not:

15. Have possible adverse effects of the intervention on the target group(s) been considered and minimized?

Explanation: An adverse effect is a harmful and undesired effect resulting from an intervention.

☐ Yes

Please specify:

☐ No

Please explain why not:

16. Describe the involvement of stakeholders in the planning phase of the intervention and specify the stakeholders.

Explanation: a stakeholder is a person, group or organization that affects or can be affected by the intervention.

17. Specify the sectors represented by the professionals that were involved in the intervention (e.g. health, transport, environment, education, etc.) and describe their role in the intervention.

18. How much of the total budget was allocated to the evaluation of the programme (as a percentage of the total budget)?

19. How was the programme management carried out?

☐ A timetable in which tasks, activities and responsibilities were clearly described
☐ Day-to-day-planning with programme team
☐ Other technique, namely: _____
☐ No specific programme management technique was applied

Please provide further details about your answer option:

II. Monitoring and Evaluation

20. Has resource utilization (funds, human resources, materials) for the intervention been monitored?

☐ Yes

Please specify the indicators and their frequency of measurement:

☐ No

Please explain why not:

21. Describe how the process of the intervention was measured.

☐ Specific indicators were used

Please specify the indicators and the frequency of measurement for each indicator:

☐ Summary evaluation was carried out at the end of the intervention

☐ No specific monitoring or evaluation was carried out

Process indicators are used to measure progress in the processes of change and to investigate how something has been done, rather than what has happened as a result. An example is the setting up of an expert advisory committee with active responsibility for quality assurance of the intervention or adherence to the time plan of the programme. Process indicators should be measurable (use at least qualitative dimensions), factual (mean the same to everyone), valid (measure what they claim to measure), verifiable (be able to be checked) and sensitive (reflect changes in the situation).

22. Describe how the output of the intervention was measured.

☐ Specific indicators were used

Please specify the indicators and the frequency of measurement for each indicator:

☐ Summary evaluation was carried out at the end of the intervention

☐ No specific monitoring or evaluation was carried out

Output indicators are used to quantify conducted activities, for example the total number of participants. They are also used to measure the outputs or products that result from processes, such as the publication of a booklet on healthy diets. Output indicators can also include improving the social and physical environments of various settings to support the adoption of healthier types of behaviour, such as improved access to fruit and vegetables or safe cycling routes. They should be linked to the objectives and be measurable, factual, valid, verifiable and sensitive.

23. Describe how the outcome of the intervention was measured.

☐ Specific indicators were used

Please specify the indicators and the frequency of measurement for each indicator:

☐ Summary evaluation was carried out at the end of the intervention
☐ No specific monitoring or evaluation was carried out

Outcome indicators are used to measure the ultimate outcomes of an action. Depending on the specified objectives, these might be short-term (such as increased knowledge), intermediate (such as change in behaviour) or long-term (such as reduction in incidence of cardiovascular disease). An example is the reduction of the percentage of primary school children in the community of Sandes not reaching the minimum recommended amount of physical activity by 5%. They should be related to the targets as well as quantifiable, factual, valid and verifiable.

24. Indicate the demographic and socioeconomic factors of the target population that have been measured.

☐ Age Gender
☐ Income/socioeconomic status
☐ Education
☐ Occupation
☐ Ethnicity
☐ Geographical location
☐ Other, namely:
☐

25. Was a long-term follow-up carried out after the end of the intervention?

☐ Yes

Please specify how many months after the end of the intervention:

☐ No

Please explain why and continue with question 27:

26. Describe the sample of the study population that was monitored as part of the follow up *(please give a percentage)*.

27. Were statistical methods used in the evaluation of the intervention?

☐ Yes

Please specify:

☐ No

Please explain why not:

28. Were confounding factors taken into consideration?

Explanation: A confounding factor is a variable that can cause or prevent the outcome of interest, is not an intermediate variable, and is associated with the factor under investigation. A confounding factor may be due to chance or bias. Unless it is possible to adjust for confounding variables, their effects cannot be distinguished from those of factor(s) being studied.

☐ Yes

Please specify:

☐ No

Please explain why not:

29. Have cost–effectiveness calculations been made?

Explanation: Cost–effectiveness compares the relative expenditure (costs) and outcomes (effects) of two or more courses of action. Typically cost–effectiveness is expressed in terms of a ratio, where the denominator is a gain in health from a measure (e.g. years of life, sight-years gained) and the numerator is the cost of the health gain. A special case is cost–utility analysis, where the effects are measured in terms of years of healthy life lived, using a measure such as quality-adjusted life years (QALY) or disability-adjusted life years (DALY).

☐ Yes

Please provide further details about how the calculations were made:

☐ No

Please explain why not:

30. Has an evaluation of the intervention been carried out?

☐ Yes, an external evaluation
☐ Yes, an internal evaluation
☐ Yes, both internal and external evaluations
☐ No (*please go to part III*)

Please provide further details about the evaluation that has been carried out:

31. Are stakeholders' opinions assessed in monitoring and evaluation?

☐ Yes

Please specify and indicate the respective stakeholders:

☐ No

Please explain why not:

32. Is the monitoring and evaluation process described in the main programme documentation?

☐ Yes

Please give an overview and provide a reference:

☐ No

Please explain why not:

III. Implementation

33. Has a pilot study been performed?

☐ Yes

Please provide details of the pilot study:

☐ No

Please explain why not:

34. Describe the activities that have been carried out.

35. Describe the performance of the intervention in terms of time management and the activities that were undertaken to ensure high-quality delivery.

36. Describe which stakeholders were involved in the implementation and describe their roles.

37. Is the initiative coordinated or linked with other relevant interventions?

☐ Yes

Please specify the intervention(s):

☐ No

Please explain why not:

38. Provide an overview of the resources that were invested and indicate where more information can be found.

39. Is the implementation process described in the main programme documentation?

☐ Yes

Please give an overview and provide a reference:

☐ No

Please explain why not:

40. Has actual outcome performance been measured against a control group?

☐ Yes

Please specify where further documentation on the outcome performance can be found:

☐ No

Please explain why not:

41. Has the planned target group participation been reached?

☐ Yes

Please specify:

☐ No

Please explain why not:

42. To what extent have the planned key activities indicated in section I (question 7) been carried out? *(Please give a percentage):*

43. To what extent have the objectives indicated in section I (question 3) been achieved? *(Please give a percentage):*

Appraisal form – a checklist for reviewers

I. Main intervention characteristics

Targets

1. The aims of the intervention are clearly described.

☐ Yes
☐ No

2. The intervention combines healthy eating and physical activity.

☐ Yes
☐ No

3. SMART objectives are provided.

☐ Yes, at least 3 of the 5
☐ No, or not specified

Explanation: SMART objectives are:

1. **S***pecific: objectives should clearly specify what is to be achieved*
2. **M***easurable: objectives should be phrased in a way that achievement can be measured*
3. **A***chievable: objectives should refer to something that the intervention can actually influence and change*
4. **R***ealistic: objectives should be realistically attainable within the given time frame and with the available resources (human and financial resources and capacity)*
5. **T***ime-bound: objectives should relate to a clearly stated time frame.*

Relevance

4. The intervention is based on current scientific knowledge and/or theoretical models and/or previous experience.

☐ Yes, current scientific knowledge
☐ Yes, theoretical models
☐ Yes, previous experience
☐ No, or not specified

5. The intervention acts in coherence with existing diet and/or physical activity guidelines.

☐ Yes, the intervention acts in coherence with national or international guidelines
☐ No, or other guidelines, or not specified

6. A needs assessment has been performed.

☐ Yes
☐ No, or not specified

7. Planned key activities are relevant to the needs of the target group.

☐ Yes
☐ No, or not specified

8. The activities also address environmental factors (i.e. factors beyond individual control).

☐ Yes
☐ No, or not specified

Examples

School: provision of healthy meals in the canteen, school fruit and vegetable schemes, removal or change of contents of vending machines, provision of cheap or free water supply.
Workplace: promotion of stair use, availability of facilities for physical activity and showers for staff coming by bicycle, provision of healthy meals in the canteen, promotion of participation in sports, such as a company marathon team.
Community: improved information and access to a choice of healthier foods and to sport and recreational facilities and green spaces for physical activity, availability and accessibility of a safe transport infrastructure and of institutional or organizational incentives for non-motorized means of transportation, presence of aesthetic attractions and comforts as well as absence of physical disorder.
Media: improved image of healthy eating and living through in television, video games and billboards.

Sustainability

9. The intervention is designed to have a lasting effect on the risk factors.

- ☐ Yes
- ☐ No, or not specified

10. The activities are taking place within structures that can carry on the intervention.

- ☐ Yes
- ☐ No, or not specified

Examples
School: inclusion of nutrition education in the curriculum, teacher training in the promotion of healthy nutrition and/or physical activity.
Workplace: presence of staff canteens serving quality meals, provision of facilities for physical activity in the workplace (e.g. gym, basketball court).
Transport: improved provision of walking and cycling routes, promotion of stair use in public buildings.
Community: provision of information on nutrition in local stores, improvement of the aesthetics of the environment.
Media: popular soap operas promote healthy choices and active living.

Target group

11. The target group(s) is/are clearly stated.

- ☐ Yes
- ☐ No, or not specified

12. There is a special focus on vulnerable groups (socioeconomically disadvantaged people, ethnic minorities, children, elderly people, etc.).

- ☐ Yes
- ☐ No, or not specified

13. The intervention aims to empower the target group(s).

- ☐ Yes
- ☐ No, or not specified

Explanation: The intervention increases the capacity of individuals or groups to make choices about their health and to transform those choices into desired actions and outcomes by strengthening personal abilities such as self control, confidence and autonomy.

14. The target group(s) has/have been involved in setting the objectives and designing the intervention.

- ☐ Yes
- ☐ No, or not specified

15. Possible adverse effects of the intervention were considered and minimized.

- ☐ Yes
- ☐ No, or not specified

Partners and cooperation

16. The main stakeholders were involved in the planning phase of the intervention.

- ☐ Yes, all
- ☐ Yes, at least one
- ☐ No, or not specified

Examples of stakeholders
Family and preschool: parents, social workers, kindergarten or nursery teachers, children.
School: children, parents, teachers, school board members, food providers.
Workplace: employees, company board members, staff association, food providers.
Community: community members, community board members, social workers of ongoing projects or established institutions.
Media: target group members, advocacy groups of the target group (such as representing youth, ethnic groups, women, socioeconomically disadvantaged people), experts in this field of action, governing health policy department.

17. The intervention involves professionals from different sectors.

- ☐ Yes
- ☐ No, or not specified

Planning

18. A proportion of the budget is allocated to monitoring and evaluation.

- ☐ Yes, 5% or more
- ☐ Yes, less than 5%
- ☐ No, or not specified

19. A timetable has been set in which tasks, activities and responsibilities are clearly described.

- ☐ Yes
- ☐ No, or not specified

II. Monitoring and evaluation

Indicators and monitoring

20. Resource utilization (funds, human resources, materials) have been monitored.

- ☐ Yes
- ☐ No, or not specified

21. Process indicators are measured regularly.

- ☐ Yes
- ☐ No, or not specified

Explanation: Process indicators are used to measure progress in the processes of change and to investigate how something has been done, rather than what has happened as a result. An example is the setting up of an expert advisory committee with active responsibility for quality assurance of the intervention or adherence to the time plan of the programme. Process indicators should be measurable (use at least qualitative dimensions), factual (mean the same to everyone), valid (measure what they claim to measure), verifiable (be able to be checked) and sensitive (reflect changes in the situation).

22. Output indicators are measured regularly.

- ☐ Yes
- ☐ No, or not specified

Explanation: Output indicators are used to quantify conducted activities such as the total number of participants. They are also used to measure the outputs or products that come about as the result of processes, for example the publication of a booklet on healthy diets. Output indicators can also include improving the social and physical environments of various settings to support the adoption of healthier types of behaviour, such as improved access to fruit and vegetables or safe cycling routes. They should be linked to the objectives and be measurable, factual, valid, verifiable and sensitive.

23. Outcome indicators are measured regularly.

- ☐ Yes
- ☐ No, or not specified

Explanation: Outcome indicators are used to measure the ultimate outcomes of an action. Depending on the specified objectives, these might be short-term (such as increased knowledge), intermediate (such as change in behaviour) or long-term (such as reduction in incidence of cardiovascular disease). An example is the reduction of the percentage of primary school children in the community of Sandes not reaching the minimum recommended amount of physical activity by 5%. They should be related to the targets as well as quantifiable, factual, valid and verifiable.

Measurements

24. Demographic and socioeconomic factors of the target population are measured (age, gender, income/socioeconomic status/education, occupation, ethnicity and geographical location).

- ☐ Yes, at least one of the above-mentioned factors
- ☐ No

25. A long-term follow-up was performed at least 6–12 months after the intervention.

- ☐ Yes
- ☐ No, or not specified

26. The follow-up is performed in a representative sample of the target group and includes more than 80% of the evaluation sample.

- ☐ Yes
- ☐ No, or not specified

Statistical methods

27. The statistical methods are described.

- ☐ Yes
- ☐ No, or not specified

28. Confounding factors are taken into consideration.

- ☐ Yes
- ☐ No, or not specified

Explanation: The theme of confounding is mentioned and existing confounding factors are explained (if reported) and the extent of confounding is discussed.

Result assessment

29. Cost–effectiveness calculations are made.

- ☐ Yes
- ☐ No, or not specified

Explanation: Cost–effectiveness compares the relative expenditure (costs) and outcomes (effects) of two or more courses of action. Typically cost–effectiveness is expressed in terms of a ratio, where the denominator is a gain in health from a measure (e.g. years of life, sight-years gained) and the numerator is the cost of the health gain. A special case is cost–utility analysis, where the effects are measured in terms of years of healthy life lived, using a measure such as quality-adjusted life years (QALY) or disability-adjusted life years (DALY).

30. External and/or internal evaluations have been performed.

- ☐ Yes, both
- ☐ Yes, an external evaluation
- ☐ Yes, an internal evaluation
- ☐ No, or not specified

Stakeholders

31. Stakeholders' opinions are assessed in monitoring and evaluation.

- ☐ Yes
- ☐ No, or not specified

Communication

32. The monitoring and evaluation process is described in the main intervention documentation.

- ☐ Yes
- ☐ No, or not specified

III. Implementation

Performance

33. A pilot study has been performed.

- ☐ Yes
- ☐ No, or not specified

34. The activities that are carried out are relevant to the objectives of the intervention (compare with question 3 under main intervention characteristics).

- ☐ Yes, all
- ☐ Yes, partially
- ☐ No, or not specified

35. The intervention was implemented according to the timetable, and activities to ensure high-quality delivery were carried out.

- ☐ Yes
- ☐ No, or not specified

Partners and cooperation

36. Relevant stakeholders are involved in the implementation.

- ☐ Yes, all
- ☐ Yes, at least one
- ☐ No, or not specified

Examples
Family and preschool: parents, social workers, kindergarten or nursery teachers, children.
School: children, parents, teachers, school board members, food providers.
Workplace: employees, company board members, staff association, food providers.
Community: community members, community board members, social workers of ongoing projects or established institutions.
Media: target group members, advocacy groups of the target group (such as representing youth, ethnic groups, women, socioeconomically disadvantaged people), experts in this field of action, governing health policy department.

37. The initiative is coordinated and linked with other relevant interventions.

- [ ] Yes
- [ ] No, or not specified

Explanation: Networking can strengthen the sustainability of the programme and is an indicator of transparency and willingness to learn from others.

Communication and documentation

38. Resource information (funds, human resources, materials) is described in the main programme documentation.

- [ ] Yes
- [ ] No, or not specified

39. The implementation process (activities, staff affiliations, timetable, monitoring and evaluation) is described in the main programme documentation.

- [ ] Yes
- [ ] No, or not specified

40. The main programme documentation is publicly accessible (a web link is provided).

- [ ] Yes
- [ ] No, or not specified

Target group participation

41. The planned target group participation has been reached.

- [ ] Yes
- [ ] No, or not specified

Achievement of intervention objectives

42. A minimum of 70% of planned activities have been performed.

- [ ] Yes
- [ ] No, or not specified

43. At least 90% of the objectives have been achieved.

- [ ] Yes
- [ ] No, or not specified

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Appendix 2. OPEN tool question list.

Name:
Position:
Name of the programme:
City-Country:

Questions for the main programme coordinator

The aim of this interview is to better understand your organization and your childhood obesity prevention activities in order to provide you with practical advice, based on the experience we have in implementing community-based programmes. We ask you to give your point of view on the following themes: general organization, political involvement, public & private partnership, campaigns & interventions, communication, scientific aspects and budget.

A. General –How is the programme organised

1. What organization (government, company, NGO…) and what department are you part of?
2. What is your background?
    a. Have you followed any extra training for this programme? Please describe.
3. How long have you been working on the XXX programme?
4. How many days/hours per week do you work on the XXX programme?
5. Has a team been organised as a result of the xxxx programme?
    a. How is this team organized?
        i. How many members working for the programme
        ii. Their expertise
        iii. Their task/duties (in the programme)?

6a. Are there on-going programmes / campaigns as part of a National Plan on obesity prevention / promotion of healthy lifestyle?

6b. Does your programme fit in that plan?

- How?

7. Please describe the communities reached and target groups approached

a. Number of communities
b. Number of people
c. Age groups

B. Political involvement at National/Regional level

1. Is there a formal agreement to the programme at National/regional level with political structure?
   -If yes,
   a. What does it include?
      - Tasks/responsibilities of the parties? What do(es) political partner(s) provide to the XXX programme (e.g. Financial ? / Expertise? / Benefits in kind: physical space, communication materials, manpower, evaluation, data use?)?
      - How do they contribute?
   b. Who is responsible in y our programme /team for ensuring political commitment at national*/local* level?

2a. Is the programme supported within the municipality?

2b. How does this translate in practice (structures, organisations, human resources, advocacy, funds)

3. Do political partners actively advocate the programme? How?
4. What do the National/Regional political representatives think about the programme? (supporters, neutral, against)
5. Are you working directly with a political representative representing the programme?

a. Who

6. Do the other sectors of the municipality contribute to the XXX programme?

a. How? Is there cooperation between these sectors (inter-sectoral cooperation)?

b. Which ones?

c. Do elected representatives of the municipality contribute to the programme?

7. How do you communicate the progress of the programme to your political partners? Telephone calls – frequency; Emails – frequency ;Reports – frequency

a. Meetings – frequency

8. When are the next National/Regional elections?

9a. Are you satisfied with the established political commitment?

9b. What is needed to progress?

C. Public-private partnership

1. Are there public/private partnerships involved?

-If yes,

a. Who is responsible for creating/handling the PPPs in your team? What are his/her tasks regarding it?

b. How PPP is being applied in the national/regional level? What does it mean for the programme (parties involved in the agreement – NGO and communication agency, national/local authorities and private partners, government and NGO/for-profit organisation-, how important is it for the programme to have an agreement between these parties?

c. How is this activity (e.g. time/materials/personnel spent for recruitment and management) financed?

d. Helping factors/barriers for the development of PPP?

-If no,

- Why not?

- Do you plan to involve a partnership like this in xxxx? In what way?
- Who, why, when?

2. Has knowledge been acquired for the development and management of PPP, and if so how?
    - Existed expertise or training(s)? Could you explain?
    - If training, by whom? Was it helpful?
    - Do you use it in your work? If yes, how?
3. What is the position of the National/Regional government regarding PPP?
4. What is the
    a. Society's
    b. Scientific community's view on PPP?
5. Who are your actual partners?
    a. public
    b. private
    c. Are there any potential partners?
        i. Public
        ii. private

    List to ask:

Government:	Media
Universities:	Companies:
Hospitals:	Foundations:
Health-others:	Religious bodies:
Associations:	Political bodies:

6. Do you have a PPP charter?
    - Is it programme-specific or a pre-existing document? Which one?
    - Have you undergone conflict of interest issues? How did you solve the problem?

7. How do these parties contribute to the programme?
    - Financial? / Expertise? / Benefits in kind: physical space, communication materials, manpower, evaluation, data use?

    a. Public partners
    b. Private partners
        - How is this agreed? (price + period)

8. Why did these partners join the programme?
    a. How did you convince them?
    b. What is the advantage for them to join the programme? / Good reputation? / Health of employees? / corporate social responsibility / other)?
    c. How do you keep them motivated (regular meetings, annual reviews, media coverage reports, evaluation reports, etc.)?

9. How often do you meet your private partners and on what occasions (single meetings, events etc.)

10. Are you satisfied with the established PPP?
    i. What is needed to progress?

D. Development of interventions and campaigns at National/Regional level

1. Do you develop and implement interventions and/or campaigns? Specify
    a. At what level?

2. Has knowledge been acquired regarding the design and deployment of interventions and/or campaigns? specify

-if so
    a. Existed expertise or training(s)? Could you explain?
    b. If training, by who and was it helpful?
    c. Do you use it in your work and how?

3. Which are the target groups of your interventions / campaigns? Specify
    a. Final target group (s)

b. Parent as target group
c. Other intermediate target group (s) (e.g. local managers)
d. Do you consider the local stakeholders participating in the interventions and campaigns as target groups?

4. Has a target group analysis been done? If yes, how did you use it?

5. Could you please describe the process of the **planning** of an intervention?

a. Who is responsible for this? What are his/her tasks?

b. How is the theme decided? On what basis (needs analysis, focus groups, ITVs, feedback from local project managers). Please give details of the process.

c. Who else is involved and what are the specific tasks?

i. Is the final target group involved in the planning phase?

ii. Any private partners?

d. Are you satisfied with the overall process for **planning** the interventions and campaigns?

i. What is needed to progress?

6. Could you please describe the process of the **implementation** of an intervention?

a. Who is responsible for this? What are his/her tasks?

b. Who is developing the tools? Form contents to graphic design and printing.

c. Is there anyone validating the contents of the tools/intervention? Please give details

d. Who else is involved and what are the specific tasks. Private partners?

e. Is there any training of the people involved in the field (form LPM to volunteers)?

f. Are you satisfied with the overall process for **implementing** the interventions and campaigns?

i. What is needed to progress?

7. What tools do you develop for your target groups? (e.g. intervention guide, poster, leaflet, book, recipe sheet)
8. If there are on-going programmes / campaigns on childhood obesity prevention or on other related public health issues, do you make use of their tools? How?

9. Do you use the experience of the local coordination teams/ actors directly involved for the design of future interventions/campaigns?

- If yes, how (the actions they have implemented, their methodology, the tools they have developed, their feedback on the tools etc)?
- If not, why?

10. What do your interventions/ campaigns (specify) include in terms of:

a. Themes: Food habits/physical activity/ other
    i. (micro/macro)environmental change/
b. Activities: organization of events, workshops, PR/ other

11. Can you describe the last intervention/campaign (specify) you have led?

- Duration
- When was it
- Theme
- Methodological tools
- Communication tools
- Intervention tools
- Was it was a success/not a success? Why

Can you provide us with some materials?

Local level:

- *Do you include other existing actions in the town in the XXX programme? Which are they?*
- *To what extend do you use the materials (methodological, communication, intervention tools) provided by the national coordination? Why?*

E. Communication on the programme at National/Regional level

1. Has knowledge been acquired on communication / PR activities?
    a. Existing expertise or training(s)? Could you explain?
    b. If trainings, from where? was it helpful?
    a. Do you use it in your work and how?
2. What communication materials and channels do you use*?

    *Website, Newsletter, Press releases, Press events, One-to-one direct communication (journalists, political, scientific, private partners), Newspapers, TV, social media, Web TV, Radio, Facebook, Twitter, Google +, Google groups

3. Who is responsible for the communication of the programme?
    - Internal/external?
    - Why is it organized like this? (if not answered previously)
    - Does it work well?
    - Helping factors/barriers?
4. Are your PPP partners involved in the PR communication activities?

    - If yes, how?
        - Advantages – disadvantages of this involvement?

    5. Is there a communication plan?
        - If yes, how often is it being set-up?
6. Do you evaluate your PR communication?
    a. What are your results in terms of media coverage/visibility?
    b. Are you satisfied with these results? Why?

F. Scientific aspects at National/Regional level

1. Is scientific support used within the programme?
    a. Did you create a scientific advisory board or individual experts are collaborating occasionally, or both? Please explain.
    b. Who is part of it? What are their areas of expertise?

c. What are their responsibilities within the programme? (tools contents, validation, evaluation, publication, spokesperson)
d. Do you have scientific spokespersons?
    - Who?
e. How often do you meet the scientific experts and for what purpose?
f. How is it financed?
g. How do you feel about this collaboration?
    - Does it work well?
    - Why?

2. Have knowledge been acquired on the scientific aspects of the programme (understanding obesity, intervention protocol, evaluation) and if so how?
    - Do you use it in your work? How?
3. Does an evaluation take place?
    a. Is there an evaluation framework?
        i. If yes, Who developed it? Does it follow a specific methodology (e.g a logic model, definition of SMART objectives)?
    b. Who is responsible for the evaluation?
4. What is evaluated?
    c. Processes:
        i. Central coordination
        ii. Local coordination
        iii. Setting/actions
    d. Effects:
        i. Behavioral change of children/ families
        ii. BMI

If the interviewee explains in detail, make sure the elements in q5 are mentioned.

5. At what points does evaluation take place?
    - Why is it organised like this?
    - How is this financed?
    - Does it work well? Why?

6. Are you satisfied with the evaluation process of your programme (what is evaluated, funding, feasibility)?

i. What is needed to progress?

7. Do you have implementation and evaluation results?

a. How do you use them (scientific publication, dissemination, other use)

b. Do you have scientific publications?

COLLECT PUBLICATIONS

8. What scientific events do you participate in and how (poster, presentation, workshop…)?

9. What scientific events do you attend?

10. Budget (% or €) for evaluation activities

Footnotes

^: Questions addressed to the intervention level.

Appendix 3. Template of the analysis grid of the OPEN tool.

A. GENERAL CHARACTERISTICS OF THE PROGRAMME							
CODE	**ELEMENT**	**INTERVIEW QUESTION**	**ANSWER**	**SCORING CATEGORIES**	**REASERCHERS' COMMENT**	**SCORE**	**MAX SCORE**
A1	**Structure**	What organization (government, company, NGO…) and what department are you part of?			Descriptive	NOT SCORED	
A2	**Background**	What is your background? a. Have you followed any extra training for this programme? Please describe.				NOT SCORED	
A3	**How long working for the programme**					NOT SCORED	
A4i	**Principal programme Coordinator Commitment**	How many days/hours per week do you work on the XXX programme?		1. Part time, some full time 2. Full time	The ones operating at the same level and share the tasks are combined.		2

A4ii	**Project Coordinator Commitment (local level)**			1. Part time, some full time 2. Full time	The ones operating at the same level and share the tasks are combined.		2
A5i	**Programme team**	Has a team been organised as a result of the programme? ai. How many members working for the programme		0. 1 person 1. 2-3 people 2. more than 3			2
A5ii	**Programme team expertise**	aii. Their expertise		0. One expertise 1.Two expertise 2. 3 or more expertise			2
A6a	**National plan on obesity prevention/promotion of healthy lifestyle**	a. Are there on-going programmes / campaigns as part of a National Plan on obesity prevention / promotion of healthy lifestyle?		a. No/Don't know -> *skip the next question* b. Yes-> *go to the next question*			0
A6b	**Collaboration with existing programmes of National plan**	b. Does your programme fit in that plan?		0. We do not fit in the plan 2. we are part/fit in the plan			2
A7a	**Communities reached**				Descriptive	NOT SCORED	

=:

A7b	**People reached**				Descriptive	NOT SCORED	
A7c	**Target groups**				Descriptive	NOT SCORED	
					A. TOTAL		8

B. POLITICAL INVOLVEMENT

CODE	ELEMENT	INTERVIEW QUESTION	ANSWER	SCORING CATEGORIES	REASERCHERS' COMMENT	POINTS SCORE	MAX POINT
B1	**Formal agreement**	Is there a formal agreement to the programme at National/regional level with political structure?		0. No 2. Yes			2
B1a	**Type of contribution**	What do(es) political partner(s) provide to the XXX programme ?		0. No contribution 1.Financial/expertise/in kind contribution/ networking advocacy-visibility/institutional support 2. three or more of 1 (incl. financial/expertise/in kind)			2

B1b	**Person in charge of Political partnerships establishment and management**	Who is responsible for creating/handling the political commitment in your team? What are his/her tasks regarding it?		0. Nobody 1. someone but not a specific person of the team 2. one or more clearly identified people			2
B2a	**Municipal support**	Is the programme supported within the municipality?		0. No 1. sometimes 2.yes always			2
B2b	**Type of municipal contribution**	*How does this translate in practice (structures, organisations, human resources, funds)*		0. No contribution 1.Financial/expertise/in kind contribution/structures / organisations/ human resources 2. More than two of 1.			2
B3	**Advocacy of political partners NATIONAL LEVEL**	Do political partners actively advocate the programme? How?		0. No 1.A little (involved but passive) 2. Yes (pro-active)			2
	Add: Advocacy of political partners LOCAL LEVEL			0. No 1.A little (involved but passive)/some pro-active, some not 2. Yes (pro-active)			2

B4	**Programme reputation within political structures NATIONAL LEVEL**	What do the National/Regional political representatives think about the programme? (supporters, neutral, against)		a. Against b. Neutral c. Positive		NOT SCORED	
ADDITIONAL	**Opinion of political representative on programme LOCAL LEVEL**			a. Against b. Neutral c. Positive		NOT SCORED	
B5	**Political representative**	Are you working directly with a political representative representing the programme?		0. No 2. Yes			2
B5a		Who?				NOT SCORED	
B6	***Intersectoral contribution***	*Do the other sectors of the municipality contribute to the XXX programme?*		0. Not at all (or barely) 1. contribution in some of the communities 2. contribution in the majority of the communities			2

<

B6a	***Intersectoral collaboration***	*How? Is there cooperation between these sectors (Intersectoral cooperation)?*		0. Not at all (or barely) 1. Intersectoral in some of the communities 2. Intersectoral in the majority of the communities	Depends on the municipality rather than on the programme	NOT SCORED	
B6b	***Which sectors?***	Which ones?		0. 1 sector 1. 2-3 sectors 2. More than 3 sectors			2
B6c	***Elected representatives (aldermen/decision makers) contribution***	Do elected representatives of the municipality contribute to the programme?		0. No 1. Sometimes 2.Yes always			2
B7a	**Type of communication with Political partners**	How* do you communicate the progress of the programme to your political partners?		0. No communication 1. Some of the list **excl.** face-to face communication 2. Some of the list **incl.** face-to face communication	***List face-to-face meeting, telephone, skype, email, letter		2
B7b	**Frequency of Communication with Political partners**			0. 1 time / year or less 1. 2-3/year 2. more than 3/year			2
B9a	**Satisfaction**	Are you satisfied with the established political commitment?		a. No b. It could be better c. Yes, satisfied		NOT SCORED	

B9b	**Needs assessment**	What is needed to progress?				NOT SCORED	
					B. TOTAL		26
			C. PUBLIC AND PRIVATE PARTNERSHIPS				
CODE	**ELEMENT**	**INTERVIEW QUESTION**	**ANSWER**	**SCORING CATEGORIES**	**RESEARCHERS' COMMENT**	**POINTS SCORED**	**MAX POINTS**
C1	**Involvement of private partnerships**	Are any there PPPs involved?		0.No 1.Yes, occasionally 2.Yes, constantly			2
C1a	**PPP management in the team**	Who is responsible for creating/handling the PPPs in your team? What are his/her tasks regarding it?		0. Nobody 1. Someone but not a specific person of the team 2. One or more clearly identified people			2
C1b	**Type of involvement**	How PPP is being applied in the national/regional level? What does it mean for the programme (parties involved in the agreement – NGO and communication agency,				NOT SCORED	

		national/local authorities and private partners, government and NGO/for-profit organisation?					
C1c	**Financing PPP activities**	How is this activity (e.g. time/materials/personnel spent for recruitment and management) financed?				NOT SCORED	
C1d	**Facilitators and Barriers**	Helping factors/barriers for the development of PPP?				NOT SCORED	
C2	**Knowledge on PPPs**	Has knowledge been acquired for the development and management of PPP, and if so how?		0. No 1. Short training 2. Existing expertize or experience			2
C3	**Government opinion on PPP**	What is the position of the National/Regional government regarding PPP?		a. Negative/ reluctant b. Neutral c. Positive		NOT SCORED	
C5a	**NATIONAL LEVEL-Private**	Which are your actual partners?		0. 0 1. 1-3 2. more than 3			2
C5b	**NATIONAL LEVEL - Public/Non for profit**	Which are your actual partners?		0. 0 1. 1-3			2

				2. More than 3			
C5ci	**Potential Private Partners**					NOT SCORED	
C5cii	**Potential Public Partners**					NOT SCORED	
C6	**PPP CHARTER**			0. No charter 1. Some conditions / partner 2. Charter			2
C7a	**Contribution of private partners**	How do these parties contribute to the programme?		0. No contribution 1.Financial/expertise/in kind contribution/ networking advocacy-visibility/institutional support / human resources 2. 3 or more of 1st category (incl. financial/expertise/in kind)			2
C7b	**Contribution of public partners**	How do these parties contribute to the programme?		0. No contribution 1.Financial/expertise/in kind contribution/ networking advocacy-visibility/institutional	Within advocacy visibility is considered		2

				support / human resources 2. three or more of 1 (incl. financial/expertise/in kind)			
C8	**Motive for partnership**	Why did these partners join the programme? a. How did you convince them? b. What is the advantage for them to join the programme? / Good reputation? / Health of employees? / corporate social responsibility / other)?				NOT SCORED	
C9	**Communication with Private partners (frequency of contacts)**	How often do you meet your private partners and on what occasions*		0. 1 time / year or less (no face to face contact) 1. 2-3/year (incl. 1 face to face contact) 2. more than 3/year (incl. 1 face to face contact)	* List: face-to-face meeting, events		2
C10	**Satisfaction**	Are you satisfied with the established PPPs?		a. No b. It could be better c. Yes, satisfied	NOT SCORED		

x

C10i.	**Needs assessment**	What is needed to progress?				NOT SCORED	
					C. TOTAL		**16**
D. DEVELOPMENT OF INTERVENTIONS AND CAMPAINGS							
CODE	**ELEMENT**	**INTERVIEW QUESTION**	**ANSWER**	**SCORING CATEGORIES**	**RESEARCHERS' COMMENT**	**POINTS SCORED**	**MAX POINTS**
D1	**Are there interventions/campaigns**	Do you develop and implement interventions and/or campaigns? Specify		0. No 1. Occasionally 2. Systematically		2	2
D1a	**Level of implementation of intervention**	At what level?		Descriptive		NOT SCORED	
D2	**Knowledge for developing interventions/ campaigns**	Has knowledge been acquired regarding the design and deployment of interventions and/or campaigns? Specify. a. Existed expertise or training(s)? Could you explain?		0. No 1. Short training/short-term experience (less than 4 years and developed few interventions) 2. Expertize-appointed experts /long term experience (more than 4 years and developed			2

				various interventions)			
D3a	**Age groups of interventions / campaigns**	Which are the target groups of your interventions / campaigns? specify		0. One of the list 1. 2 target groups of the list 2. All 3 target groups of the list	List: Children 0-3, children 4-12, adolescents 13-18		2
D3b	**Parents as target groups**			0. No 1. Occasionally 2. Constantly (each campaign)	We need to know if there are specific interventions/actions towards parents-Account for it for 2nd appraisal		2
D3c	**Intermediate target groups**			0. None 1. Occasionally 2. Constantly			2
D3d	**Local stakeholders considered as target groups**	Do you consider the local stakeholders participating in the interventions and campaigns as target groups?		0. No 1. Occasionally 2. Constantly (each campaign)			2

D4	**Target group analysis**	Has a target group analysis been done? If yes, how did you use it?		0. No 1. Occasionally/partly 2. Constantly (each campaign)	Here analysis of the final target group assessed; social marketing in the field		2
D5a	**Multi-disciplinary team for the planning phase**	Could you please describe the process of the **planning** of an intervention? a. Who is responsible for this?		0. One expertise 1.Two expertise 2. 3 or more expertise			2
Additional	**commitment of the team in planning phase**	Do they work full time or part time?		1. Part time /Some part time, some full time/ on demand 2. Everyone full time			2
D5b	**Following a process to select a theme**	*How is the theme decided?* On what basis (needs analysis, focus groups, ITVs, feedback from local project managers). Please give details of the process.		0. No specific basis 1. Based on scientific knowledge or assessments on the local level 2. Based on scientific knowledge and assessments on the local level			2
D5c	**Multi-stakeholder involvement in the**	Who else is involved and what are the specific		0. No 1. Yes occasionally			2

	planning phase	tasks?		2. Yes constantly			
D5ci	**Final target group involvement in the planning phase**	Who else is involved and what are the specific tasks?		0. No 1. Yes occasionally 2. Yes constantly			2
D5cii	**Can Private partners intervene in the contents?**	Any private partners?		0. Yes 1. No			1
D5d	**Satisfaction regarding the planning**	Are you satisfied with the overall process for planning the interventions and campaigns? What is needed to progress?		a. No b. It could be better c. Yes, satisfied		NOT SCORED	
D5di	**Need assessment**	What is needed to progress?				NOT SCORED	
D6b	**Existence of a social marketing team OR Expert**	Who is developing the tools? Form contents to graphic design and printing		0. No 1. Yes, one person 2. Yes, a team			2
D6c	**Validation of the campaigns contents**	Is there anyone validating the contents of the tools/intervention? Please give details		0. No 1. Yes, by one expert (e.g. dietician) 2. Yes, by the SAB or more experts			2
D6e	**Training of the Local Manager**	Is there any training of the people involved in the field (form LPM to volunteers)?		0. No 1. For some activities/campaigns			2

				2. Yes, systematically			
D5f	**Satisfaction regarding the implementation**	Are you satisfied with the overall process for **implementing** the interventions and campaigns?		a. No b. It could be better c. Yes, satisfied		NOT SCORED	
D5fi	**Programme Need assessment**	What is needed to progress?				NOT SCORED	
D7	**Tools developed/used**	What tools do you develop for your target groups? (e.g. intervention guide, poster, leaflet, book, recipe sheet) -		0. None 1. Methodological or communication tools 2. methodological and communication tools	methodological tools (e.g. action sheet, guide) Communication tools (e.g leaflet, poster, whatever increase knowledge)		2
D8	**Use of tools from other programmes**	If there are on-going programmes / campaigns on childhood obesity prevention or on other related public health issues, do you make use of their tools? How?			Not a Social Marketing element	NOT SCORED	

D9	**Use of experience of local actors**	Do you use the experience of the local coordination teams/ actors directly involved for the design of future interventions/campaigns? A. If yes, how (the actions they have implemented, their methodology, the tools they have developed, their feedback on the tools etc)?		0. Never 1. Sometimes 2.Constantly			2
D10a	**Diversity of the themes**	What do your interventions/ campaigns (specify) include in terms of: a. Themes: Food habits/physical activity/ other		0. 1 theme (e.g. only PA) 1. 2 themes (e.g. PA and food habits) 2. More than 2 themes			2
D10ai	**Changing of the environment**			0. None 1. one macro/micro-environmental change 2. both macro/micro-environmental change or more on than one in any level	micro- (e.g. family, culture) and macro-level considered equally important; though more		2

					stakeholders involved in macro level		
D10b	**Diversity of the activities**	What do your interventions/ campaigns (specify) include in terms of: b. Activities: organization of events, workshops, PR/ other		0. single method/approach for short term 1. single method/approach for long term 2. Synergy of methods with interventions			2
ADDITIONAL	**Number of activities implemented / month**			0. Less than 3 1. 2 to 5 2. More than 5			2
					D. TOTAL		43

E. COMMUNICATION

CODE	ELEMENT	INTERVIEW QUESTION	ANSWER	SCORING CATEGORIES	RESEARCHERS' COMMENT	POINTS SCORED	MAX POINTS
E1	**Training of the coordination Team**	Has knowledge been acquired on communication / PR		0. No 1. Short training 2. Expertize/assigned to			2

		activities?		expert			
E2	**Communication materials and channels**	What communication materials and channels* do you use?		0. none 1. 1 to 4 channels 2. More than 4	*Website, Newsletter, Press releases, Press events, One-to-one direct communication (journalists, political, scientific, private partners), Newspapers, TV, social media, Web TV, Radio, Facebook, Twitter, Google +, Google groups, other		2
E3	**Communication responsibility**	Who is responsible. for the communication on the programme			For information	NOT SCORED	
E4	**Involvement of PPP**				There can be	NOT SCORED	

	in communication activities				advantages and inconvenience		
E5	**Existence of a communication plan**	Is there a communication plan? If yes, how often is it being set-up?		0. No 1. We answer when there is an opportunity 2. Communication plan			2
E6	**Evaluation of the PR campaigns**	Do you evaluate your PR communication?		0. No 1. Yes light (press clips) 2. Yes consistent (number of people reached, ROI)			2
E6a	**PR Results**					NOT SCORED	
E6b	**Satisfaction with communication results**	b. Are you satisfied with these results? Why?		a. No b. It could be better c. Yes, satisfied		NOT SCORED	
					E. TOTAL		8

F. SCIENTIFIC APSECTS

CODE	ELEMENT	INTERVIEW QUESTION	ANSWER	SCORING CATEGORIES	COMMENT	POINTS SCORED	MAX POINTS
F1a	**Existence of scientific support**	Did you create a scientific advisory board or		0. None 1. Expert consultation			2

		individual experts are collaborating occasionally, or both? Please explain.		on demand 2. SAB			
F1b	**Fields of expertize**	Who is part of it? What are their areas of expertise?		0. One expertise 1.Two expertise 2. 3 or more expertise			2
F1c	**Role of SAB / experts**	What are their responsibilities* within the programme?		0. Less than 2 (from list) 1. 2 to 3 (from list) 2. More than 3 (from list)	*List: Tools' contents, Tools' validation, Evaluation, publication, data collection, data analyses, programme design and implementation, applications for funds		2
F1d	**Scientific Spokesperson**	Do you have scientific spokespersons? Who?		0. No 1. Yes, but not a specific person 2. Yes, one or more clearly identified spokesperson			2

F1e	**Meeting frequency with scientific experts**	How often do you meet the scientific experts		0. 1 per year or less 1. 2 to 3 per year 2. More than 3 per year			2
F1f	**How is scientific support financed**					NOT SCORED	
F1g	**Satisfaction**	How do you feel about this collaboration?		a. No b. It could be better c. Yes, satisfied		NOT SCORED	
F2	**Training of the coordination team on sc. Aspects**	Have knowledge been acquired on the scientific aspects of the programme (understanding obesity, intervention protocol, evaluation) and if so how?				NOT SCORED	
F3	**Systematic evaluation approach**	Does an evaluation take place?		0. No 1. Yes, but not in representative sample/insufficient/sometimes 2. Yes, in a representative sample/ sufficient/always			2
F3a	**Evaluation framework**	Is there an evaluation framework?		0. No 2. Yes			2
F3ai	**Evaluation methodology**	Does it follow a specific methodology (e.g a logic		0. No 2. Yes			2

		model, definition of SMART objectives)?					
F3b	**Who responsible for the evaluation**	d. Who is responsible for the evaluation?		0. Nobody 1. No scientific discipline responsible 2. Scientific discipline (s) responsible			2
F4ai	**Is the central coordination level evaluated**	Are processes evaluated?		0. No 1. Yes, Sometimes/partly 2. Yes, Systematically			2
F4aii	**Is the local coordination level evaluated**	Are processes evaluated?		0. No 1. Yes, Sometimes/partly 2. Yes, Systematically			2
F4aiii	**Is the setting (actions) evaluated**	Are processes evaluated?		0. No 1. Yes, Sometimes/partly 2. Yes, Systematically			2
F4bi	**Are the children/families behaviour change evaluated**	Are effects evaluated?		0. No 1. Only once 2. Yes			2
F4bii	**BMI evaluation**	Are effects evaluated?		0. No 1. Only once 2. Yes			2

F5	**Frequency of evaluation**	At what points does evaluation take place?		0. No evaluation 1. After/one measurement 2. Before and after/ More regularly			2
	ADD Against a control group?			0. No control group 2. Yes			2
F6	**Satisfaction**	Are you satisfied with the evaluation process of your programme (what is evaluated, funding, feasibility)?		a. No b. It could be better c. Yes, satisfied		NOT SCORED	
F6i	**Need assessment**	What is needed to progress?				NOT SCORED	
F7	**Results**	Do you have implementation and evaluation results?		0. No 1. In process 2. Yes	Judging for the overall programme-existence of results		2
F7a	**Dissemination in communities and stakeholders**	How do you use them (scientific publication, dissemination, other use)		0.Not at all 1.Yes to the communities or stakeholders 3. Yes to communities and stakeholders			2

F7b	**scientific publications (peer review)**	b. Do you have scientific publications?		0.No 1. Under review 2.Yes			2
F8	**Participation to scientific events / year**	What scientific events do you participate in and how (poster, presentation, workshop…)?		0. None 1. Yes 1 to 3 2. Yes more than 3	score "yes or no" when number of conferences is missing		2
F9	**Attendance to sc. Events**					NOT SCORED	
F10	**% Budget for Evaluation**	% Budget for Evaluation		0. Less than 5% 1. 5 to 10% 2. More than 10%			2
					F. Total		**38**
TOTAL							

Chapter 3

Promoting health equity in European children: Design and methodology of the prospective EPHE (Epode for the Promotion of Health Equity) evaluation study.

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Abstract

Reducing health inequalities is a top priority of the European public health agendas. The EPHE project aims to analyse the added value of a community-based interventional programme based on the EPODE approach, adopted for the reduction of socioeconomic inequalities in childhood obesity. The interventions that will be implemented by this project focus on four energy balance-related behaviours (fruit and vegetable consumption, tap water intake, physical inactivity, sleep duration) and their determinants. This article presents the design of the effect evaluation of the EPHE project.

This is a prospective two-year follow-up evaluation study, which will collect data on the energy balance-related behaviours and potential environmental determinants of 6-8 year olds, depending on the socioeconomic status of the parents. For this purpose a parental self-reported questionnaire is constructed. This assesses the socioeconomic status of the parents (5 items) and the dietary (12 items), sedentary (2 items) and sleeping (4 items) behaviour of the child. Alongside potential family-environmental determinants are assessed. The EPHE parental questionnaire will be disseminated in schools of a selected medium-sized city in seven European countries (Belgium, Bulgaria, France, Greece, Portugal, Romania, The Netherlands). This study will evaluate the effects of the EPHE community-based interventional programmes. Furthermore, it will provide evidence for children's specific energy balance-related behaviours and family environmental determinants related to socio-economic inequalities, in seven European countries.

Introduction

Health inequalities between different population groups worldwide and in Europe exist due differences in factors that influence health, such as health related-behaviours, occupational class, education and income [1-3]. Apart from the health impacts of such disparities, the stakes are high even from an economic standpoint. According to the European Parliament, the estimated losses linked to health inequalities cost around 1.4% of GDP within the European Union in 2011[4].

Pronounced socio-economic inequalities affect the prevalence of non-communicable diseases between and within countries in Europe [2, 3, 5-9], and even at the local level (within-community/ neighbourhood) [2, 3, 5, 7, 8, 10]. Individuals of middle and lower income, occupation class and/or educational level are more likely to develop non-communicable diseases and are more exposed to related risk factors [1-3, 5, 6, 9]. The rates of obesity are higher and are increasing more rapidly in those with a relatively lower socio-economic status [5-7, 9, 11, 12]. Furthermore, unhealthy dietary habits and less active lifestyles are more common among subgroups with a relatively low socio-economic status [8-10, 13].

Tackling inequalities in overweight, obesity and related determinants has become a top priority for the European research and policy agendas over the last few years, stressing the necessity for action [6, 7, 9, 11, 14]. While action is needed, it is nevertheless imperative that evidence for the effectiveness of the proposed interventions in reducing inequalities in obesity is provided [5, 9].

The EPHE project

Based on the rationale outlined above, the "Epode for the Promotion of Health Equity" (EPHE) project was designed. EPHE is a European project

running from 2012 to 2015 with the support of the European Commission DG Health and Consumers. Its overall objective is to analyse the added value of community-based approaches -based on the EPODE approach [15, 16] in order to reduce inequities associated to childhood obesity and related determinants. Based on scientific evidence [10, 17-19], four determinants of obesity and overweight will be addressed by the EPHE interventions: promotion of fruit and vegetable intake, tap water intake, active lifestyle and adequate sleep duration. The project involves seven different community-based programmes across Europe (EPODE in France, HEALTHY KIDS in Bulgaria, JOGG in The Netherlands, Maia in Portugal, PAIDEIATROFI in Greece, SETS in Romania, VIASANO in Belgium) and is guided by an EPHE Scientific Advisory Board composed of representatives from 6 European Universities. Based on the results of the baseline measurements, the interventions will focus on the energy balance-related behaviours and their associated environmental determinants where there is the largest gap between high and low socio-economic status groups.

The EPHE evaluation study aims (1) to identify the energy balance-related behaviours and explore environmental determinants which are associated with inequalities in childhood obesity and overweight in seven European countries, (2) to assess the effectiveness of EPODE approach to tackle inequalities in obesity and overweight, (3) to assess the sustainability of potential effects, a year after the termination of the interventions and (4) to provide evidence-based results concerning the inequalities in childhood obesity and overweight across seven European countries. This article aims to describe the design and approach of the

effect evaluation of the EPHE project, which will assess the outcomes of the EPHE selected community-based programmes.

Methods/Design

The EPHE evaluation plan consists of a prospective two-year follow-up study. It will assess the behavioural change in some energy balance-related behaviours and their associated environmental determinants in children-according to their socio-economic status- and its sustainability over time. The evaluation study will be performed in three measurement periods; baseline (May-June 2013), after the end of the EPHE interventions (May-June 2014) and a year later (May-June 2015). All countries will follow this timeline, with exception of the baseline measurements of France that will be conducted on September 2013, due to practical restraints. The study will include only self-reported measurements by means of a parental questionnaire.

The survey obtained formal declaration from the Medical Ethics Committee of the VU University Medical Centre, that it does not fall under the scope of the Medical Sciences people research Act (WMO). In addition, permission to research in schools was acquired from local community and/or school authorities, where necessary.

City/town selection

Each country is represented by a member of its EPHE National Coordination Team, who is a member of the EPHE Operational Board. The National Coordination Team responsible for guiding the Local Project Managers, who are in charge of data collection at community level. All the countries will follow a standardised protocol for the selection of the EPHE-city and the data collection, which will be described further in this article.

The evaluation study, as well as the interventions, will be implemented in a medium-sized city/town, where the population will be diverse and made up of families with varying socio-economic statuses. The selected city/town should preferably not have implemented many interventions relevant to nutrition and physical activity addressed to the EPHE target group, in order to prevent inhibition of detecting differences between the socio-economic group.

To ensure the comparability among the participant communities, the National Coordination Teams must provide a description of the city they will select, before the baseline measurements are conducted. The description will include socio-economic information and health promotion programmes/campaigns conducted in the city/town, along with general information of the selected school(s), including infrastructure.

Sampling and recruitment

We aim at recruiting at least 150 families with children aged between 6 to 9 years old in every selected city/town with a similar variation regarding age and ethnicity per site, and a preferably low number of different ethnicities (other than the local) per site.

The families will be approached through schools. Every National Coordination Team and Local Team is in charge of engaging committing teachers in the selected schools to enable the distribution and collection of the questionnaires. Teachers, acting as mediators, will approach the families. The National Coordination Teams and Local Project Managers of every country are responsible for engaging and guiding school directors and teachers in order to recruit the participants. Parents will

be provided with an informed consent, describing the purpose of the study.

School selection

Of major importance is to account for the variability of the socio-economic status and ethnicity of the sample population, both within and between communities. For that reason, the schools should be selected from different neighbourhoods of various socio-economic statuses that ensure recruitment of a sample population including both higher and lower socio-economic statuses. This should be monitored in the city monitoring at the baseline.

Socio-economic assessment

Education, social class and income are the most commonly used indicators to assess the socio-economic status in nutritional research [12]. In this study educational level, employment status and income position will be used in order to categorise the socio-economic status of the parents. Given the current challenging economic instability of the European Union, employment status will be assessed instead of the social class. As for some countries it is difficult to evaluate or to obtain high quality data, we used the concept of perceived income position, asking parents to self-report their current financial status. Two socio-economic groups will be distinguished based on classification for each indicator: education (low-high), employment status (employed-not employed), income position (good-not good).

Data collection

In order to ensure the confidentiality of the data, a process to warrant the anonymity will be applied. Each city/town will receive the edited questionnaires labelled with the country's abbreviation and a three-

digit code, indicating the subject's number. This number will correspond to the family's name, indicated in a document that will be kept by the National Coordination Team of every country. As such, only the National Coordination Team will be aware of the subject's identity, for follow-up purposes. The filled out questionnaires, will be returned sealed in a provided envelope. The parents will be informed in advance for the process of confidentiality through an information letter, which will include the informed consent as well. Only the children that will return the informed consent indicating agreement of the parent will participate in the study.

The questionnaires will be distributed through schools. More specifically, the teachers will be provided with the labelled questionnaires and envelopes, which will be disseminated by them to the participating children in the class. Following this distribution, the children will give the questionnaires to their parents. The number of distributed questionnaires has to be noted down, in order to monitor the response rates after the collection.

Similarly, after a specified period of one to two weeks, the questionnaires shall be returned to the teachers. Finally the Local Project Managers will be responsible for collecting the returned questionnaires and deliver them to their National Coordination Team. Every National Coordination Team has to keep at least one hard copy of each document, for safety reasons. As mentioned earlier, each local University will have access to their national data.

Development of questionnaire

A self-reported questionnaire (Appendix 1) is developed, with questions addressed to the parents. The questionnaire will assess information

relevant to (1) the family's socio-economic status and household's food security level, (2) the child's energy balance-related behaviours and associated environmental determinants and (3) the parental perception of a healthy body of a child. Based on those measurements, it is expected that potential behavioural changes of the child and/or parents will be detected, which will reflect the EPHE- interventions.

The EPHE parental questionnaire was developed using items from relevant, validated questionnaires addressed in European populations. Items derived from validated questionnaires of large European socio-economic surveys [20, 21] were chosen to define the socio-economic status. For the assessment of the energy balance-related behaviours and their environmental determinants, items from the ENERGY parent and child questionnaires [22], the Pro-children child questionnaire [23] and its updated version PRO-GREENS [24], were used. These tools have been translated and validated in several European languages [23, 25], including some of our interest. Items with intraclass correlation coefficient (ICC) classified as "poor" (ICC < 0.5) were excluded [23, 25]. Concerning the household food security level, a short form of the household food security scale developed from the United States Department of Agriculture [26] was used. In order to assess the parent's perception of their child's body weight, the pictorial instrument and related questions developed by Collins [27] were used. All items derived from validated questionnaires were adapted for the needs of the EPHE parental questionnaire, where necessary. Additional items were constructed in the cases that no validated items or questionnaires existed to our knowledge.

The questionnaire will be translated in every language, respective to the participant countries and back-translated to English. It is mandatory for

all participant countries to use the same version, layout and format of questionnaire.

Data handling

The questionnaires from all countries will be shipped to the coordinating University in the Netherlands (Vrije University of Amsterdam), where the general analyses will be conducted. A scanned process from the same scanning company will facilitate the data transfer into SPSS files, for all three stages of the evaluation. All the national data will be made available to the national participant-University of country for further analysis.

Data cleaning and analysis plan

All the data sets will be checked for missing and double-crossed values. The missing values will be treated by the multiple imputation method. The sample will be divided in two groups, according to the socio-economic indicator used in the assessment. Descriptive analysis will include appropriate non-parametric tests for comparing means, in order to detect differences in behaviours and determinants between the two socio-economic groups. The SPSS software 21.0 (IBM Corp., Armonk, NY, USA) will be used for all the analyses.

Description of selected cities

In each country, EPODE municipality(ies) were selected by the local representatives (National Coordination Team) to participate in the EPHE poject. Table 1 illustrates the descriptive characteristics of the EPHE cities. All countries are represented by one city, with exceptions to France and Bulgaria where two towns\cities participate in the project.

All cities are considered as medium-sized for the country-specific standards. With exception of France, the selected cities are located in urbanised areas. In the cases of Bulgaria, Greece and Portugal, the cities belong to the metropolitan areas of the big cities, in contrary to the rest of the EPHE-cities. Figure 1 illustrates their location. Mouscron (Belgium) is positioned in the west of Belgium, in the French speaking part close to the French border. The towns of Triaditsa and Studenski (Bulgaria) belong to the metropolitan area of the capital city Sofia, located in the west of Bulgaria. Communauté de communes Flandres Lys (CCFL) (France) is located in the northeast of France. Marousi town (Greece) is part of the metropolitan of the capital city Athens, positioned in the centre of Greece. Maia city (Portugal) is situated to the north of to Porto city, in the north of Portugal. Otopeni (Romania) is located in the south of Romania, 15 kilometres northern to the capital, Bucharest. Zwolle (The Netherlands) is positioned in the north of The Netherlands, 120 kilometres northeast of Amsterdam. As shown in table 1, three out of the nine participant municipalities began the implementation of the EPODE approach during the last year, whereas the other six were already committed to an EPODE-like programme. Health campaigns launched by programmes other than those that are EPODE-like, are taking place in the majority of the engaged municipalities. However, these do not always overlap with the target group or the themes of EPHE.

Description of schools

The sample for the evaluation study will be recruited through schools, selected by the local coordinators of each country. The selection of schools took into account the need to obtain a mixed sample with children and families from different socioeconomic statuses.

Table 1. Descriptive characteristics of the EPHE cities.

EPHE -city, Country	Population *(census)*	Area	Year of entrance in EPODE
Mouscron, Belgium	56.008 *(2011)*	Urban	2006
Triaditsa, Bulgaria	65.000 *(2006)*	Urban	2012
Studentski, Bulgaria	71.961 *(2006)*		
Communauté de communes Flandres Lys, France	34.768 *(2009)*	Rural	1992
Marousi, Greece	72.480 *(2011)*	Urban	2010
Maia, Portugal	135.306 *(2011)*	Urban	2013
Otopeni, Romania	12.671 *(2013)*	Urban	2013
Zwolle, The Netherlands	122.625 *(2013)*	Urban	2010

Figure 1. Map of the cities participating in the EPHE programme**.**

In some countries we found these socioeconomic variations in the same school, but in other countries, schools belonging to different socioeconomic areas were selected. In Belgium, four schools (three public and one private) from low to medium\high socio-economic areas participate. In Bulgaria ten schools have been recruited (nine public and one private) from nine socio-economically mixed areas and one with higher SES. Greece has recruited two public schools, from mixed socio-economic areas, as has Portugal. In Romania one public school participates in the EPHE project, including students from a range of socio-economic statuses. On the contrary, in The Netherlands two public schools participate, located in the neighbourhoods from the lowest and the highest socio-economic statuses. Finally, in France two public schools are included, one from a low socio-economic area and the other on from an area with mixed socio-economic status.

Questionnaire constructs

A total number of 105 items are included in the EPHE parental questionnaire. The average time to fill it out will be approximately 45 minutes.

Descriptive and socio-economic variables

Descriptive and socio-economic information are assessed by ten items (table 2). The descriptive information includes the age and gender of both the parent the gives the responses and child. In addition, the number of people living in the household is assessed by two items. For the socio-economic assessment the years of education, labour status and type of working sector of both parents are required. In addition, the perception regarding the household income and its main source are assessed, given ethical restrictions to ask for the exact household

income. The six-item USDA questionnaire was used to examine the food security level of the household over the past year [26].

Energy balance related Behaviours

Dietary intake and determinants are assessed by sixty-five items, whereas sedentary lifestyle is assessed by fifteen items. Table 3 demonstrates the items of the energy balance-related behaviours of the child (i.e. dietary, sedentary and sleeping behaviours) as indicated in the EPHE parental questionnaire. The consumption of fruits and vegetables is assessed by food frequency questions, referring to a usual week. These items are derived from the Pro-children questionnaire [23]. A separate item for the potatoes was added in the questionnaire to avoid misclassification in the vegetables' category [23]. Additionally, two items assessing the portions of fruit and vegetables consumed daily are included. The consumption of fruit juices, soft drinks and diet soft drinks is assessed by means of weekly frequency, based on the ENERGY child questionnaire [22, 25].

In order to measure water consumption two frequency questions were constructed, assessing daily intake. Sedentary behaviour is assessed by means of time spent daily watching television and using/playing on digital devices, such as computers, assessing time spent during the week and the weekend separately. These questions are derived from the ENERGY child questionnaire [22, 25]. Furthermore, four questions, partly informed by the ENERGY parent questionnaire and partly constructed, assess the sleeping habits of the child [22]. Finally, three items- one informed by the ENERGY parent questionnaire and the other two by Collins- along with the pictorial instrument created by Collins (1991) [27], assess the parent's perception of their child's body weight.

Assessment of family environment

The description and questionnaire items regarding the family environmental variables, mentioned also as determinants of the energy balance-related behaviours, are demonstrated in Appendix 2. With reference to the Pro Children child questionnaire [23], and its updated version PRO-GREENS [24], and the ENERGY parental questionnaire [22], the family environmental variables can be distinguished into social, physical (i.e. home availability, situation specific habit) and economic (price influence) correlates. Given that the three reference questionnaires make use of slightly different correlates, here they are aggregated into one framework. Therefore, the social correlates include the following mediators for fruit and vegetable consumption: parental demand, parental allowing, active encouragement, facilitating, parental knowledge on recommendations; and the following mediators for fruit juice\soft drink consumption and TV viewing\computer time: paying attention\monitoring, parental allowance, negotiating, communicating health beliefs, avoid negative modelling, parental self-efficacy to manage child's intake, rewarding\comforting practice. All family environmental variables were assessed by one or two items, using a five response category format. Depending on the item the response categories range a. from (-2) I fully disagree to (2) I fully agree, b. from (1) never to (5) (yes) always, c. from (1) never to (5) every day. Exemptions are the variables assessing the situation of specific habit and the TV availability, where binary response categories are used (i.e. 1.yes, 2. no).

Table 2. Descriptive and socio-economic variables measured in the EPHE parental questionnaire

Variable	Questionnaire item	Response Categories
Descriptive		
Questionnaire respondent [a]	This questionnaire is filled in by:	(1) The mother (2) The stepmother (3) The father (4) The stepfather (5) The grandmother (6) The grandfather (7) The caregiver
Age of child	How old is your child?	(1) 6 (2) 7 (3) 8 (4) 9 and above
Age of parent (respondent) [b]	Which age group do you belong to?	(1) 20 and below (2) 20-24 (3) 25-30 (4) 31-35 (5) 36-40 (6) 41 and above
Size of the household [b]	1. How many persons live in your household, including yourself? 2. How many children (below 18 years old) live in your household?	1. (1) 2 persons (2) 3-4 persons (3) 5-6 persons (4) More than 6 persons 2. (1) 1 child (2) 2 children (3) 3 children (4) a children (5) more than 4 children
Socio-economic		
Education [b]	How many years have you/your partner spend in full time study including school?	(1) Less than 6 years (2) 6-8 years (3) 9-11 years (4) 12-14 years (5) 15-17 years (6) More than 17 years (7) I don't have a spouse /partner

Table 2. Descriptive and socio-economic variables measured in the EPHE parental questionnaire *(continued)*.

Variable	Questionnaire item	Response Categories
Labour status [b]	How would you define your/your partners' current labour status?	(1) Carry out a job or profession, including unpaid work for a family business or holding, including an apprenticeship or paid traineeship etc. (2) Unemployed (3) Student, further training, unpaid work experience (4) In retirement or early retirement or has given up business (5)Permanently disabled (6) In compulsory military or community service (7) Fulfilling domestic tasks (8) Other inactive person (9) I don't have a spouse /partner
Sector of employment [c]	Which of the types of organisation you/your spouse work/worked for?	(1) Central or local government (2) Other public sector (such as education and health) (3) A state-owned enterprise (4) A private firm (5) Self-employed (6) Other (7) I don't have a spouse /partner
Perception of income [c]	Which of the description below comes closest to how you feel about your household's income nowadays?	(1) Living comfortably on present income (2) Coping on present income (3) Finding it difficult on present income (4) Finding it very difficult on present income
Main source of income [c]	Please consider the income of all household members and any income which may be received by the household as a whole. What is the main source of income in your household?	(1) Wages or salaries (2) Income from self-employment (excluding farming) (3) Income from farming (4) Pensions (5) Unemployment/redundancy benefit (6) Any other social benefits or grants (7) Income from investment, savings, insurance property (8) Income from other sources

a**:** Item retrieved from the ENERGY parental questionnaire [22].
b**:** Item retrieved or adopted from the European Health Survey questionnaire [21].
c**:** Item retrieved from the European Social Survey questionnaire [20].

Table 3. Dietary, sedentary and sleeping behaviour measured in the EPHE parental questionnaire.

Energy balance-related behaviour	Questionnaire item	Response categories
Dietary Behaviour		
Fruit consumption [a]	1. How often does your child usually eat fresh fruit?	8-point scale; (1) Never (2) Less than 1 day/week (3) 1 day/week (4) 2–4 days a week (5) 5–6 days a week (6) Every day, once/day (7) Every day, twice a day (8) Every day, more than twice/day
Vegetable consumption [a]	1. How often does your child usually eat salad or grated vegetables?	
	2. How often does your child usually eat other raw vegetables?	
	3. How often does your child usually eat cooked vegetables (incl. vegetable soup)?	
Water consumption	1. How many times a day does your child usually drink water?	6-point scale; (1) Never (2) Less than once a day (3) Once a day (4) 2-4 times a day (5) 5-6 times a day (6) More than 6 times a day
	2. When your child drinks water, how many glass(es) does (s)he drink?	
Fruit juices consumption [b]	1. How many times a week does your child usually drink fruit juices?	7-point scale; (1) Never (2) Less than once a week (3) Once a week (4) 2-4 days a week (5) 5-6 days a week (6) Every day, once a day (7) Every day, more than once a day
	2. On a day that your child drinks fruit juices, how many glass(es), carton(s), bottle(s) or can(s) does (s)he drink?	
Soft drinks consumption [b]	1. How many times a week does your child usually drink soft drinks?	
	2. On a day that your child drinks soft drinks, how many glass(es), can(s) or bottle(s) does (s)he drink?	
Diet soft drinks	1. How many times a week does your child usually drink diet soft drinks?	
	2. On a day that your child drinks diet soft drinks, how many glasses, cans or bottles does (s)he drink?	

Table 3. Dietary, sedentary and sleeping behaviour measured in the EPHE parental questionnaire (*continued*).

Sedentary Behaviour		
Television viewing [b]	1. About how many hours a day does your child usually watch television in his/her free time?	9-point scale; (1) None at all (2) 30 minutes/day (3) 1.0 hour/day (4) 1.5 hours/day (5) 2.0 hours/ day (6) 2,5 hours/ day (7) 3.0 hours/ day (8) 3.5 hours/ day (9) 4.0 or more hours/ day
Computer time [b]	1. About how many hours a day does your child usually plays computer games or uses the computer for leisure activities?	
Sleeping Behaviour		
	1. Does your child have a set daily routine for bedtime? [b]	(1) yes (2) no
	2. How many hours a night does your child sleep? [b]	(1) 6-7 hours (2) 8-9 hours (3) 10-11 hours (4) 12 or more hours
	3. What time does your child usually goes to bed?	(1) At 18.00 o'clock (2) At 19.00 o'clock (3) At 20.00 o'clock (4) At 21.00 o'clock (5) At 22.00 o'clock (6) At 23.00 o'clock (7) After 23.00 o'clock
	4. What time does your child usually wake up?	(1) At 05.00 o'clock or earlier (2) At 06.00 o'clock at 07.00 o'clock (3) At 08.00 o'clock (4) At 09.00 o'clock (5) After 09.00 o'clock

a: Items based on the Pro children child questionnaire [23]
b: Items derived from the ENERGY parental questionnaire [22].

Discussion

This article describes the approach of the effect evaluation of the EPHE project, aimed to reduce the socio-economic inequalities in selected energy balance-related behaviours. The EPHE evaluation study is a two-year prospective follow-up survey, which will collect self-reported data of the energy balance-related behaviours of 6-8 year olds and their potential family environmental determinants, depending on the socio-economic status of the parents.

Little research has been conducted to associate childhood obesity and behavioural determinants with socio-economic inequalities at the country level [10]. Nevertheless, obesogenic environments seem to influence the energy balance-related behaviours of lower socio-economic populations to a greater extent when compared with higher socio-economic groups [12, 28, 29]. Screen exposure of children is inversely associated with parental education [30], whereas lower fruit and vegetable intake is observed more frequently in children whose parents have low education level [31, 32]. In contrast, specific behaviours and determinants of childhood obesity in relation to parental socio-economic status have yet to be identified. The current study will provide evidence for the existence of socio-economic inequalities related to children's energy balance-related behaviours and potential family environmental determinants, specifically regarding fruit and vegetable consumption, beverage consumption, sedentary lifestyle and sleeping behaviour.

This is one of the few evaluation studies that will assess the effectiveness of interventions in children from lower socio-economic statuses, whereas such evidence is limited [11]. The assessment of

potential family environmental correlates, influential to children's health behaviour, in the socio-economic context is one of the strengths of this study. Furthermore, the use of three different indicators to assess the socio-economic status of the families, while the most relevant studies use the educational level [30-32], is another strong element. It is worth mentioning that these correlates have shown moderate to good reliability and validity in European populations [23, 25]. To our knowledge, this is the first study to make use of such correlates in order to evaluate community-based interventions. In addition, the cross-cultural character of the sample will enable the exploration of inequalities in childhood obesity across different European countries.

It is important to note that this study has some limitations. The EPODE approach is conventionally implemented according to the needs and available resources of the community [15, 16]. Although this flexibility is an advantage for the implementation the EPODE approach itself, it complicates the establishment of a robust evaluation framework common for all communities [16]. Considering these elements, the capacity of the current evaluation study to account for the variations of the local practices and interventions that can influence the effect of the programme is limited. Additionally, relative differences (i.e. country-specific) by means of three indicators will approximately determine the socio-economic inequalities within-countries, instead of using more indicators. This reduces the strength of the study to detect absolute inequalities. Self-reported behaviours and determinants may lead to recall bias and eventual socially desirable answers. Furthermore, errors from the constructed items are possible, given that they are not

validated. Considering that the family environmental correlates are assessed mostly by one item each, the reliability of the instrument may be violated [22]. Another weakness is the lack of a comparison group, which may result to biased effect size. Finally, this is an observational study and consequently, no conclusions about causality will be drawn.

Considering the strengths and limitations of this evaluation study design, we believe that this study will contribute to the available knowledge and allow the scientific community to further explore and describe the health inequalities in sedentary lifestyle, dietary intake and sleep and relevant family environmental across European countries, especially now during the economic crisis in Europe.

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Appendices

Appendix 1. The EPHE parental questionnaire.

PARENTAL QUESTIONNAIRE FOR THE CHILD'S ENERGY BALANCE-RELATED BEHAVIOR

Final

Student number

PART I

General questions

Socio-demographic information

S1. This questionnaire is filled in by:
Please tick one box.

- ❑ The mother
- ❑ The stepmother
- ❑ The father
- ❑ The stepfather
- ❑ The grandmother
- ❑ The grandfather
- ❑ The caregiver

S2. How old is your child?

- ❑ 6 years old
- ❑ 7 years old
- ❑ 8 years old
- ❑ 9 years old and above

S3. What is the sex of your child?

- ❑ Boy
- ❑ Girl

S4. Which age group do you belong to?

- ❑ Below 20
- ❑ 20-24
- ❑ 25-30
- ❑ 31-35
- ❑ 36-40
- ❑ above 40

S5. How many years have you/your partner spend in full time study including school?

Me

- ❑ Less than 6 years
- ❑ 6-8 years
- ❑ 9-11 years
- ❑ 12-14 years
- ❑ 15-17 years
- ❑ More than 17 years

Spouse/partner

- ❑ Less than 6 years
- ❑ 6-8 years
- ❑ 9-11 years
- ❑ 12-14 years
- ❑ 15-17 years
- ❑ More than years 17

❑ I don't have a spouse /partner

Student number

S6. How would you define your/your partners' current labour status?

Please tick one box in every column.

Me	Spouse/partner	
❑ Carry out a job or profession, including unpaid work for a family business or holding, including an apprenticeship or paid traineeship etc.	❑ Carry out a job or profession, including unpaid work for a family business or holding, including an apprenticeship or paid traineeship etc.	❑ I don't have a spouse/partner
❑ Unemployed	❑ Unemployed	
❑ Student, further training, unpaid work experience	❑ Student, further training, unpaid work experience	
❑ In retirement or early retirement or has given up business	❑ In retirement or early retirement or has given up business	
❑ Permanently disabled	❑ Permanently disabled	
❑ In compulsory military or community service	❑ In compulsory military or community service	
❑ Fulfilling domestic tasks	❑ Fulfilling domestic tasks	
❑ Other inactive person	❑ Other inactive person	

S7. Which of the types of organisation you/your spouse work/worked for?

Me	Spouse/partner	
❑ Central or local government	❑ Central or local government	❑ I don't have a spouse/partner
❑ Other public sector (such as education and health)	❑ Other public sector (such as education and health)	
❑ A state-owned enterprise	❑ A state-owned enterprise	
❑ A private firm	❑ A private firm	
❑ Self-employed	❑ Self-employed	
❑ Other	❑ Other	

Student number

Household information

S8. How many adults live in your household, including yourself?

- ❑ 1 person
- ❑ 2 persons
- ❑ 3-4 persons
- ❑ 5-6 persons
- ❑ More than 6 persons

S9. How many children (below 18 years old) live in your household?

- ❑ 1 child
- ❑ 2 children
- ❑ 3 children
- ❑ 4 children
- ❑ More than 4 children

S10. Which of the description below comes closest to how you feel about your household's income nowadays?

- ❑ Living comfortably on present income
- ❑ Coping on present income
- ❑ Finding it difficult on present income
- ❑ Finding it very difficult on present income

S11. Please consider the income of all household members and any income which may be received by the household as a whole. What is the main source of income in your household?

- ❑ Wages or salaries
- ❑ Income from self-employment (excluding farming)
- ❑ Income from farming
- ❑ Pensions
- ❑ Unemployment/redundancy benefit
- ❑ Any other social benefits or grants
- ❑ Income from investment, savings, insurance property
- ❑ Income from other sources

Student number

For the following statements that people have made about their food situation, please mark how do they apply in your situation, over the last 12 months;

S12. "The food that I bought just didn't last, and I didn't have money to get more". Was that:

- ❑ Often true
- ❑ Sometimes true
- ❑ Never true
- ❑ Don't know

S13. "I couldn't afford to eat balanced meals". Was that:

- ❑ Often true
- ❑ Sometimes true
- ❑ Never true
- ❑ Don't know

S14. In the last 12 months did you in your household ever cut up the size of meals or skip meals because there was not enough money for food?

- ❑ Yes
- ❑ No

If NO, go to question S15

S14a. If yes, how often did this happen?

- ❑ Almost every month
- ❑ Some months but not every month
- ❑ Only 1 or 2 months
- ❑ Don't know

S15. In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food?

- ❑ Yes
- ❑ No
- ❑ Don't know

S16. In the last 12 months, were you ever hungry but didn't eat because there wasn't enough money for food?

- ❑ Yes
- ❑ No
- ❑ Don't know

Student number

PART II

a. Some questions about fruit and vegetables

You child's fruit and vegetable consumption habits

F1. How often does your child usually eat fresh fruit?

- ❑ Never
- ❑ Less than one day per week
- ❑ One day per week
- ❑ 2-4 days a week
- ❑ 5-6 days a week
- ❑ Every day, once a day
- ❑ Every day, twice a day
- ❑ Every day, more than twice a day

F2. How often does your child usually eat salad or grated vegetables?

- ❑ Never
- ❑ Less than one day per week
- ❑ One day per week
- ❑ 2-4 days a week
- ❑ 5-6 days a week
- ❑ Every day, once a day
- ❑ Every day, twice a day
- ❑ Every day, more than twice a day

F3. How often does your child usually eat other raw vegetables?

- ❑ Never
- ❑ Less than one day per week
- ❑ One day per week
- ❑ 2-4 days a week
- ❑ 5-6 days a week
- ❑ Every day, once a day
- ❑ Every day, twice a day
- ❑ Every day, more than twice a day

F4. How often does your child usually eat potatoes?

- ❑ Never
- ❑ Less than one day per week
- ❑ One day per week
- ❑ 2-4 days a week
- ❑ 5-6 days a week
- ❑ Every day, once a day
- ❑ Every day, twice a day
- ❑ Every day, more than twice a day

Student number

F5. How often does your child usually eat cooked vegetables (incl. vegetable soup)?

- ❑ Never
- ❑ Less than one day per week
- ❑ One day per week
- ❑ 2-4 days a week
- ❑ 5-6 days a week
- ❑ Every day, once a day
- ❑ Every day, twice a day
- ❑ Every day, more than twice a day

F6. I do not give my child some foods, because they cost too much.

- ❑ I fully agree
- ❑ I agree a somewhat
- ❑ Neither agree nor disagree
- ❑ I disagree somewhat
- ❑ I fully disagree

F7. What do you consider to be the three most important characteristics of your child's meal? *Please tick three boxes*

- ❑ Nutritious
- ❑ Provides energy
- ❑ Exhibits high variety
- ❑ Satisfies my child's liking
- ❑ Home-prepared
- ❑ Organic
- ❑ Vegetarian
- ❑ Taking into account religious requirements

Some questions about fruit only

F8. How many serving portions of fruits does your child eat per day?

- ❑ None
- ❑ 1*(serving portion-country specific)*
- ❑ 2 *(serving portions-country specific)*
- ❑ 3*(serving portions-country specific)*
- ❑ 4 *(serving portions-country specific)*
- ❑ 5 or more *(serving portions-country specific)*

Student number

F9. Do you think that your child eats much or a little fruit?

- ❑ Very much fruit
- ❑ Much fruit
- ❑ Not much, not little
- ❑ Little fruit
- ❑ Very little fruit

F10. How much fruit do you think your child should eat to have a healthy diet?

- ❑ No fruit
- ❑ 1-3 pieces per week
- ❑ 4-6 pieces per week
- ❑ 1 piece per day
- ❑ 2 pieces per day
- ❑ 3 pieces per day
- ❑ 4 pieces per day
- ❑ 5 pieces per day or more

F11. My spouse/partner and/or I often encourage our child to eat fruits.

- ❑ I fully agree
- ❑ I agree somewhat
- ❑ Neither agree nor disagree
- ❑ I disagree somewhat
- ❑ I fully disagree

F12. We often eat fruit together the whole family.

- ❑ I fully agree
- ❑ I agree somewhat
- ❑ Neither agree nor disagree
- ❑ I disagree somewhat
- ❑ I fully disagree

F13. It is a habit of my child to eat fruit every day.

- ❑ I fully agree
- ❑ I agree somewhat
- ❑ Neither agree nor disagree
- ❑ I disagree somewhat
- ❑ I fully disagree

F14. Does your child usually bring fruit with him/her at school?

- ❑ Yes, always
- ❑ Yes, most days
- ❑ Sometimes
- ❑ Seldom
- ❑ Never

Student number

F15. Do you and/or your spouse/partner tell your child to eat fruit every day?

- ❑ Yes, always
- ❑ Yes, most days
- ❑ Sometimes
- ❑ Seldom
- ❑ Never

F16. Is your child allowed to eat as much fruit as (s)he likes at home?

- ❑ Yes, always
- ❑ Yes, most days
- ❑ Sometimes
- ❑ Seldom
- ❑ Never

F17. Are there usually different kinds of fruits available in your home?

- ❑ Yes, always
- ❑ Yes, most days
- ❑ Sometimes
- ❑ Seldom
- ❑ Never

F18. Do you or your spouse/partner usually cut up fruit for your child in between meals?

- ❑ Yes, always
- ❑ Yes, most days
- ❑ Sometimes
- ❑ Seldom
- ❑ Never

Some questions about vegetables only

F19. How many serving portions of vegetables does your child eat per day?

- ❑ None
- ❑ 1*(serving portion-country specific)*
- ❑ 2 *(serving portions-country specific)*
- ❑ 3*(serving portions-country specific)*
- ❑ 4 *(serving portions-country specific)*
- ❑ 5 or more *(serving portions-country specific)*

Student number

F20. Do you think that your child eats many or few vegetables?

- ❑ Very many vegetables
- ❑ Many vegetables
- ❑ Not many, not few
- ❑ Few vegetables
- ❑ Very few vegetables

F21. How many vegetables do you think your child should eat to have a healthy diet?

- ❑ No vegetables
- ❑ 1 - 3 portions (serving spoons) per week
- ❑ 4 - 6 portions (serving spoons) per week
- ❑ 1 portion (serving spoon) every day
- ❑ 2 portions (serving spoons) every day
- ❑ 3 portions (serving-spoons) every day
- ❑ 4 portions (serving-spoons) every day
- ❑ 5 or more portions (serving spoons) every day

F22. My spouse/partner and/or I often encourage our child to eat vegetables every day.

- ❑ I fully agree
- ❑ I agree somewhat
- ❑ Neither agree nor disagree
- ❑ I disagree somewhat
- ❑ I fully disagree

F23. We often eat vegetables together the whole family.

- ❑ I fully agree
- ❑ I agree somewhat
- ❑ Neither agree nor disagree
- ❑ I disagree somewhat
- ❑ I fully disagree

F24. It is a habit for my child to eat vegetables every day.

- ❑ I fully agree
- ❑ I agree somewhat
- ❑ Neither agree nor disagree
- ❑ I disagree somewhat
- ❑ I fully disagree

F25. Does your child usually bring vegetables with him/her at school?

- ❑ Yes, always
- ❑ Yes, most days
- ❑ Sometimes
- ❑ Seldom
- ❑ Never

Student number

F26.Which of the following vegetables does your child like or dislike?

Please, tick one box in every line

	Like very much	Like a bit	Dislike a bit	Dislike very much	Have not tried
Tomatoes	❑	❑	❑	❑	❑
Cucumber	❑	❑	❑	❑	❑
Lettuce	❑	❑	❑	❑	❑
Cabbage	❑	❑	❑	❑	❑
Spinach	❑	❑	❑	❑	❑
Leak	❑	❑	❑	❑	❑
Green beans	❑	❑	❑	❑	❑
Onion	❑	❑	❑	❑	❑
Carrots	❑	❑	❑	❑	❑
Broccoli	❑	❑	❑	❑	❑
Cauliflower	❑	❑	❑	❑	❑
Green peas	❑	❑	❑	❑	❑

F27. Do you and/or your spouse/partner tell your child to eat vegetables every day?

- ❑ Yes, always
- ❑ Yes, most days
- ❑ Sometimes
- ❑ Seldom
- ❑ Never

F28. Is your child allowed to eat as many vegetables as (s)he would like at home?

- ❑ Yes, always
- ❑ Yes, most days
- ❑ Sometimes
- ❑ Seldom
- ❑ Never

Student number

F29. Are there usually different kinds of vegetables available in your home?

- ❑ Yes, always
- ❑ Yes, most days
- ❑ Sometimes
- ❑ Seldom
- ❑ Never

F30. Do you or your spouse/partner usually cut up vegetables for your child in between meals?

- ❑ Yes, always
- ❑ Yes, most days
- ❑ Sometimes
- ❑ Seldom
- ❑ Never

F31. Are there usually vegetables served with dinner (or lunch) at your home?

- ❑ Yes, always
- ❑ Yes, most days
- ❑ Sometimes
- ❑ Seldom
- ❑ Never

Student number

Some Questions about water

In this section we mean water from the tap or water from bottles (artesian well water, spring water, mineral water and sparkling water).

G1. How many times a day does your child usually drink water?

- ❑ Never
- ❑ Less than once a day
- ❑ Once a day
- ❑ 2-4 times a day
- ❑ 5-6 times a day
- ❑ More than 6 times a day

G2. When your child drinks water, how many glass(es) does (s)he drink?

- ❑ None
- ❑ 1 glass
- ❑ 2 glasses
- ❑ 3 glasses
- ❑ 4 glasses
- ❑ 5 or more glasses

G3. Does your child drink water during mealtime?

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

G4. Does your child drink water between meals?

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

G5. Does your child drink water during/after sports or playing?

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

Student number

Some questions about fruit juices

By fruit juices we mean fruit juices made from concentrated fruit juices and 100% freshly blended fruit juices.

J1. How many times a week does your child usually drink fruit juices?

- ❑ Never
- ❑ Less than once a week
- ❑ Once a week
- ❑ 2-4 days a week
- ❑ 5-6 days a week
- ❑ Every day, once a day
- ❑ Every day, more than once a day

J2. In which situation(s) is your child most likely to drink fruit juices?

You may tick more than one boxes

- ❑ During the weekend
- ❑ Breakfast
- ❑ Lunch
- ❑ Dinner
- ❑ At school
- ❑ While watching television
- ❑ As a thirst quencher between meal
- ❑ During/after sports
- ❑ At birthdays/parties
- ❑ (S)he never drinks fruit juices

J3. On a day that your child drinks fruit juices, how many glass(es), carton(s), bottle(s) or can(s) does (s)he drink? *Please tick a box in every column*

a. Glasses or small cartons (250 ml)

- ❑ None
- ❑ 1 glass/cartons
- ❑ 2 glasses/cartons
- ❑ 3 glasses/cartons
- ❑ 4glasses/cartons
- ❑ 5 or more glasses/cartons

b. Regular cans/cartons/ bottles (330ml)

- ❑ None
- ❑ 1 can/carton/bottle
- ❑ 2 cans/cartons/bottles
- ❑ 3 cans/cartons/ bottles
- ❑ 4 cans/cartons/ bottles
- ❑ 5 or more cans/cartons/ bottles s

Student number

J4. There are fruit juices available at home for my child.

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

J5. I pay attention to the amount of fruit juices my child drinks.

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

J6. If my child asks for fruit juices, I will give it to him/her.

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

J7. My child is allowed to take fruit juices whenever (s)he wants.

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

J8. I negotiate with my child how much fruit juices (s)he is allowed to drink.

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

J9. How often do you tell your child that fruit juices are not good for him/her?

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

J10. How often do you tell your child that fruit juices make him/her fat?

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

J11. If I would like to drink fruit juices, I would restrain myself because of the presence of my child.

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

Student number

J12. If I prohibit my child from drinking fruit juices, (s)he tries to drink anyway.

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

J13. If I prohibit my child from drinking fruit juices, I find it difficult to stick to my rule(s) if (s)he starts negotiating.

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

J14. I give fruit juices to my child as a reward or to comfort him/her.

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

J15. How often do you and/or your spouse/partner drink fruit juices together with your child?

- ❑ Never
- ❑ Less than once a week
- ❑ Once a week
- ❑ 2-4 days a week
- ❑ 5-6 days a week
- ❑ Every day, once a day
- ❑ Every day, more than once a day

Student number

Some questions about soft drinks

By soft drinks, we mean fizzy drinks and fruit squash, but NOT diet drinks and fruit juices. Examples:

Fizzy drinks are: cola, 7-up, Pepsi, Fanta, Sprite etc.

Fruit squash/ cordials: Ice tea, lemonade etc.

Sport and energy drinks: lucozade, redbull etc.

K1. How many times a week does your child usually drink soft drinks?

- ❑ Never
- ❑ Less than once a week
- ❑ Once a week
- ❑ 2-4 days a week
- ❑ 5-6 days a week
- ❑ Every day, once a day
- ❑ Every day, more than once a day

K2. In which situation(s) is your child most likely to drink soft drinks?

You may tick more than one boxes

- ❑ During the weekend
- ❑ Breakfast
- ❑ Lunch
- ❑ Dinner
- ❑ At school
- ❑ While watching television
- ❑ As a thirst quencher between meal
- ❑ During/after sports
- ❑ At birthdays/parties
- ❑ (S)he never drinks fruit juices

Student number

K3. On a day that your child drinks soft drinks, how many glass(es), can(s) or bottle(s) does (s)he drink? *Please tick a box in every column*

a. Glasses or small bottles (250 ml)

- ❑ None
- ❑ 1 glass/small bottle
- ❑ 2 glasses/small bottles
- ❑ 3 glasses/ small bottles
- ❑ 4glasses/ small bottles
- ❑ 5 or more glasses/ small bottles

b. Cans (330ml)

- ❑ None
- ❑ 1 can
- ❑ 2 cans
- ❑ 3 cans
- ❑ 4 cans
- ❑ 5 or cans

c. Bottles (500 ml)

- ❑ None
- ❑ 1 bottle
- ❑ 2 bottles
- ❑ 3 bottles
- ❑ 4 bottles
- ❑ 5 or more bottles

K4. There are soft drinks available at home for my child.

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

K5. I pay attention to the amount of soft drinks my child drinks.

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

K6. If my child asks for soft drinks, I will give it to him/her.

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

K7. My child is allowed to take soft drinks whenever (s)he wants.

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

Student number

K8. How often do you tell your child that soft drinks are not good for him/her?

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

K9. How often do you tell your child that soft drinks make him/her fat?

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

K10. If I would like to drink soft drinks, I would restrain myself because of the presence of my child.

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

K11. If I prohibit my child from drinking soft drinks, (s)he tries to drink anyway.

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

K12. If I prohibit my child from drinking soft drinks, I find it difficult to stick to my rule(s) if (s)he starts negotiating

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

K13. I give soft drinks to my child as a reward or to comfort him/her.

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

Student number

K14. How often do you (one parent/ spouse/partner or both) drink soft drinks together with your child?

- ❑ Never
- ❑ Less than once a week
- ❑ Once a week
- ❑ 2-4 days a week
- ❑ 5-6 days a week
- ❑ Every day, once a day
- ❑ Every day, more than once a day

Student number

Some questions about diet soft drinks

D1. How many times a week does your child usually drink diet soft drinks?

- ❑ Never
- ❑ Less than once a week
- ❑ Once a week
- ❑ 2-4 days a week
- ❑ 5-6 days a week
- ❑ Every day, once a day
- ❑ Every day, more than once a day

D2. On a day that your child drinks diet soft drinks, how many glasses, cans or bottles does (s)he drink? *Please tick a box in every column.*

a. Glasses or small bottles (250 ml)

- ❑ None
- ❑ 1 glass/small bottle
- ❑ 2 glasses/small bottles
- ❑ 3 glasses/ small bottles
- ❑ 4 glasses/ small bottles
- ❑ 5 or more glasses/ small bottles

b. Cans (330ml)

- ❑ None
- ❑ 1 can
- ❑ 2 cans
- ❑ 3 cans
- ❑ 4 cans
- ❑ 5 or cans

c. Bottles (500 ml)

- ❑ None
- ❑ 1 bottle
- ❑ 2 bottles
- ❑ 3 bottles
- ❑ 4 bottles
- ❑ 5 or more bottles

Student number

Part III

Questions about your child's screen behaviour

For the following questions, when we say watching television, we mean also watching DVD's, videos and watching films in the computer.

By computer games, we mean also games in mobile phone/computer/ tablets and consoles (e.g. playstation)

T1. About how many hours a day does your child usually watch television in his/her free time?

a. Weekdays (average of all weeks)

- ❑ None at all
- ❑ 30 minutes/day
- ❑ 1,0 hour/day
- ❑ 1,5 hours/day
- ❑ 2,0 hours/ day
- ❑ 2,5 hours/ day
- ❑ 3,0 hours/ day
- ❑ 3,5 hours/ day
- ❑ 4,0 or more hours/ day

b. Weekend days (average of all weekends)

- ❑ None at all
- ❑ 30 minutes/day
- ❑ 1,0 hour/day
- ❑ 1,5 hours/day
- ❑ 2,0 hours/ day
- ❑ 2,5 hours/ day
- ❑ 3,0 hours/ day
- ❑ 3,5 hours/ day
- ❑ 4,0 or more hours/ day

T2. TV is available in my child's room.

- ❑ Yes
- ❑ No

T3. How often is the TV on during dinner (supper/ evening meal) in your home?

- ❑ Every day
- ❑ 4-6 days a week
- ❑ 1-3 days a week
- ❑ Less than 1 day week
- ❑ Never

Student number

T4. About how many hours a day does your child usually plays computer games or uses the computer for leisure activities? *Please tick one box in every column*

a. Weekdays (average of all weeks)	b. Weekend days (average of all weekends)
☐ None at all	☐ None at all
☐ 30 minutes/day	☐ 30 minutes/day
☐ 1,0 hour/day	☐ 1,0 hour/day
☐ 1,5 hours/day	☐ 1,5 hours/day
☐ 2,0 hours/ day	☐ 2,0 hours/ day
☐ 2,5 hours/ day	☐ 2,5 hours/ day
☐ 3,0 hours/ day	☐ 3,0 hours/ day
☐ 3,5 hours/ day	☐ 3,5 hours/ day
☐ 4,0 or more hours/ day	☐ 4,0 or more hours/ day

For questions T5-T13, please tick one box in column a AND b.

T5. I pay attention to the amount of the time my child:

a. watches TV	b. plays computer games
☐ Always	☐ Always
☐ Often	☐ Often
☐ Sometimes	☐ Sometimes
☐ Not often	☐ Not often
☐ Never	☐ Never

T6. If my child asks if (s)he is allowed to watch TV/play computer games I will allow it:

a. watch TV	b. play computer games
☐ Always	☐ Always
☐ Often	☐ Often
☐ Sometimes	☐ Sometimes
☐ Not often	☐ Not often
☐ Never	☐ Never

Student number

T7. My child is allowed to watch TV/play computer games whenever (s)he wants:

a. watch TV	b. play computer games
❑ Always	❑ Always
❑ Often	❑ Often
❑ Sometimes	❑ Sometimes
❑ Not often	❑ Not often
❑ Never	❑ Never

T8. I negotiate with my child how much (s)he is allowed to watch TV/play computer games:

a. watch TV	b. play computer games
❑ Always	❑ Always
❑ Often	❑ Often
❑ Sometimes	❑ Sometimes
❑ Not often	❑ Not often
❑ Never	❑ Never

T9. If I would like to watch TV/use the computer for leisure time, I would restrain myself because of the presence of my child.

a. watch TV	b. use computer
❑ Always	❑ Always
❑ Often	❑ Often
❑ Sometimes	❑ Sometimes
❑ Not often	❑ Not often
❑ Never	❑ Never

Student number

T10. If I prohibit my child to watch TV/use the computer for leisure time, (s)he would do it anyway.

a. watch TV	b. use computer
❑ Always	❑ Always
❑ Often	❑ Often
❑ Sometimes	❑ Sometimes
❑ Not often	❑ Not often
❑ Never	❑ Never

T11. If I prohibit my child from watching TV/playing computer games, I find it difficult to stick to my rule(s) if (s)he starts negotiating:

a. watching TV	b. playing computer games
❑ Always	❑ Always
❑ Often	❑ Often
❑ Sometimes	❑ Sometimes
❑ Not often	❑ Not often
❑ Never	❑ Never

T12. I allow my child to watch TV/ play computer games as a reward or to comfort him/her.

a. watch TV	b. play computer games
❑ Always	❑ Always
❑ Often	❑ Often
❑ Sometimes	❑ Sometimes
❑ Not often	❑ Not often
❑ Never	❑ Never

Student number

T13. How often do you and/or spouse/ partner watch television/play computer games together with your child?

a. watch TV

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

b. play computer games

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

T14. How often do you tell to your child that watching TV/playing computer games is not good for him/her?

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

T15. How often do you tell to your child that watching TV/playing computer games makes him/her fat?

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Not often
- ❑ Never

a. Some questions about your child's sleep

L1. Does your child have a set daily routine for bedtime?

- ❑ Yes
- ❑ No

Student number

L2. How many hours a night does your child sleep?

Please tick one box in every column.

a. Weekdays(average per night)	b. Weekend days (average per night)
❑ 6-7 hours	❑ 6-7 hours
❑ 8-9 hours	❑ 8-9 hours
❑ 10-11 hours	❑ 10-11 hours
❑ 12 or more hours	❑ 12 or more hours

L3. What time does your child usually goes to bed?

Please tick one box in every column.

a. Weekdays (average of all weeks)	b. Weekend days (average of all weekends)
❑ At 18.00 o'clock	❑ At 18.00 o'clock
❑ At 19.00 o'clock	❑ At 19.00 o'clock
❑ At 20.00 o'clock	❑ At 20.00 o'clock
❑ At 21.00 o'clock	❑ At 21.00 o'clock
❑ At 22.00 o'clock	❑ At 22.00 o'clock
❑ At 23.00 o'clock	❑ At 23.00 o'clock
❑ After 23.00 o'clock	❑ After 23.00 o'clock

L4.What time does your child usually wake up?

Please tick one box in every column.

a. Weekdays(average of all weeks)	b. Weekend days (average of all weekends)
❑ At 05.00 o'clock or earlier	❑ At 05.00 o'clock or earlier
❑ At 06.00 o'clock	❑ At 06.00 o'clock
❑ At 07.00 o'clock	❑ At 07.00 o'clock
❑ At 08.00 o'clock	❑ At 08.00 o'clock
❑ At 09.00 o'clock	❑ At 09.00 o'clock
❑ After 09.00 o'clock	❑ After 09.00 o'clock

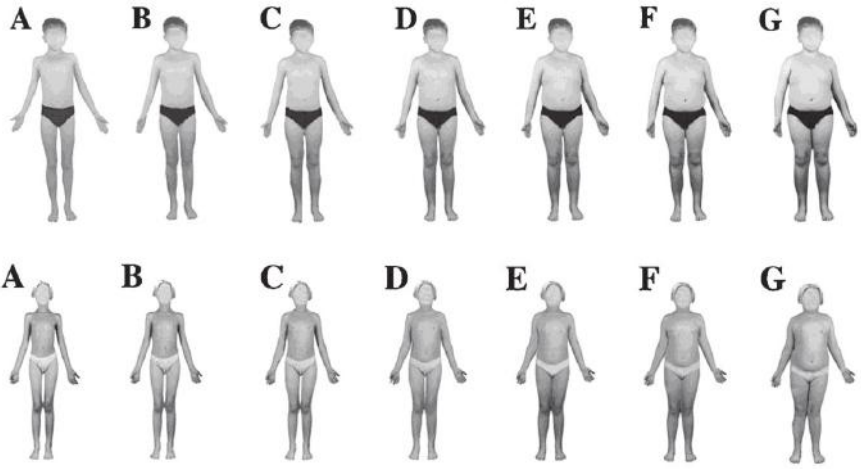
Student number

c. Some questions about your child's weight

W1. What do you think about your child's weight?

- ❑ My child's weight is ok
- ❑ My child's weight is a bit too much
- ❑ My child's weight is way too much
- ❑ My child's weight is a bit too little
- ❑ My child's weight is way too little

Please look carefully the picture below and answer the following questions:



W2. Choose at the figure that you think most accurately represents your child at this moment

Write down the letter of the figure

☐

W3. Choose the figure that you think that represents the one you think would be the best for your child

Write down the letter of the figure

☐

Thank you for completing this questionnaire!

Appendix 2. Measurement items of each determinant per energy balance-related behaviour of the EPHE parental questionnaire.

Family Environmental categorised correlates								
	Description	**Fruit** [a]	**Vegetables** [a]	**Water**	**Fruit juices** [b]	**Soft drinks** [b]	**Television viewing** [b]	**Computer time**
Social Environment								
Parenting practices	Assessing parenting rules and practices applied to the child in relation to energy balance-related behaviours	1. My spouse/partner and/or I often encourage our child to eat fruits.	1. My spouse/partner and/or I often encourage our child to eat vegetables every day.		1. I pay attention to the amount of fruit juices my child drinks.	1. I pay attention to the amount of soft drinks my child drinks.	1. I pay attention to the amount of the time my child watches TV.	1. I pay attention to the amount of the time my child plays computer games.
		2. Do you and/or your spouse/partner tell your child to eat fruit every day?	2. Do you and/or your spouse/partner tell your child to eat vegetables every day?		2. If my child asks for fruit juices, I will give it to him/her.	2. If my child asks for soft drinks, I will give it to him/her.	2. If my child asks if (s)he is allowed to watch TV, I will allow it.	2. If my child asks if (s)he is allowed to use the computer, I will allow it.

Appendix 2. Measurement items of each determinant per energy balance-related behaviour of the EPHE parental questionnaire (*continued*).

Family Environmental categorised correlates							
	Fruit [a]	**Vegetables** [a]	**Water**	**Fruit juices** [b]	**Soft drinks** [b]	**Television viewing** [b]	**Computer time**
	3. Is your childallowed to eat as much fruit as (s)he likes at home?	3. Is your child allowed to eat as many vegetables as (s)he would like at home?		3. My child is allowed to take fruit juices whenever (s)he wants.	3. My child is allowed to take soft drinks whenever (s)he wants.	3. My child is allowed to watch TV whenever (s)he wants.	3. My child is allowed to play computer games whenever (s)he wants.
	4. Do you or your spouse/partner usually cut up fruit for your child in between meals?	4. Do you or your spouse/partne r usually cut up vegetables for your child in between meals?		4. I negotiate with my child how much fruit juices (s)he is allowed to drink.	4. I negotiate with my child how much soft drinks (s)he is allowed to drink.	4. I negotiate with my child how much (s)he is allowed to watch TV.	4. I negotiate with my child how much (s)he is allowed to play computer games.

=:

Appendix 2. Measurement items of each determinant per energy balance-related behaviour of the EPHE parental questionnaire (*continued*).

Family Environmental categorised correlates						
	Fruit [a]	**Vegetables** [a]	**Water**	**Fruit juices** [b]	**Soft drinks** [b]	**Television viewing** [b]	**Computer time**
		5. Are there usually vegetables served with dinner (or lunch) at your home?		5. How often do you tell your child that fruit juices are not good for him/her?	5. How often do you tell your child that soft drinks are not good for him/her?	5. If I would like to watch TV for leisure time, I would restrain myself because of the presence of my child	5. If I would like to use the computer for leisure time, I would restrain myself because of the presence of my child
				6. How often do you tell your child that fruit juices make him/her fat?	6. How often do you tell your child that soft drinks make him/her fat?	6. If I prohibit my child το watcη TV, I find it difficult to stick to my rule(s) if (s)he starts negotiating.	6. If I prohibit my child to use the computer, I find it difficult to stick to my rule(s) if (s)he starts negotiating.

Appendix 2. Measurement items of each determinant per energy balance-related behaviour of the EPHE parental questionnaire (*continued*).

Family environmental correlates						
	Fruit [a]	**Vegetables** [a]	**Water**	**Fruit juices** [b]	**Soft drinks** [b]	**Television viewing** [b]	**Computer time**
				7. If I would like to drink fruit juices, I would restrain myself because of the presence of my child.	7. If I would like to drink soft drinks, I would restrain myself because of the presence of my child.	7. I allow my child to watch TV as a reward or to comfort him/her.	7. I allow my child toplay computer games as a reward or to comfort him/her.
				8. If I prohibit my child from drinking fruit juices, I find it difficult to stick to my rule(s) if (s)he starts negotiating.	8. If I prohibit my child from drinking soft drinks, I find it difficult to stick to my rule(s) if (s)he starts negotiating.	8. How often do you tell to your child that watching TV/playing computer games is not good for him/her?	8. How often do you tell to your child that playing computer games is not good for him/her?

Appendix 2. Measurement items of each determinant per energy balance-related behaviour of the EPHE parental questionnaire (*continued*).

	Family environmental correlates							
	Description	**Fruit** [a]	**Vegetables** [a]	**Water**	**Fruit juices** [b]	**Soft drinks** [b]	**Television viewing** [b]	**Computer time**
					9. I give fruit juices to my child as a reward or to comfort him/her.		9. How often do you tell to your child that watching TV/playing computer games makes him/her fat?	9. How often do you tell to your child that playing computer games makes him/her fat?
Parental knowledge	Assessing parental perception of child's dietary intake and knowledge of recommended dietary intake	1. Do you think that your child eats much or a little fruit?	1. Do you think that your child eats many or few vegetables?					
		2. How much fruit do you think your child should eat to have a healthy diet?	2. How many vegetables do you think your child should eat to have a healthy diet?					

Appendix 2. Measurement items of each determinant per energy balance-related behaviour of the EPHE parental questionnaire (*continued*).

Family environmental correlates								
	Description	**Fruit [a]**	**Vegetables [a]**	**Water**	**Fruit juices [b]**	**Soft drinks [b]**	**Television viewing [b]**	**Computer time**
Performing EBRB together	Assessing the frequency that parents conduct the EBRB together with their child	1. We often eat fruit together the whole family.	1. We often eat vegetables together the whole family.		1. How often do you and/or your spouse/partner drink fruit juices together with your child?	1. How often do you and/or your spouse/partner drink fsoft drinks together with your child?	1. How often do you and/or your spouse/partner watch TV together with your child?	1. How often do you and/or your spouse/partner play computer games together with your child?
Child's nagging behaviour	Assess the child's reaction when parent prohibits an action				1. If I prohibit my child from drinking fruit juices, (s)he tries to drink anyway.	1. If I prohibit my child from drinking soft drinks, (s)he tries to drink anyway.	1. If I prohibit my child from watching TV, (s)he tries to do it anyway.	1. If I prohibit my child from playing computer games, (s)he tries to do it anyway.

Appendix 2. Measurement items of each determinant per energy balance-related behaviour of the EPHE parental questionnaire (*continued*).

	Family environmental correlates							
	Description	**Fruit** [a]	**Vegetables** [a]	**Water**	**Fruit juices** [b]	**Soft drinks** [b]	**Television viewing** [b]	**Computer time**
Physical Environment								
Home availability	Assessing whether specific food products or equipment related to Energy balance-related behaviours are available at home for the child	1. Are there usually different kinds of fruits available in your home?	1. Are there usually different kinds of vegetables available in your home?		1. There are fruit juices available at home for my child.	1. There are soft drinks available at home for my child.	1. TV is available in my child's bedroom.	
Situation specific habit	Assessing the specific situations that child habitually conducts an EBRB	1. It is a habit of my child to eat fruit every day.	1. It is a habit for my child to eat vegetables every day.	1. Does your child drink water during mealtime?	1. In which situation(s) is your child most likely to drink fruit juices?	1. In which situation(s) is your child most likely to drink soft drinks?	1. How often is the TV on during dinner (supper/ evening meal) in your home?	

Appendix 2. Measurement items of each determinant per energy balance-related behaviour of the EPHE parental questionnaire (*continued*).

		Family environmental correlates						
	Description	**Fruit** [a]	**Vegetables** [a]	**Water**	**Fruit juices** [b]	**Soft drinks** [b]	**Television viewing** [b]	**Computer time**
		2. Does your child usually bring fruit with him/her at school?	2. Does your child usually bring vegetables with him/her at school?	2. Does your child drink water between meals?				
				3. Does your child drink water during/after sports or playing?				
Economic Environment								
Price influence	Assessing price influence on parent's food choices for their child	1. I do not give my child some foods because they cost too much [b]						

Appendix 2. Measurement items of each determinant per energy balance-related behaviour of the EPHE parental questionnaire (*continued*).

	Family environmental correlates							
	Description	**Fruit** [a]	**Vegetables** [a]	**Water**	**Fruit juices** [b]	**Soft drinks** [b]	**Television viewing** [b]	**Computer time**
Food characteristics	Assessing characteristics that influence parents' food choice for the child's meal	1. What do you consider to be the most important characteristic (s) of your child's meal?						

[a] Items of these categories are based on the Pro children [23] and PRO-GREENS [24] child questionnaires.
[b] Items of these categories are derived from the ENERGY parental questionnaire [22].

Chapter 4

Inequalities in energy-balance related behaviours and family environmental determinants in European children: Baseline results of the prospective EPHE evaluation study.

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Abstract

Tackling inequalities in overweight, obesity and related determinants has become a top priority for the European research and policy agendas. Although it has been established that such inequalities accumulate from early childhood onward, they have not been studied extensively in children. The current article discusses the results of an explorative analysis for the identification of inequalities in behaviours and their determinants between groups with high and low socio-economic status groups. This study is part of the Epode for the Promotion of Health Equity (EPHE) evaluation study, the overall aim of which is to assess the impact and sustainability of EPODE methodology to diminish inequalities in childhood obesity and overweight. Seven community-based programmes from different European countries (Belgium, Bulgaria, France, Greece, Portugal, Romania, The Netherlands) participate in the EPHE study. In each of the communities, children aged 6-8 years participated, resulting in a total sample of 1266 children and their families. A parental self-administrated questionnaire was disseminated in order to assess the socio-economic status of the household, selected energy balance-related behaviours (1. fruit and vegetable consumption; 2. soft drink/ fruit juices and water consumption; 3. screen time and 4. sleep duration) of the children and associated family environmental determinants. The Mann-Whitney U test and Pearson's chi-square test were used to test differences between the low and high education groups. The country-specific median was chosen as the cut-off point to determine the educational level, given the different average educational level in every country. Children with mothers of relatively high educational level consumed fruits and vegetables more frequently than their peers of low socio-

economic status. The latter group of children had a higher intake of fruit juices and/or soft drinks and had higher screen time. Parental rules and home availability were consistently different between the two socio-economic status groups in our study in all countries. However we did not find a common pattern for all behaviours and the variability across the countries was large. Our findings are indicative of socio-economic inequalities in our samples, although the variability across the countries was large. The effectiveness of interventions aimed at chancing parental rules and behaviour on health inequalities should be studied.

Background

Over the past 20 years, numerous studies have examined social differences in lifestyle, in an effort to explain social inequalities in health [1]. Nowadays it is established that pronounced socio-economic inequalities-defined by the educational level and/or occupational class and/or income- in non-communicable diseases exist between and within countries in Europe [2-8], even at the local level, namely within cities, communities and neighbourhoods [3, 4, 6, 8-10]. Recent evidence shows that obesity rates are higher and are growing more rapidly in populations with relatively low socio-economic status [4, 5, 7, 8, 11-16], while socio-economic inequalities in obesity are broadening in the European region [11]. In addition, it is well-established that individuals of middle and lower income, occupation class and/or educational level are more likely to develop non-communicable diseases and to be more exposed to related risk factors [2-5, 7, 9, 11, 15]. This may, at least partly, be explained by relatively unhealthy dietary habits and a less active lifestyle which are more common amongst subgroups with a relatively low socio-economic status [6, 7, 10, 11, 17-22].

Inequalities in childhood obesity and overweight have not been studied extensively. Robertson et *al* report in their review that there is a general an association between parental socio-economic status and the prevalence of obesity and overweight in European children [7]. A more recent study, however, found variations in socio-economic disparities regarding childhood overweight across European regions, suggesting the need for further research in nationally representative samples [23]. At the local level, data show that particular neighbourhoods have both increased rates of childhood overweight as well as unhealthy behaviour

[10] and that there are associations between lower family income/parental education with increased childhood obesity rates [15, 22]. Additionally, findings from the Health Survey of England showed that despite the levelling-off of childhood obesity and overweight prevalence between 2004-2007, the socio-economic disparities have been increased [24].

Tackling inequalities in overweight, obesity and related determinants has become a top priority for the European research and policy agendas over the last few years [5, 7, 8, 11, 25]. Based on the fact that such inequalities accumulate from early childhood onward [3, 26] and that childhood is a critical period for shaping behaviours, targeting children is of major importance. Nevertheless, evidence for the effectiveness of interventions in reducing inequalities in obesity and overweight in children are scarce [4, 7, 16, 25]. Research into the socio-economic differences in behaviours and determinants of behaviours across different populations could give insight into what kinds of interventions are needed to successfully decrease socio-economic inequalities.

The current study aims to identify the differences in energy balance-related behaviours and explore related environmental determinants, between high and low socio-economic groups. Specifically, it will provide evidence for inequalities in unhealthy behaviours and related determinants, in different urban populations from cities across seven European countries.

Design and Methods

This study is part of the EPHE (Epode for the Promotion of Health Equity) evaluation study [27], the overall aim of which is to assess the impact and sustainability of the EPODE (Ensemble Prévenons l'Obésité

Des Enfants-Together let's prevent obesity) methodology [28, 29] in diminishing inequalities in childhood obesity and overweight. Here we present and describe the results of the baseline measurements.

It is a two-year follow up study, that seeks to identify inequalities in energy-balance related behaviours (EBRB) of children and their related family-environmental determinants, while also assessing the effectiveness and sustainability of EPODE approach to change those behaviours and determinants in populations from low socio-economic status [27]. The current paper presents the baseline measurements, which are results of a descriptive and explorative analysis for the identification of inequalities in behaviours and their determinants between groups of high and low socio-economic status.

The survey obtained formal declaration from the Medical Ethics Committee of the VU University Medical Centre, that it does not fall under the scope of the Medical Sciences people research Act (WMO). In addition, permission to research in schools was acquired from local community and/or school authorities, where necessary.

Sample and recruitment

Seven community-based programmes which are part of the Epode International Network and implement the EPODE methodology participate in the EPHE project: VIASANO (Belgium), EPODE (France), PAIDEIATROFI (Greece), Maia Healthy Menu (Portugal), SETS (Romania), JOGG (The Netherlands) HEALTHY KIDS (Bulgaria); the latter programme is part of the Nestle's Healthy Kids programme and implements similar approach to EPODE. Every programme is based in a medium-sized city. We aimed at recruiting a minimum of 150 families with children aged between 6 to 8 years old in every selected

community with a similar variation regarding age and ethnicity per site. The recruitment was conducted through schools. More information about sampling and recruitment are described elsewhere [27]. The number of invited and finally recruited children is indicated in figure 1.

Data collection

The questionnaires, including an informed consent, were distributed to the children at school and delivered to their parents, between May/June 2013, before the intervention period. After a specified period of one to two weeks, the completed questionnaires were collected and only the ones including a signed informed consent were taken into consideration. In order to ensure the confidentiality of the data, a process to guarantee anonymity of participant families was applied [27].

Development of the EPHE parental questionnaire

In order to identify inequalities, i.e. socio-economic differences in energy-balance related behaviours and their determinants, a self-administered parental questionnaire was constructed. The EPHE parental questionnaire was developed using items from relevant, validated questionnaires addressed in European populations: ENERGY parent and child questionnaires [30], the Pro-children child questionnaire [31] and its updated version PRO-GREENS [32], European Health Examination Survey questionnaire [33], European Social Survey questionnaire [34], United States Department of Agriculture questionnaire [35]. Additional items were constructed since no validated items or questionnaires existed to our knowledge. The rationale and development of the questionnaire are described in detail elsewhere [27].

Assessment of energy-balance related behaviours in the EPHE parental questionnaire

The questionnaire assessed four energy-balance related behaviours of the child: 1. fruit and vegetable consumption; 2. soft drink/ fruit juices and water consumption; 3. screen time and 4. sleep duration, as well as determinants related to the social and physical environment of the child, within the family setting. In order to keep the length of the questionnaire within acceptable limits, we had to prioritise the many aspects of behaviour that could be relevant. The Scientific Committee decided (in consultation of experts) to keep sedentary behaviour as the indicator of physical activity. Other relevant aspects which were not included were snacks and meals (such as breakfast, lunch and dinner) and consumption of energy-dense food.

The consumption of fruits and vegetables was assessed by food frequency questions, referring to a usual week and measured in an 8-point Likert scale (1.Never-8.Every day, more than twice a day) [32]. The consumption of fruit juices, soft drinks and diet soft drinks was measured by means of weekly frequency and amount consumed. The frequency was measured in a 7-point Likert scale (1.Never-7.Every day, more than once a day) [30]. The amount was measured by 2 items for fruit juices and 3 items for soft and diet soft drinks, assessing how many glasses (or small bottles; 250 ml), cans (330 ml) or big bottles (500 ml) the children drink [30]. The amount was calculated by summing the portions. In order to measure water consumption two questions were constructed to measure the daily frequency (1. Never -7. More than 6 times a day) and number of glasses consumed when drinking water (1. None - 6. 5 or more glasses). Sedentary behaviour is assessed by means of daily time spent in television (TV) viewing and time of computer (PC)

use, for the week and the weekend days separately, measured in a 9-point Likert scale (1.Not at all - 9. 4 or more hours a day) [30]. The total screen time was calculated by the sum of weekly (hours per weekday[a]5+hours per weekend day[a]2) TV and PC use. Furthermore, 2 questions informed by the ENERGY parent questionnaire assess the sleeping habits of the child (1.sleeping routine; 2.sleep duration per week/weekend-day) [30].

Assessment of determinants of energy-balance related behaviours in the EPHE parental questionnaire

The determinants assessed refer to the social and physical family environment of the child. These were mainly assessed by one item and most of them measured in a 5-point Likert-types scales (0. never - 4. always or -2. fully disagree - 2. fully agree), unless otherwise stated below and in the tables of this article. The social environmental determinants are: a. for *fruit and vegetable* consumption i. parental demand (0. never - 4. yes, always), ii. parental allowance (0. never - 4. yes, always), iii. active encouragement (-2. fully disagree - 2. fully agree), iv. facilitating (0. never - 4. yes, always) and v. parental knowledge on recommendations (1. no fruit – 8. 5 pieces per day) [32]; b. for *fruit juice**soft drink* consumption and *TV viewing**computer* exposure i. paying attention\monitoring (0. never - 4. always), ii. parental allowance (0. never - 4. always), iii. negotiating (0. never - 4. always), iv. communicating health beliefs (0. never - 4. always), v. avoid negative modelling (0. never - 4. always), vi. parental self-efficacy to manage child's intake (0. never - 4. always), vii. rewarding\comforting practice (0. never - 4. always), viii. conducting energy-balance related behaviour together with the child (1. Never - 8. Every day more than once; for TV viewing/computer time the scale is "0. never - 4. always")[32]. The

physical environmental determinants are: a. for the consumption of *fruit and vegetables* i. home availability (0. never – 4. always) and ii. situation specific habit (-2. fully disagree - 2. fully agree) b. for *fruit juices/soft drinks* consumption i. home availability (0. never - 4. yes, always) and ii. situation specific habit (1. yes - 2. no); c. for *water* consumption i. situation specific habit- measured by three items (0. never - 4. always) and d. for *TV viewing\computer* exposure i. availability (1.yes - 2.no) ii. situation specific habit (1. every day – 5. never) more details are described in Mantziki et al [27].

Socio-economic assessment

Socio-demographic characteristics (table 1) were measured in a. Likert-type scales (i. age of the respondent: 1. 20 and below-6. 41 and above; ii. age of the child: 1.6 years olds- 4. 9 years old and above; iii. parental education level: 1. Less than 6 years-6. More than 17 years; iv. perception of income: 1. Living comfortable in the present income-4. Finding it difficult in present income), b. in 8-category scale (i. labour status; ii. source of income), c. in 6-category scale (sector of employment). The food security level of the household was also assessed [27].

Two socio-economic status groups were distinguished, based on classification for each indicator assessed: "mother's and father's employment status" (employed - not employed), "income position" (good – not good), "mother's and father's educational level" (low-high). The aforementioned variables are described in detail by Mantziki et *al*. Subdivision into two socio-economic status groups was very unequal when based on employment status and income position for the majority of the samples (table 1). In addition, knowing that educational

level has been classified as a good social factor that explains differences in nutritional outcomes [1, 20, 23], for the current article, the samples were divided in two groups based on the "educational level of the mother" (low-high). For each country's sample the median of the educational level was used as the cut-off point to determine the educational level of the mother (low-high).

Statistical analysis

All the datasets were checked for missing and double-crossed (more than one boxes selected in an item, either by mistake or because the answer was between 2 categories) values. The double-crossed values were corrected where possible, by choosing the valid selection or selecting the more frequent of the two options selected. The total sample analyses included all subjects from all communities. Due to minor discrepancies between the translated versions of the questionnaire, i.e. missing response categories in certain items, minor adaptations in the response categories were made when necessary.

The Mann-Whitney U test for the ordinal variables and Pearson's Chi-square test for the binary variables were used to detect differences in behaviours and determinants between the two socio-economic status groups. Here we present medians and quartile ranges (Mann-Whitney U test), as well as percentages (Pearson's Chi-square) in order to illustrate the differences between the two groups. Knowing that the mean ranks produced by non-parametric tests are not always sufficiently informative and that differences in spread may be equally important as differences in medians [36], further assessment of frequencies and distributions per item was explored. The results of the

additional assessments are discussed in the article, but not presented for practical reasons.

All analyses were conducted using the SPSS software 21.0 (IBM Corp., Armonk, NY, USA).

Adjustment for multiple testing was conducted using the Benjamini and Hochberg method [37], using the Stata software 13 (StataCorp. 2013. *Stata Statistical Software: Release 13*. College Station, TX: StataCorp LP).

Results

A total of 1266 children and their families were included in the EPHE study. Table 1 summarizes the socio-demographic characteristics of the population per country. In all counties boys and girls represented almost 50% each of the recruited samples and the average age of the participant children was 7 years old. The response rates per country were more than 85% for all countries, excluding the Netherlands where the response rate was 65% (figure 1).

Given the large variation of identified differences per country, in this paper we focus on discussing the statistically significant differences in the samples.

Inequalities in energy balance-related behaviours

Children of the high education groups consumed fruit significantly more frequently during the week than their peers from the low education group (table 2). Vegetable consumption was also higher for some high education groups, while the same trend was observed for the overall sample for both fruit and vegetable consumption (table 2).

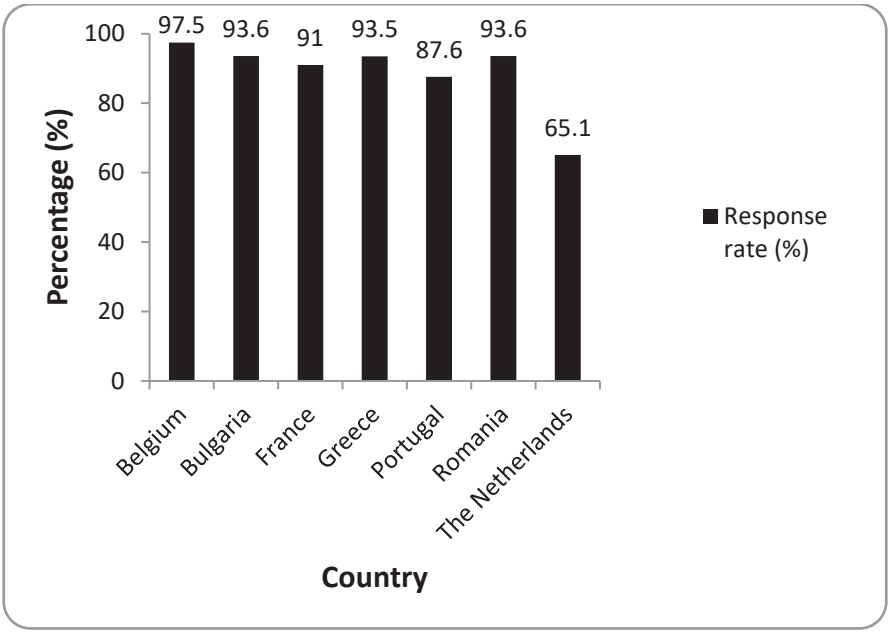

Figure 1. Number of invited and recruited children to the EPHE baseline measurements per country.

Differences between the high and low education groups were also observed in the amount and of fruit juices and soft drinks (table 3) consumed on a weekly basis. The values demonstrate that children with mothers of low education in all countries were more likely to have a higher amount (in ml) of intake when they drank fruit juices/soft drinks; though statistical significance varied at country-level and was not found in all countries. Results from the total participating population indicate the same trends for the amount of fruit juices/ soft drinks consumed and for the frequency of soft drinks consumption (table 3). With regard to the frequency of fruit juices we observed that in some communities it was higher in the high education group compared to the low education group, while in the most of them the opposite was observed (table 3). Water consumption frequency was significantly higher for the low

education group in two of the communities, whereas no difference was found in the rest of them.

Furthermore, for the children of the low education group in all countries higher amounts of screen time were reported, with a statistically significant difference between the two groups in the majority of the participant countries (table 4). A noteworthy finding is the amount of time spent watching TV during the week, which was higher for the low education group in all countries and the difference with the high education group reached statistical significance in almost all countries. Similar were the differences regarding the time spent watching TV in weekend days, reaching statistical significance in some of the samples (table 4). Computer time was significantly higher for the low education group in a few samples during weekdays and weekend days as well. Consistent results were observed in the total sample; children of the low education group in all countries spent more time in front of screens (total screen time) during the week than their counterparts of the high education group (table 4). There was also disparity between the groups in terms of sleep duration only in two countries (table 4). We were unable to identify significant differences between the education groups for sleep duration in the total sample.

Inequalities in determinants of fruit and vegetable consumption

Social environment (Appendix 1)*:* Parental demand for fruit consumption was significantly higher for high educated mothers only in one country. Parental allowance for fruit and vegetable consumption was higher for high educated mothers compared to the low educated mothers in one country and for fruit consumption, in the total sample as well. Furthermore, high educated parents from one country reported

to eat fruit more frequently with their children (perform energy-balance related behaviour together), than the parents of the respective low education group. In addition, parents of the high education group in some countries served vegetables at meal time (parental facilitation) significantly more frequently, compared to the respective low education groups.

In the overall sample, similar differences in the social environmental determinants of fruit consumption between the low and high education groups were found for parental demand, parental allowance and facilitation of fruit consumption (Appendix 1). Likewise all parental practices related to vegetable consumption, apart from parental demand, were significantly better for the high education group.

Physical environment (Appendix 1): Fruit availability at home was more frequent for children of the high education group of some countries and similarly for the total sample. Availability of vegetables at home was higher for the high education group in only one country compared to the low education group. The same trend was observed in the total sample analysis for the home availability of both fruits and vegetables. Moreover, only in one country children of highly educated mothers were more likely to have the habit of eating vegetables daily, rather than their peers of low educated mothers. This was also observed in the total sample.

Inequalities in determinants of fruit juices and soft drinks consumption

Social environment: Low educated mothers reported to reward/comfort their child by giving fruit juices more often than high educated mothers, which was the case for the total sample as well (Appendix 2). Additionally, in some of our samples parental efficacy to

retain rules with regard to the child's fruit juices intake was significantly more frequent in the high educated mothers compared to the efficacy of the low educated mothers (Appendix 2). At the same time, higher frequency of trying to drink fruit juices when intake was prohibited (nagging) was reported for children of low educated mothers (Appendix 2).

In reference to soft drinks consumption, more frequent parental allowance was reported by the low educated mothers compared to highly educated mothers in one country and total sample (Appendix 3). In addition, low educated mothers were drinking soft drinks together with their child (perform energy-balance related behaviour together) significantly more often than the highly educated ones, while only one sample of highly educated mothers reported higher frequency of avoiding negative modelling for soft drinks intake (Appendix 3). Nagging for soft drinks intake was more frequent for children of some low education groups, compare to the respective higher education groups. In the total sample it was observed that the low educated mothers drank soft drinks together with their child more often compared to the high educated ones (Appendix 3).

Physical environment (Appendix 5): availability of soft drinks at home was more frequent for the children of the low educated groups. Moreover, in the total sample, children of low educated mothers were more likely to drink fruit juices while watching television and soft drinks during the weekend, at lunch and at dinner. The corresponding differences for the situations of habitual intake -both soft drinks and fruit juices-, varied highly across the countries.

Inequalities in determinants of screen exposure

Social environment (Appendix 4): Highly educated mothers monitored (paying attention/monitoring) the amount of time their child watched television more frequently than the low educated ones. Low educated mothers allowed their children to watch television (parental allowance) more often than the high educated ones, whereas only one sample of highly educated mothers was more likely to restrain watching television in presence of the child (avoid negative modelling) than the low educated mothers. The majority of the low educated groups reported watching television with their children more frequently than the respective high educated groups, although statistical significance varied.

In reference to the social determinants of computer exposure, the highly educated mothers were more likely to negotiate with their child about the time that was allowed to spend on computer activities, compared to the low educated ones. However, the high educated mothers of only one country were more likely to avoid computer use in the presence of their child. Furthermore, children from the low education group were more likely to try playing computer games when it was forbidden (nagging), compared to their peers form the high education group. Parents with low education reported playing computer games together with their child more frequently than the ones with high education (Appendix 4).

Some of the parental practices related to television viewing were more favourable for the high education group in the total sample: parental allowance; parental monitoring; avoiding negative modelling. For the two latter determinants the same trend was observed in reference to computer exposure (Appendix 4).

Physical environment: The majority of low education groups, including the total sample, reported having the television on during meal time significantly more frequently than the high education group. More children of low educated mothers had television in their bedroom than their peers of highly educated mothers. This difference was significant in almost all countries and in the total sample (Appendix 5).

Results after multiple testing adjustments

Adjustments for multiple testing resulted in critical p-values lower than 0.05, as initially set by the authors (Appendix 6). Consequently, less of the differences found within the education groups of each of the samples (based on α=0.05) were significant based on the adjusted lower threshold (Appendix 6). As an illustration, the statistically significant differences between the two groups in the total sample analysis were initially 44 and after the adjustments these were 41.

Table 1. Socio-demographic characteristics of the EPHE population per country

Country	Total n	Gender		Age child (years)	Age of mother[a]		Income position[b]		Employment status mother		Educational level mother	
		Boys (%)	Girls (%)	Mean (SD)	<30 (%)	>30 (%)	Good (%)	Not good (%)	Employ-ed (%)	Not employ-ed (%)	High (%)	Low (%)
Belgium	196	53,4	45,4	6,58 (0,55)	21,4	77,9	88,8	11,2	64,8	24,5	42,7	57,3
Bulgaria	205	46,8	52,7	7,97 (0,78)	8,7	90,1	81,8	18,2	84,1	15,9	74,3	25,7
France	160	38,8	57,5	6,34 (0,55)	30,9	69,1	79,6	20,4	53,5	46,5	35,2	64,8
Greece	159	46,5	45,9	7,37 (0,66)	3,2	94,4	51,0	49,0	61,5	38,5	52,8	47,2
Portugal	241	51,0	48,5	6,85 (0,74)	12,4	87,1	55,8	44,2	73,8	26,2	46,0	54,0
Romania	176	56,8	43,2	7,39 (0,54)	17,7	82,3	75,9	24,1	78,0	22,0	53,8	46,2

Table 1. Socio-demographic characteristics of the EPHE population per country (*continued*).

Country	Total n	Gender		Age child (years)	Age of mother[a]		Income position[b]		Employment status mother		Educational level mother	
		Boys (%)	Girls (%)	Mean (SD)	<30 (%)	>30 (%)	Good (%)	Not good (%)	Employ-ed (%)	Not employ-ed (%)	High (%)	Low (%)
The Nether-lands	129	47,3	52,7	7,83 (0,98)	6,5	90,7	87,9	12,1	76,8	21,4	61,3	38,7
Total	1266	49,8	49,2	7,17 (0,90)	14,6	84,4	73,6	26,4	72,5	27,5	52,7	47,3

a: The analysis includes the age of the mother only when the mother was the respondent; the age of the second parent was not assessed. Response categories: 1= Below 20, 2= 21-24, 3= 25-30, 4= 31-35, 5= 36-40, 7= Above 40. Number of subjects included in "age of mother" per country: Belgium=148, Bulgaria=171, France=136, Greece=128, Portugal=208, Romania=147, The Netherlands=107, Total=1038

b: Income position categories: (1) Living comfortably on present income (2) Coping on present income (3) Finding it difficult on present income (4) Finding it very difficult on present income. Income position was defined as "good" when the response was (1) or (2) and "not good" when the response was (3) or (4).

Table 2. Rounded median values and quartiles (q_1-q_3) for weekly dietary intake for each educational group per country.

	Fruit consumption (frequency/week)[1]		**Salad/grated vegetables consumption (frequency/week)**[1]		**Raw vegetables consumption (frequency/week)**[1]		**Cooked vegetables consumption (frequency/week)**[1]	
Educational level / **Country**	High	Low	High	Low	High	Low	High	Low
Belgium	4 (4-6)	4 (3-5)	3 (2-4)	4 (2-5)	3 (2-5)	3 (2-4)	5 (4-6)	4 (4-6)
Bulgaria	6 (4-6)	6 (4-6)	5 (4-6)	5 (4-6)	5 (4-6)	5 (4-6)	4 (3-5)	4 (4-5)
France	4 (3-6)	4 (3-5)	4 (2-5)	4 (2-4)	4 (2-4)	3 (2-4)	4 (3-6)	4 (3-5)
Greece	6 (4-6)	6 (4-6)	4 (4-6)	5 (4-6)	**3 (2-4)**[a]	**4 (3-4)**	4 (3-6)	3 (3-4)
Portugal	**7 (6-7)**[c]	**6 (5-7)**	**6 (5-7)**[c]	**5 (4-6)**	4 (3-5)	4 (2-5)	**7 (6-7)**[c]	**6 (5-7)**
Romania	**6 (4-6)**[a]	**5 (4-6)**	4 (4-6)	4 (4-5)	4 (3-5)	4 (3-5)	**5 (4-6)**[a]	**4 (4-6)**

Table 2. Rounded median values and quartiles (q_1-q_3) for weekly dietary intake for each educational group per country (*continued*).

	Fruit consumption (frequency/week)[1]		**Salad/grated vegetables consumption (frequency/week)**[1]		**Raw vegetables consumption (frequency/week)**[1]		**Cooked vegetables consumption (frequency/week)**[1]	
Educational level / **Country**	High	Low	High	Low	High	Low	High	Low
The Netherlands	**6 (5-7)**[b]	**5 (4-6)**	4 (3-4)	4 (3-4)	3 (2-4)	4 (3-4)	5 (4-5)	5 (4-5)
Total	**6 (4-7)**[c]	**5 (4-6)**	**4 (3-6)**[a]	**4 (3-6)**	**4 (3-5)**[b]	**4 (2-4)**	5 (4-6)	4 (4-6)

Comparison between the educational groups of each country and the total sample with Mann-Whitney U test.
a,b,c: significant at .05, .01 and .001 respectively
1: Response categories: **1**.Never **2**.Less than once a week **3.**Once a week **4**.2-4 days a week **5**.5-6 days a week **6.**Every day, once a day **7.**Every day, more than once a day
2: Response categories: **1**.Never **2**.Less than once per day **3.**Once a day **4**.2-4 times a day **5**.5-6 times a day **6.M**ore than 6 times a day
3: The indicated amounts are derived from the sum of the respective question items; J3a and J3b and K3a, K3b and K3c for fruit juices amount and soft drinks amount respectively (27). The variables are categorical with specific values of ml in each category

Table 3. Rounded median values and quartiles (q1-q3) for weekly beverage intake for each educational group per country.

	Fruit juices frequency[1]		**Fruit juices amount (ml)**[3]		**Soft drinks frequency**[1]		**Soft drinks amount (ml)**[3]		**Water frequency**[2]	
Education level/ Country	Low	High	Low	High	Low	High	Low	High	Low	High
Belgium	6 (4-7)	6 (4-6)	**580 (250-750)**	**500 (250-580)**[a]	4 (2-5)	4 (2-5)	500 (250-580)	250 (250-580)	4 (4-5)	4 (3 -5)
Bulgaria	4 (3-5)	4 (3-5)	**830 (580-1160)**	**580 (500-830)**[a]	2 (2-4)	2 (1-3)	500 (250-750)	250 (0-958)	**6 (5-6)**	**5 (5-6)**[b]
France	6 (4-6)	4 (4-6)	580 (250-830)	250 (250-790)	4 (2-5)	3 (2-4)	580 (250-1020)	330 (250-580)	4 (4-5)	5 (4-6)
Greece	4 (4-5)	4 (4-6)	580 (580-830)	580 (250-580)	2 (1-2)	1 (1-2)	250 (0-580)	250 (0-393)	**5 (5-6)**	**5 (4-6)**[b]
Portugal	4 (3-4)	4 (2-4)	580 (250-580)	580 (250-580)	**2 (2-3)**	**2 (1-3)**[b]	**500 (250-580)**	**250 (250-580)**[a]	5 (4-6)	5 (4-6)

Table 3. Rounded median values and quartiles (q1-q3) for weekly beverage intake for each educational group per country (*continued*).

	Fruit juices frequency[1]		**Fruit juices amount (ml)**[3]		**Soft drinks frequency**[1]		**Soft drinks amount (ml)**[3]		**Water frequency**[2]	
Education level/ Country	Low	High	Low	High	Low	High	Low	High	Low	High
Romania	**4 (2-4)**	**4 (3-5)**[a]	**580 (580-1160)**	**580 (250-830)**[a]	**3 (2-4)**	**2 (1-3)**[c]	**830 (330-1080)**	**580 (63-580)**[c]	5 (5-6)	5 (5-6)
The Netherlands	3 (2-5)	4 (2-5)	**580 (250-1000)**	**375 (250-580)**[a]	3 (2-6)	4 (2-6)	250 (250-750)	250 (250-580)	4 (3-4)	3 (3-4)
Total	4 (3-6)	4 (4-6)	**580 (250-830)**	**580 (250-580)**[c]	**3 (2-4)**	**2 (1-4)**[c]	**580 (250-750)**	**250 (0-580)**[c]	5 (4-6)	5 (4-6)

Comparison between the educational groups of each country and the total sample with Mann-Whitney U test.
a,b,c: significant at .05, .01 and .001 respectively
1: Response categories: **1**.Never **2**.Less than once a week **3.**Once a week **4**.2-4 days a week **5**.5-6 days a week **6.**Every day, once a day **7.**Every day, more than once a day
2: Response categories: **1**.Never **2**.Less than once per day **3.**Once a day **4**.2-4 times a day **5**.5-6 times a day **6.**More than 6 times a day
3: The indicated amounts are derived from the sum of the respective question items; J3a and J3b and K3a, K3b and K3c for fruit juices amount and soft drinks amount respectively [27]. The variables are categorical with specific values of ml in each category.

Table 4. Rounded median values and quartiles (q_1-q_3) for screen exposure and sleep hours per educational group per country.

Education level/ Country	TV weekdays (h/day)[1]		TV weekend days (h/day)[1]		Total screen time (h/week) [3]		PC weekend days (h/day)[1]		PC weekdays (h/day)[1]		Sleep duration weekdays (h/day)[2]		Sleep duration weekend days (h/day)[2]	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Belgium†	**4 (3-6)**	**3 (2-4)[c]**	**7 (5-9)**	**5 (4-7)[b]**	**19 (12-26)**	**12,5 (9-18)c**	3 (1-5)	2 (2-4)	**2 (1-3)**	**1 (1-2)[b]**	3 (2-3)	3 (2-3)	3 (2-3)	3 (3-3)
Bulgaria	4 (3-5)	3 (3-4)	6 (4-7)	5 (4-7)	**26 (14,-31)**	**18 (12-27)[a]**	**4 (3-5)**	**3 (2-4)[a]**	**3 (2-4)**	**2 (2-3)[c]**	2 (2-2)	2 (2-2)	3 (2-3)	3 (2-3)
France	**4 (3-5)**	**3 (2-4)[b]**	**6 (4-8)**	**5 (4-7)[a]**	**19,5 (11-25)**	**14,0 (8,0-24,0)[a]**	3 (2-4)	2 (1-3)	2 (1-3)	2 (1-2)	3 (2-3)	3 (2-3)	3 (2-3)	3 (3-3)
Greece	**4 (3-4)**	**3 (2-4)[b]**	6 (4-7)	5 (4-6)	**18 (13-22,5)**	**14 (10-22,5)[a]**	3 (2-3)	3 (2-4)	2 (1-3)	2 (1-2)	2 (2-3)	2 (2-3)	3 (2-3)	3 (2-3)

Table 4. Rounded median values and quartiles (q_1-q_3) for screen exposure and sleep hours per educational group per country.

Education level/ Country	TV weekdays (h/day)[1]		TV weekend days (h/day)[1]		Total screen time (h/week)[3]		PC weekend days (h/day)[1]		PC weekdays (h/day)[1]		Sleep duration weekdays (h/day) [2]		Sleep duration weekend days (h/day)[2]	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Portugal^	**3 (3-4)**	**3 (2-4)[b]**	**6 (4-7)**	**5 (4-6)[a]**	**17,5 (12-24,5)**	**15 (10-20)[b]**	3 (2-5)	3 (2-5)	2 (1-2)	2 (1-2)	**2 (2-3)**	**3 (2-3)[b]**	3 (2-3)	3 (2-3)
Romania^	**4 (3-6)**	**3 (3-5)c**	6 (4-7)	5 (4-6)	22 (15-30,5)	20 (14-25)	**3 (1-5)**	**4 (2-5)[a]**	2 (1-3)	2 (1-4)	2 (2-2)	2 (2-3)	3 (2-3)	3 (2-3)
The Netherlands^	3 (3-4)	3 (2-4)	4 (4-6)	4 (4-5)	14,5 (11-23,5)	13,5 (11-20)	3 (2-4)	3 (2-4)	2 (2-3)	2 (2-3)	**3 (2-3)**	**3 (3-3)[c]**	**3 (2-3)**	**3 (3-3)[a]**
Total	**4 (3-5)**	**3 (3-4)[c]**	**6 (4-7)**	**5 (4-6)[c]**	**19,5 (12,5-25,5)**	**15,5 (10-23)[c]**	3 (2-5)	3 (2-4)	2 (1-3)	2 (1-3)	2 (2-3)	2 (2-3)	3 (2-3)	3 (2-3)

Comparison between the educational groups of each country and the total sample with Mann-Whitney U test.
a,b,c: significant at .05, .01 and .001 respectively
1: Response categories: **1.**Not at all **2.**30 min/day **3.1 h/day 4.**2h/day **5.**2,5 h/day **6.**3 h/day **7.**3,5 h/day **8.**4 or more h/day
2: Response categories: **1.** 6 hours or less/ per night **2.**7 hours/ per night **3.**8 hours/ per night **4.**9 hours/ per night **5.**10 hours/ per night **6.**More than 10 hours per night.
3: The indicated amounts of hours are derived from the sum of the respective question items for TV (T1a and T1b) and PC time (T4a and T4b) [27]. The variables are categorical with specific values of hours in each category.
†: the variables TV/PC time for weekdays and weekend-days are measured with an extra response category for 1,5 h/day (coded as 4); as such the items include 9 response categories. This does not apply for the results of the total sample.
^: the variables PC time for weekdays and weekend-days are measured with an extra response category for 1,5 h/day (coded as 4); as such the items include 9 response categories. This does not apply for the results of the total sample.

Discussion

This study showed that children from communities of seven different European countries of relatively high socio-economic status consumed fruits and/or vegetables more frequently than their peers of low socio-economic status. In addition, the latter group of children had a higher intake of fruit juices and/or soft drinks and had higher screen time. It is important to note that increased screen activity found among children from lower socio-economic status is attributed to television watching, rather than computer activity.

The results of our study are compatible with studies that demonstrate that children from lower socio-economic status across Europe have unhealthier dietary habits and increased sedentary behaviour compared to their high socio-economic status peers. Norwegian children of lower socio-economic status reported a particularly low frequency of fruit consumption [17]. Furthermore, low vegetable consumption was associated with overweight in Dutch children of lower socio-economic status [30]. The IDEFICS study illustrated that the “healthy” dietary pattern (including fruit and vegetable intake) was positively associated with high socio-economic status, whereas the “processed” pattern (including sweetened drinks) was inversely associated with high socio-economic status [19]. The Healthy Behaviour in School-aged Children (HBSC) study revealed higher fruit consumption for children from high socio-economic status (measured in terms of both the family affluence scale and parental occupation) and higher soft drink consumption with

decreasing score of parental occupational class [20]. Elinder et *al*, found that Swedish children of parents with a relatively low level of education were eating less vegetables and were consuming more sweetened drinks than their peers with highly educated parents [22]. Less is known for socio-economic differences in fruit juices consumption among children, although evidence shows higher consumption of fruit juices in children and adolescents living in low-income households in the USA [39]. With respect to television viewing and computer activity, Fairclouhg et *al* found an inverse association with socio-economic status in 9-10 year-olds [40] and Fernandez-Alvira et *al* showed that these behaviours partly mediate the association between parental education and child's body composition [41].

Important differences between the two socio-economic status groups in our samples were observed in the determinants of the social and physical family-environment of the child. Despite that we did not find a common pattern for all behaviours, parental rules and home availability were consistently different between the two socio-economic status groups in our study in all countries. This indicates the importance of the family environment, related to socio-economic inequalities in childhood obesity. In addition, these differences varied to a large extent across countries, illustrating the heterogeneity of inequalities across the EPHE communities, as other studies also confirm [23, 38].

Family-environmental determinants have been associated with energy-balance related behaviours, although little is known about socio-economic disparities in these associations. A survey reviewing multi-disciplinary literature to identify the determinants

of childhood obesity, concluded, among others, that *the shared environment created by parents, affects children's choices and eventually their body weight outcomes* [42]. Related evidence demonstrates that parental rules and/or accessibility at home are significantly associated with energy balance- related behaviours, such as screen time, intake of sugary drinks and fruit and vegetable consumption [22, 43, 44]. The increased accessibility of fruits and vegetables-measured in terms of home availability, parental facilitation and allowance- have been shown to mediate adolescents' intake [21, 45]. On the other hand, the presence of screens in the child's bedroom is associated with higher adiposity in preadolescents [46], while it contributes to the excess of the screen time [47]. Accordingly, we consider that parental rules and home availability are crucial to be addressed in interventions aiming to decrease inequalities in childhood obesity.

Overall, the differences in energy balance-related behaviours and family-related determinants assessed in this study were statistically significant but not large. The significant differences can be explained by *differences in spread* in the response categories of the assessed variables as well as by *differences in the median* and quartile values that are presented in this paper. The Mann-Whitney U test is able to detect differences in shape and spread, which are, usually, equally important as differences in median [36]. Differences in spread could also explain the significant findings when identical median and quartile values were found in both groups. That is to say that the low socio-economic status groups were more likely to fall into the less favourable response categories, in the vast majority of the

variables assessed, unless otherwise stated in the tables and appendices.

To our knowledge, this is the first evaluation study that provides baseline data on socio-economic inequalities in family-environmental determinants associated with energy-balance related behaviours. The cross-cultural character of the sample enables the exploration of inequalities in factors that have been highly associated with childhood obesity, across different European countries. Hence the opportunity to enhance insight of health inequalities is given, particularly in the European region where the socio-economic factors are changing rapidly over time. Also there is the prospect to sensitize communities with respect to socio-economic inequalities in childhood obesity and overweight. In addition, our results give new insight into energy-balance behaviours and their determinants, which should be the focus for the development of effective interventions aimed at reducing inequalities in childhood obesity. Another strength of this study is the high response rate achieved in almost all countries and successful commitment of the target groups.

For the purposes of the EPHE evaluation study, the participant programmes were selected on the basis of implementing the EPODE or EPODE-like approach. At this point it should be clarified that the interventions implemented within the EPHE project will be new and specifically focused at the selected behaviours and determinants to reduce health inequalities. Similar to the programme selection, it was a prerequisite for the participant city to be already engaged in an EPODE structure. The schools from which the samples were recruited were selected based on

accessibility and convenience criteria. These schools were also chosen due to a limited time-frame. Hence, one limitation of this study is that sampling bias is likely present at many levels and our samples may not be representative of each country's population. Another weakness of this study could be that we used the educational level of the mother as a proxy for socio-economic status, instead of using more indicators. Although, parental education level has been characterised as an adequate socio-economic indicator by relevant and more elaborative studies [1, 20, 23], this still reduces the strength of detecting absolute inequalities. Moreover, the data were self-reported and recall bias and/or socially desirable answers are possible. Furthermore, errors from the constructed items are possible, given that they were not validated. Another source of bias of our whole-sample results could be from errors in the translated versions of the questionnaires, where, despite efforts regarding forth-back translations, slightly different answer categories were used. This occurred in the variables assessing screen exposure (missing category) and the frequency that the television was on during meal times. Considering that the family environmental correlates are assessed mostly by one item each, the reliability of the instrument may be violated [30]. Finally, this is an observational study and thus conclusions about causality cannot be drawn.

Implications for public health

In this study we confirm that socio-economic inequalities exist in energy-balance related behaviours in various European communities. Addressing these behaviours may aid in reducing socio-economic differences in health. Moreover, this study has

additionally identified community-specific inequalities in the determinants of these behaviours. Targeting these behavioural determinants in public health interventions, aimed at changing these behaviours, in a favourable way may increase their effectiveness.

Conclusions

Our study indicates socio-economic inequalities in factors strongly related to childhood obesity and overweight and provides evidence for those in seven European communities. These findings are indicative of socio-economic inequalities in our samples, but the variability across the countries was large. The effectiveness of interventions aimed at chancing parental rules and behaviours on health inequalities should be studied.

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Appendices

Appendix 1. Median values and quartiles (q_1-q_3) for determinants of the child's social environment and fruit/vegetable consumption.

	Fruit consumption															
	Determinants of the social environment												**Determinants of the physical environment**			
	Parental Demand *Never (0) -yes, always (4)*		Parental allowance *Never (0) - yes, always (4)*		Active encouragement *fully disagree (-2) - fully agree (2)*		Facilitating *Never (0) - yes, always (4)^*		Parental knowledge on recommendations *None (1) - 5 or more pieces/portions per day (8)*		Performing EBRB together with the child *Never (0) - yes, always (4)*		Home availability *Never (0) - yes, always (4)*		Habit to eat fruit/vegetables daily *(-2) fully disagree-(2) fully agree*	
Educational level (mother) / **Country**	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
Belgium	3 (2-3)	3 (2-3)	4 (3-4)	4 (3-4)	2 (1-2)	2 (1-2)	2 (1-3)	2 (1-3)	5 (4-6)	5 (4-6)	1 (0-2)	1 (0-1)	**3 (3-4)[b]**	**3 (2-4)**	0 (-1-2)	0 (-1-1)
Bulgaria	4 (3-4)	4 (2-4)	**4 (4-4)[b]**	**4 (3-4)**	2 (2-2)	2 (2-2)	3 (2-3)	3 (2-4)	6 (5-6)	6 (5-6)	2 (1-2)	2 (1-2)	3 (3-4)	3 (2-4)	1 (1-2)	2 (1-2)
France	3 (2-4)	3 (2-3)	3 (3-4)	3 (3-4)	1 (1-2)	1 (1-2)	2 (1-3)	2 (1-2)	5 (4-5)	5 (4-5)	1 (0-1)	1 (0-1)	3 (2-3)	3 (2-3)	1 (-1-2)	1 (0-1)
Greece	3 (3-4)	4 (3-4)	4 (4-4)	4 (3-4)	2 (1-2)	2 (2-2)	3 (2-4)	3 (2-4)	5 (5-6)	5 (5-6)	1 (1-2)	2 (1-2)	4 (3-4)	3 (3-4)	**1 (0-1)[a]**	**1 (1-2)**
Portugal	4 (3-4)	4 (3-4)	4 (3-4)	3 (3-4)	2 (2-2)	2 (2-2)	2 (2-3)	2 (2-3)	5 (5-6)	5 (5-6)	**2 (2-2)[b]**	**2 (1-2)**	**4 (3-4)[b]**	**3 (3-4)**	2 (1-2)	2 (1-2)
Romania	4 (3-4)	4 (3-4)	4 (4-4)	4 (4-4)	2 (2-2)	2 (2-2)	**2 (2-3)[a]**	**2 (2-3)**	5 (5-6)	5 (4-6)	2 (1-2)	2 (2-2)	**4 (3-4)[b]**	**3 (2-4)**	2 (1-2)	2 (1-2)
The Netherlands	**3 (3-4)[c]**	**3 (2-3)**	4 (3-4)	4 (3-4)	2 (1-2)	2 (1-2)	3 (2-3)	3 (2-3)	5 (5-5)	5 (4-5)	1 (1-2)	1 (0-2)	4 (3-4)	4 (3-4)	2 (1-2)	1 (1-2)
Total	**3 (3-4)[b]**	**3 (3-4)**	**4 (3-4)[c]**	**4 (3-4)**	2 (1-2)	2 (1-2)	**2 (2-3)[c]**	**2 (2-3)**	5 (5-6)	5 (4-6)	2 (1-2)	1 (1-2)	**3 (3-4)[c]**	**3 (3-4)**	**2 (1-2)[a]**	**1 (0-2)**

Appendix 1. Median values and quartiles (q_1-q_3) for determinants of the child's social environment and fruit/vegetable consumption (*continued*).

	Vegetable consumption															
	Determinants of the social environment												Determinants of the physical environment			
	Parental Demand *Never (0) - yes, always (4)*		Parental allowance *Never (0) - yes, always (4)*		Active encouragement *fully disagree (-2) - fully agree (2)*		Facilitating *Never (0) - yes, always (4)^*		Parental knowledge on recommendations *None (1) - 5 or more pieces/portions per day (8)*		Performing EBRB together with the child *Never (0) - yes, always (4)*		Home availability *Never (0) - yes, always (4)*		Habit to eat fruit/vegetables daily *(-2) fully disagree-(2) fully agree*	
Educational level (mother) / **Country**	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
Belgium	4 (3-4)	3 (3-4)	4 (3-4)	4 (3-4)	2 (1-2)	1 (1-2)	3 (2-4)	3 (3-4)	5 (4-6)	5 (5-6)	2 (1-2)	1 (1-2)	3 (3-4)	3 (3-4)	1 (0-2)	1 (0-2)
Bulgaria	4 (3-4)	4 (3-4)	4 (4-4)	4 (4-4)	2 (1-2)	2 (1-2)	3 (3-4)	3 (2-4)	6 (5-6)	5 (4-6)	2 (1-2)	2 (1-2)	3 (3-4)	3 (3-4)	1 (1-2)	2 (0-2)
France	4 (3-4)	3 (3-4)	3 (3-4)	3 (3-4)	1 (1-2)	1 (1-2)	3 (3-4)	3 (3-3)	5 (4-6)	5 (4-6)	1 (1-2)	1 (0-1)	3 (3-4)	3 (3-3)	1 (0-2)	1 (0-1)
Greece	3 (3-4)	3 (3-4)	4 (4-4)	4 (4-4)	1 (1-2)	2 (1-2)	3 (3-4)	3 (3-4)	**4 (4-5)[a]**	**4 (4-5)**	1 (1-2)	2 (1-2)	4 (3-4)	3 (3-4)	0 (0-1)	1 (0-1)
Portugal	4 (3-4)	4 (3-4)	**4 (3-4)[a]**	**3 (3-4)**	2 (1-2)	2 (1-2)	**3 (3-4)[a]**	**3 (2-3)**	**5 (5-6)[c]**	**5 (4-6)**	2 (1-2)	2 (1-2)	**3 (3-4)[b]**	**3 (2-4)**	2 (1-2)	1 (1-2)
Romania	4 (3-4)	4 (3-4)	4 (4-4)	4 (4-4)	2 (2-2)	2 (2-2)	**3 (3-4)[b]**	**3 (2-3)**	5 (4-6)	4 (4-5)	2 (1-2)	2 (2-2)	**4 (3-4)[b]**	**3 (3-4)**	2 (1-2)	2 (1-2)
The Netherlands	4 (3-4)	3 (3-4)	4 (3-4)	4 (3-4)	2 (2-2)	2 (1-2)	**4 (3-4)[c]**	**3 (3-4)**	5 (5-5)	5 (4-5)	**2 (2-2)[a]**	**2 (2-2)[d]**	3 (3-4)	3 (3-4)	**2 (1-2)[a]**	**1 (1-2)**
Total	4 (3-4)	3 (3-4)	**4 (3-4)[c]**	**4 (3-4)**	**2 (1-2)[a]**	**2 (1-2)**	**3 (3-4)[c]**	**3 (2-4)**	**5 (5-6)[c]**	**5 (4-6)**	**2 (1-2)[b]**	**2 (1-2)[d]**	**3 (3-4)[c]**	**3 (3-4)**	**1 (1-2)[a]**	**1 (0-2)**

Comparison between the educational groups of each country and the total sample with Mann-Whitney U test. Rounded values are presented.
a,b,c: significant at .05, .01 and .001 respectively; d: Negligible differences were found in spread between the two socioeconomic groups.
^: The determinant was assessed by items F18 (regarding fruit consumption) and F31 (regarding vegetable consumption) of the EPHE parental questionnaire.

Appendix 2. Median values and quartiles (q_1-q_3) for determinants of the child's social environment and fruit juices consumption.

	Fruit juices consumption																	
	Determinants for the social environment																	
	Paying attention/ monitoring *never (0)-always (4)*		Parental allowance *never (0)-always (4)*		Negotiating *never (0)-always (4)*		Communicating health beliefs *never (0)-always (4)*		Avoid negative modelling *never (0)-always (4)*		Parental self-efficacy to retain rules *never (0)-always (4)*		Rewarding/comforting practice *never (0)-always (4)*		Performing EBRB together with the child *Never (1) - every day more than once a day (7)*		Nagging behaviour *Never (0)-yes, always (4)*	
Educational level (mother) / **Country**	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
Belgium	3 (2-4)	3 (2-4)	3 (2-4)	3 (2-4)	2 (0-3)	1 (0-2)	0 (0-2)	0 (0-2)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-1)	0 (0-0)	0 (0-0)	4 (2-6)	4 (3-6)	0 (0-0)	0 (0-0)
			2 (1-3)[a]	**3 (2-4)**			0 (0-0)	0 (0-1)										
Bulgaria	3 (2-4)	4 (3-4)	3 (3-4)	4 (3-4)	3 (1-3)	3 (2-4)	2 (0-3)	2 (0-3)	2 (0-3)	2 (0-4)	1 (0-2)	1 (0-2)	0 (0-1)	0 (0-2)	3 (3-3)	3 (3-3)	1 (0-2)	1 (0-2)
			3 (3-4)	4 (2-4)			0 (0-2)	0 (0-2)										
France	3 (2-4)	3 (2-4)	3 (2-3)	2 (2-3)	2 (0-3)	2 (0-3)	0 (0-2)	1 (0-2)	0 (0-0)	0 (0-0)	**0 (0-0)[a]**	**0 (0-2)**	0 (0-0)	0 (0-0)	4 (2-6)	4 (3-6)	**0 (0-0)[b]**	**0 (0-2)**
			2 (1-3)	2 (1-3)			**0 (0-0)[b]**	**0 (0-2)**										
Greece	4 (3-4)	4 (3-4)	4 (3-4)	3 (2-4)	**2 (1-3)[a]**	**3 (2-4)**	1 (0-2)	1 (0-3)	0 (0-2)	0 (0-2)	1 (0-2)	1 (0-2)	0 (0-1)	0 (0-1)	3 (2-4)	3 (2-4)	0 (0-1)	1 (0-1)
			3 (2-4)	3 (2-4)			0 (0-2)	0 (0-2)										
Portugal	4 (3-4)	4 (3-4)	2 (2-2)	2 (2-3)	1 (0-3)	2 (0-3)	2 (1-3)	2 (1-3)	1 (0-2)	1 (0-3)	0 (0-1)	0 (0-1)	**0 (0-1)[b]**	**0 (0-1)**	3 (2-4)	3 (2-4)	0 (0-1)	0 (0-1)
			2 (1-2)	2 (1-2)			**1 (0-2)[a]**	**2 (1-3)**										
Romania	**3 (3-4)[a]**	**3 (2-4)**	3 (2-4)	3 (2-4)	1 (0-3)	1 (0-2)	2 (0-3)	1 (0-3)	0 (0-2)	0 (0-2)	**0 (0-1)[a]**	**1 (0-2)**	0 (0-0)	0 (0-0)	3 (2-4)	3 (2-4)	1 (0-2)	1 (0-2)
			3 (2-4)	3 (1-4)			0 (0-2)	0 (0-2)										

Appendix 2. Median values and quartiles (q_1-q_3) for determinants of the child's social environment and fruit juices consumption (*continued*).

	Determinants for the social environment																	
	Paying attention/ monitoring *never (0)-always (4)*		Parental allowance *never (0)-always (4)*		Negotiating *never (0)-always (4)*		Communicating health beliefs *never (0)-always (4)*		Avoid negative modelling *never (0)-always (4)*		Parental self-efficacy to retain rules *never (0)-always (4)*		Rewarding/comforting practice *never (0)-always (4)*		Performing EBRB together with the child *Never (1) - every day more than once a day (7)*		Nagging behaviour *Never (0)-yes, always (4)*	
The Netherlands	3 (2-4)	3 (2-4)	2 (2-3)	2 (2-3)	2 (0-3)	1 (0-3)	1 (0-2)	2 (0-3)	1 (0-2)	1 (0-2)	**0 (0-0)**[c]	**0 (0-1)**	**0 (0-0)**[a]	**0 (0-1)**	3 (2-4)	2 (2-4)	**0 (0-0)**[a]	**0 (0-1)**
			1 (0-2)	2 (0-3)			1 (0-2)	1 (0-2)										
Total	3 (2-4)	3 (2-4)	3 (2-4)	3 (2-4)	2 (0-3)	2 (0-3)	1 (0-2)	1 (0-3)	0 (0-2)	0 (0-2)	0 (0-1)	0 (0-1)	**0 (0-0)**[b]	**0 (0-1)**	**3 (2-4)**[b]	**3 (2-4)***	**0 (0-1)**[a]	**0 (0-1)**[a]
			2 (1-4)	2 (1-3)			**0 (0-2)**[b]	**1 (0-2)**										

Comparison between the educational groups of each country and the total sample with Mann-Whitney U test. Rounded values are presented.
a,b,c: significant at .05, .01 and .001 respectively
* Negligible difference in spread were found between the two socio-economic status groups.

Appendix 3. Median values and quartiles (q_1-q_3) for determinants of the child's social environment and soft drinks consumption.

	Soft drinks consumption															
	Determinants for the social environment															
	Paying attention/ monitoring *never (0)-always (4)*		Parental allowance *never (0)-always (4)*		Communicating health beliefs *never (0)-always (4)*		Avoid negative modelling *never (0)-always (4)*		Parental efficacy to retain rules *never (0)-always (4)*		Rewarding/comfort -ting practice *never (0)-always (4)*		Performing EBRB together with the child *Never (1))- every day more than once a day (7)*		Nagging behaviour *Never (0)-yes, always (4)*	
Educational level (mother) / **Country**	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
Belgium	4 (3-4)	4 (3-4)	2 (1-3) 0 (0-1)	2 (1-2) 0 (0-2)	3 (3-4) 3 (1-4)	3 (3-4) 3 (1-4)	0 (0-2)	0 (0-2)	0 (0-0)	0 (0-1)	0 (0-0)	0 (0-0)	3 (1-4)	3 (1-5)	0 (0-1)	0 (0-1)
Bulgaria	4 (4-4)	4 (3-4)	1 (1-2) 1 (0-2)	2 (1-2) 1 (1-2)	4 (3-4) 3 (1-4)	4 (3-4) 3 (1-4)	3 (2-4)	3 (2-4)	0 (0-2)	0 (0-1)	0 (0-0)	0 (0-0)	2 (1-3)	2 (1-3)	0 (0-1)	1 (0-1)
France	4 (3-4)	4 (3-4)	2 (1-2) 1 (0-2)	2 (1-2) 1 (0-2)	3 (2-3) 1 (0-3)	3 (2-3) 2 (0-3)	0 (0-1)	0 (0-2)	0 (0-0)	0 (0-1)	0 (0-0)	0 (0-0)	3 (2-5)	3 (2-5)	**0 (0-0)[a]**	**0 (0-1)**
Greece	4 (4-4)	4 (4-4)	1 (0-1) 0 (0-1)	1 (0-1) 0 (0-1)	4 (3-4) 3 (2-4)	4 (3-4) 4 (3-4)	3 (1-3)	3 (1-4)	0 (0-1)	0 (0-1)	0 (0-0)	0 (0-0)	1 (1-2)	1 (1-2)	0 (0-1)	0 (0-1)

Appendix 3. Median values and quartiles (q_1-q_3) for determinants of the child's social environment and soft drinks consumption (*continued*).

	Determinants for the social environment																	
	Paying attention/ monitoring *never (0)-always (4)*		Parental allowance *never (0)-always (4)*		Communicating health beliefs *never (0)-always (4)*		Avoid negative modelling *never (0)-always (4)*		Parental self-efficacy to retain rules *never (0)-always (4)*		Rewarding/comfort -ting practice *never (0)-always (4)*		Performing EBRB together with the child *Never (1))- every day more than once a day (7)*		Nagging behaviour *Never (0)-yes, always (4)*	
Portugal	4 (3-4)	4 (4-4)	**1 (1-2)**[a]	**1 (1-2)***	3 (3-4)	3 (3-4)	1 (1-3)	2 (1-3)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-0)	**2 (1-3)**[b]	**2 (2-3)**	**0 (0-1)**[a]	**0 (0-1)**
			1 (0-1)	1 (0-1)	**2 (1-3)**[b]	**3 (1-4)**										
Romania	4 (4-4)	4 (3-4)	**1 (0-2)**[b]	**1 (1-2)**	4 (3-4)	4 (3-4)	**3 (2-4)**[a]	**2 (1-3)**	0 (0-1)	0 (0-1)	0 (0-0)	0 (0-0)	**2 (1-2)**[c]	**3 (2-3)**	1 (0-2)	1 (0-2)
			0 (0-1)[b]	**1 (0-2)**	3 (0-4)	3 (1-4)										
The Netherlands	4 (3-4)	3 (3-4)	2 (1-3)	2 (1-3)	2 (1-3)	2 (1-3)	1 (0-2)	1 (0-2)	0 (0-0)	0 (0-1)	0 (0-0)	0 (0-0)	2 (2-3)	3 (1-4)	0 (0-0)	0 (0-1)
			0 (0-2)	0 (0-2)	1 (0-2)	2 (0-2)										
Total	4 (3-4)	4 (3-4)	**1 (1-2)**[b]	**1 (1-2)**	3 (3-4)	3 (2-4)	**2 (0-3)**[b]	**2 (0-3)**	0 (0-1)	0 (0-1)	0 (0-0)	0 (0-0)	**2 (1-3)**[c]	**2 (2-4)**	0 (0-1)	0 (0-1)
			0 (0-1)[a]	**1 (0-1)**	2 (1-4)	3 (1-4)										

Comparison between the educational groups of each country and the total sample with Mann-Whitney U test. Rounded values are presented.
a,b,c: significant at .05, .01 and .001 respectively
*: Difference in spread showed that the high education group allowed soft drinks more frequently

Appendix 4. Median values and quartiles (q_1-q_3) for determinants of the child's social environment and screen exposure.

	Television exposure																	
	Determinants for the social environment																	
	Paying attention/ monitoring *never (0)-always (4)*		Parental allowance *never (0)-always (4)*		Negotiating *never (0)-always (4)*		Communicating health beliefs *never (0)-always (4)*		Avoid negative modelling *never (0)-always (4)*		Parental self-efficacy to retain rules *never (0)-always (4)*		Rewarding/comforting practice *never (0)-always (4)*		Performing EBRB together with the child *Never (0)- every day (5)*		Nagging behaviour *Never (0)-yes, always (4)*	
Educational level (mother) / **Country**	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
Belgium	**3 (2-4)[c]**	**3 (1-4)**	2 (2-3)	3 (2-3)	2 (0-3)	2 (0-3)	3 (2-3)	2 (2-3)	0 (0-2)	0 (0-2)	0 (0-0)	0 (0-1)	0 (0-1)	0 (0-1)	**2 (2-3)[b]**	**3 (2-3)**	0 (0-0)	0 (0-1)
			2 (0-2)	2 (0-3)			0 (0-2)	0 (0-3)										
Bulgaria	4 (3-4)	3 (3-4)	3 (2-3)	2 (2-3)	3 (3-4)	3 (2-4)	3 (3-4)	3 (3-3)	2 (1-3)	3 (1-3)	1 (0-2)	2 (2-3)	1 (0-2)	0 (0-2)	2 (2-3)	3 (2-3)	1 (0-2)	1 (0-2)
			2 (2-3)	2 (2-3)			2 (0-3)	3 (1-3)										
France	2 (1-3)	2 (1-3)	3 (2-3)	3 (2-4)	**1 (0-3)[a]**	**2 (0-3)**	3 (2-4)	3 (2-3)	0 (0-1)	0 (0-2)	0 (0-0)	0 (0-2)	0 (0-2)	0 (0-2)	**2 (2-3)[b]**	**3 (2-3)**	0 (0-1)	0 (0-2)
			2 (1-3)	2 (1-3)			0 (0-2)	0 (0-2)										
Greece	4 (3-4)	3 (3-4)	2 (2-3)	3 (2-3)	3 (2-4)	3 (2-3)	3 (3-4)	3 (3-4)	2 (1-3)	2 (1-3)	**1 (0-1)[a]**	**1 (0-2)**	1 (0-2)	1 (0-2)	2 (2-3)	3 (2-3)	1 (0-2)	1 (0-2)
			1 (1-2)	1 (0-2)			2 (0-3)	2 (0-3)										
Portugal	3 (3-4)	3 (2-4)	2 (2-3)	3 (2-3)	1 (0-3)	1 (0-3)	2 (2-3)	2 (2-3)	1 (0-2)	1 (0-2)	0 (0-1)	1 (0-1)	**1 (0-1)[a]**	**1 (0-2)**	2 (2-3)	2 (2-3)	**1 (0-1)[a]**	**1 (0-2)**
			2 (1-2)[a]	**2 (1-3)**			1 (0-2)	1 (0-2)										

Appendix 4. Median values and quartiles (q_1-q_3) for determinants of the child's social environment and screen exposure (*continued*).

	Determinants for the social environment																	
	Paying attention/ monitoring *never (0)-always (4)*		Parental allowance *never (0)-always (4)*		Negotiating *never (0)-always (4)*		Communicating health beliefs *never (0)-always (4)*		Avoid negative modelling *never (0)-always (4)*		Parental self-efficacy to retain rules *never (0)-always (4)*		Rewarding/comforting practice *never (0)-always (4)*		Performing EBRB together with the child *Never (0)- every day (5)*		Nagging behaviour *Never (0)-yes, always (4)*	
Romania	4 (3-4)	3 (3-4)	2 (2-3)	2 (2-3)	**2 (1-3)[a]**	**2 (0-2)**	3 (2-4)	3 (2-4)	1 (0-2)	1 (0-2)	0 (0-1)	1 (0-2)	1 (0-1)	1 (0-2)	**2 (2-3)[b]**	**2 (2-3)**	2 (0-2)	2 (1-2)
			2 (1-2)[a]	**2 (2-3)**			1 (0-3)	2 (0-3)										
The Netherlands	**3 (3-4)[a]**	**3 (2-3)**	**2 (2-3)[a]**	**2 (2-3)**	3 (2-4)	3 (2-3)	2 (2-3)	2 (1-3)	**2 (1-3)[b]**	**1 (0-2)**	0 (0-1)	0 (0-1)	1 (0-2)	0 (0-2)	2 (2-3)	2 (2-3)	0 (0-1)	0 (0-2)
			1 (0-2)	1 (0-2)			2 (0-2)	2 (0-3)										
Total	**3 (3-4)[c]**	**3 (2-4)**	**2 (2-3)[b]**	**3 (2-3)**	**3 (1-3)[c]**	**2 (1-3)**	3 (2-3)	3 (2-3)	**1 (0-3)[b]**	**1 (0-2)**	0 (0-1)	0 (0-1)	1 (0-2)	1 (0-2)	**2 (2-3)[c]**	**3 (2-3)**	**0 (0-2)[a]**	**1 (0-2)**
			2 (1-3)[a]	**2 (1-3)***			1 (0-3)	1 (0-3)										
	Computer exposure																	
Education level (mother) / **Country**	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
Belgium	4 (3-4)	4 (2-4)	2 (1-2)	2 (1-2)	2 (0-4)	2 (0-3)	0 (0-2)	2 (2-3)	0 (0-2)	0 (0-2)	**0 (0-0)[a]**	**0 (0-0)***	0 (0-1)	0 (0-2)	**1 (0-2)[a]**	**2 (0-2)**	**0 (0-0)[a]**	**0 (0-0)**
			1 (0-2)	1 (0-2)			0 (0-2)	0 (0-3)										
Bulgaria	4 (3-4)	4 (3-4)	2 (1-3)	2 (2-3)	3 (3-4)	3 (2-4)	3 (3-4)	3 (3-3)	2 (1-3)	2 (2-3)	1 (0-2)	1 (0-2)	1 (0-2)	0 (0-0)	**1 (0-2)[b]**	**2 (1-3)**	0 (0-1)	0 (0-1)
			2 (1-2)	2 (1-2)			2 (0-3)	3 (1-3)										

Appendix 4. Median values and quartiles (q_1-q_3) for determinants of the child's social environment and screen exposure (*continued*).

	Determinants for the social environment																	
	Paying attention/ monitoring *never (0)-always (4)*		Parental allowance *never (0)-always (4)*		Negotiating *never (0)-always (4)*		Communicating health beliefs *never (0)-always (4)*		Avoid negative modelling *never (0)-always (4)*		Parental self-efficacy to retain rules *never (0)-always (4)*		Rewarding/comforting practice *never (0)-always (4)*		Performing EBRB together with the child *Never (0)- every day (5)*		Nagging behaviour *Never (0)-yes, always (4)*	
France	3 (2-4)	3 (2-4)	2 (2-3)	2 (2-3)	1 (0-3)	2 (0-3)	3 (2-4)	3 (2-3)	0 (0-1)	0 (0-2)	0 (0-0)	0 (0-0)	0 (0-1)	0 (0-1)	2 (1-2)	1 (0-2)	**0 (0-0)**[a]	**0 (0-1)**
			1 (0-2)	1 (0-2)			0 (0-2)	0 (0-2)										
Greece	-	-	2 (2-3)	2 (2-2)	3 (2-4)	3 (2-3)	3 (3-4)	2 (1-3)	2 (1-3)	2 (1-3)	0 (0-1)	1 (0-1)	1 (0-2)	1 (0-2)	1 (1-2)	1 (0-2)	1 (0-2)	1 (0-2)
			1 (1-2)	1 (0-2)			2 (0-3)											
Portugal	3 (3-4)	4 (2-4)	2 (2-2)	2 (2-2)	2 (0-3)	2 (0-3)	2 (2-3)	2 (2-3)	1 (0-2)	1 (0-2)	0 (0-1)	0 (0-1)	1 (0-1)	1 (0-2)	2 (1-2)	2 (1-2)	1 (0-1)	1 (0-1)
			1 (1-2)	2 (1-2)			1 (0-2)	1 (0-2)										
Romania	4 (3-4)	4 (3-4)	2 (2-3)	2 (2-3)	**2 (0-3)**[a]	**2 (0-3)**	3 (2-4)	3 (3-4)	1 (0-2)	1 (0-2)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)	2 (1-2)	2 (2-2)	1 (0-2)	2 (0-2)
			2 (1-2)	2 (1-2)			1 (0-3)	2 (0-3)										
The Netherlands	3 (3-4)	3 (3-4)	2 (2-2)	2 (2-3)	**3 (3-4)**[a]	**3 (2-4)**	2 (2-3)	2 (1-3)	**2 (1-3)**[a]	**1 (0-2)**	0 (0-1)	0 (0-1)	1 (0-2)	0 (0-2)	2 (1-2)	2 (1-2)	0 (0-1)	0 (0-1)
			1 (0-1)	1 (0-2)			2 (0-2)	2 (0-3)										
Total	3 (3-4)	4 (3-4)	2 (2-3)	2 (2-3)	**3 (3-4)**[c]	**2 (0-3)**	3 (2-3)	3 (2-3)	**1 (0-3)**[b]	**1 (0-2)**	0 (0-1)	0 (0-1)	1 (0-2)	0 (0-2)	**2 (1-2)**[a]	**2 (1-2)**[d]	0 (0-1)	0 (0-2)
			1 (1-2)	1 (0-2)			1 (0-3)	1 (0-3)										

Comparison between the educational groups of each country and the total sample with Mann-Whitney U test. Rounded values are presented.
a,b,c: significant at .05, .01 and .001 respectively; d: negligible differences in spread were found between the socio-economic status groups.
*: Difference in spread showed that the mothers from the low education group had more often the efficacy to manage child's computer exposure.

Appendix 5. Median values and quartiles (q_1-q_3) for determinants of the child's physical environment and energy balance-related behaviours.

Determinant of physical environment	**Country**															
	Belgium		**Bulgaria**		**France**		**Greece**		**Portugal**		**Romania**		**The Netherlands**		**Total**	
Water consumption																
Education level (mother) / **Situation specific habit** *(0)never- (4)always*	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
During mealtime	**3 (2-4)[b]**	**3 (1-4)**	3 (2-3)	3 (2-3)	4 (3-4)	3 (2-4)	**3 (2-4)[b]**	**4 (3-4)**	3 (3-4)	3 (3-4)	2 (2-3)	2 (1-3)	2 (1-4)	2 (1-3)	3 (2-4)	3 (2-4)
Between meals	3 (2-3)	3 (2-3)	3 (3-4)	4 (3-4)	3 (2-4)	3 (2-3)	3 (3-4)	4 (3-4)	3 (3-4)	4 (3-4)	4 (3-4)	4 (3-4)	2 (2-3)	2 (2-3)	3 (2-4)	3 (2-4)
During/after sports/playing	3 (3-4)	4 (3-4)	4 (3-4)	4 (3-4)	4 (4-4)	4 (3-4)	4 (4-4)	4 (4-4)	4 (3-4)	4 (3-4)	4 (3-4)	4 (3-4)	**3 (2-3)[a]**	**3 (2-4)**	4 (3-4)	4 (3-4)
Fruit juices consumption																
Education level (mother) / **1.Situation specific habit** *yes (%)*	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
During the weekend	35,5	37,3	42,4	37,5	42,0	46,7	44,0	35,8	57,8	49,2	44,1	51,2	27,1	38,5	43,7	42,5
At breakfast	56,6	45,1	15,8	20,8	59,8	68,0	22,7	20,9	**9,2[b]**	**1,6**	15,1	7,5	10,5	10,4	23,9	24,4

Appendix 5. Median values and quartiles (q_1-q_3) for determinants of the child's physical environment and energy balance-related behaviours (*continued*).

	Belgium		Bulgaria		France		Greece		Portugal		Romania		The Netherlands		Total	
At lunch	**7,9**[b]	**22,5**	20,9	20,8	8,0	13,0	20,0	23,9	15,6	10,2	19,4	27,5	9,2	16,7	15,5	18,4
At dinner	10,5	17,6	29,5	22,9	**4,0**[a]	**18,5**	5,3	1,5	21,1	29,7	16,1	7,5	9,2	4,2	16,2	16,5
At school	56,6	59,8	23,7	25,0	6,0	4,3	30,7	37,3	28,4	25,0	4,3	3,8	18,4	33,3	24,4	27,1
While watching TV	6,6	14,7	**10,1**[a]	**22,9**	6,0	14,1	14,7	10,4	**0,0**[a]	**4,7**	6,5	11,2	7,9	18,8	**7,3**[b]	**12,4**
Between meals	15,8	26,5	24,5	35,4	16,0	18,5	42,7	34,3	1,8	1,6	25,8	36,2	17,1	16,7	20,2	21,8
During/after sports	6,6	14,7	9,4	16,7	2,0	7,6	26,7	19,4	1,8	0,0	3,2	88	6,6	8,3	7,9	9,6
At birthdays parties	48,7	38,2	49,6	41,7	**56,0**[b]	**77,2**	52,0	44,8	59,6	54,7	**35,5**[a]	**55,0**	27,6	31,2	47,8	52,2
2. Home availability *never (0)-always (4)*	4 (3-4)	4 (3-4)	3 (2-3)	3 (2-3)	4 (3-4)	4 (3-4)	3 (2-4)	3 (2-4)	2 (1-3)	2 (2-3)	2 (2-3)	2 (2-3)	3 (2-4)	3 (1-4)	3 (2-4)	3 (2-4)
Soft drinks consumption																
Education level (mother) / **1.Situation specific habit** *yes (%)*	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
During the weekend	52,6	49,0	28,8	33,3	60,0	64,1	32,0	26,9	43,1	46,9	32,3	46,2	36,8	47,9	**38,7**[b]	**46,5**
At breakfast	0,0	1,0	1,4	2,1	0,0	2,2	0,0	0,0	0,0	0,8	0,0	2,5	3,9	8,3	0,8	1,9

Appendix 5. Median values and quartiles (q_1-q_3) for determinants of the child's physical environment and energy balance-related behaviours (*continued*).

	Belgium		Bulgaria		France		Greece		Portugal		Romania		The Netherlands		Total	
At lunch	22,4	23,5	7,9	8,3	10,0	16,3	5,3	9,0	**0,9**[a]	**7,8**	5,4	8,8	3,9	4,2	**7,4**[b]	**12,0**
At dinner	22,4	24,5	13,7	12,5	14,0	17,4	0,0	1,3	**10,1**[a]	**21,1**	3,2	6,2	10,5	8,3	**10,7**[a]	**14,7**
At school	5,3	5,9	12,2	22,9	2,0	1,1	2,7	1,5	6,4	7,0	6,5	5,0	25,0	31,2	9,1	8,3
While watching TV	13,2	9,8	6,5	14,6	8,0	8,7	1,3	1,5	0,0	2,3	4,3	7,5	14,9	14,6	6,3	7,4
Between meals	21,1	17,6	7,2	10,4	16,0	27,2	5,3	3,0	0,0	2,3	6,5	8,8	35,5	22,9	11,5	12,6
During/after sports	3,9	10,8	3,6	4,2	0,0	1,1	0,0	3,0	0,0	0,8	3,2	**5,0**	**14,5**[a]	**2,1**	3,6	3,9
At birthdays parties	63,2	54,9	59,7	62,5	60,0	76,1	62,7	71,6	73,4	69,5	78,5	75,0	51,3	41,7	64,7	66,0
2. Home availability	2 (1-4)	2 (1-4)	**1 (0-2)**[a]	**1 (0-2)**	2 (2-4)	2 (1-4)	0 (0-1)	0 (0-1)	**1 (1-2)**[b]	**2 (1-2)**	**1 (0-1)**[a]	**1 (1-2)**	2 (1-4)	2 (1-4)	**1 (0-2)**[c]	**2 (1-3)**
never (0)-always (4)																
	TV exposure															
	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
TV in bedroom	**14,9%**[a]	**28,7%**	**39,9%**[b]	**66,0%**	20,0 %	31,1 %	20,0%	20,9 %	**36,1%**[c]	**73,4 %**	**48,9%**[c]	**75,3%**	**5,3%**[c]	**31,3%**	**29,2%**[c]	**48,2%**
yes (%)																
TV on during meal	**2 (1-5)**[a]	**1 (1-4)**	1 (1-3)	1 (1-3)	1 (1-1)	1 (1-1)	**4 (3-5)**[a]	**4 (2-5)**	**1 (1-5)**[a]	**1 (1-4)#**	3 (1-6)	3 (1-6)^	**5 (4-5)**[b]	**4 (3-5)**	**3 (1-5)**[c]	**1 (1-4)**
(1) Every day- (5) Never																

Rounded values are presented. Comparison of the educational groups per country, with Mann-Whitney U test for the categorical variables and Pearson's Chi-square test for the binomial variables.
a,b,c: significant at .05, .01 and .001 respectively

Appendix 6. Corrected critical p-values after adjustment for multiple testing.

Country	Belgium	Bulgaria	France	Greece	Portugal	Romania	Netherlands	TOTAL
Corrected overall critical p-value	**0.00210526**	**0.00105263**	**0.00052632**	**0.00053763**	**0.00842105**	**0.00421053**	**0.00315789**	**0.02157895**
Energy balance related-behaviour								
Fruit consumption frequency (per week)	0	0	0	0	1	0	1	1
Salad or grated vegetables frequency (per week)	0	0	0	0	1	0	0	1
Raw vegetables frequency (per week)	0	0	0	0	0	0	0	1
Cooked Vegetables	0	0	0	0	1	0	0	0
Water frequency	0	0	0	0	0	0	0	0
Fruit juices frequency (per week)	0	0	0	0	0	0	0	0
Fruit juices amount	0	0	0	0	0	0	0	1
Soft drinks frequency	0	0	0	0	1	1	0	1

Appendix 6. Corrected critical p-values after adjustment for multiple testing (*continued*).

Country	Belgium	Bulgaria	France	Greece	Portugal	Romania	Netherlands	TOTAL
Corrected overall critical p-value / **Energy balance related-behaviour**	**0.00210526**	**0.00105263**	**0.00052632**	**0.00053763**	**0.00842105**	**0.00421053**	**0.00315789**	**0.02157895**
Soft drinks amount	0	0	0	0	0	1	0	1
TV weekdays	1	0	0	0	1	1	0	1
TV weekend days	0	0	0	0	0	0	0	1
PC weekdays	0	1	0	0	0	0	0	0
PC weekend days	0	0	0	0	0	0	0	0
Total screen time	1	0	0	0	1	0	0	1
Sleep hours-Week days	0	0	0	0	1	0	1	0
Sleep hours-Weekend days	0	0	0	0	0	0	0	0
Determinants of fruit consumption								
Parental knowledge on recommendations	0	0	0	0	0	0	0	0
Active encouragement	0	0	0	0	0	0	0	0

Appendix 6. Corrected critical p-values after adjustment for multiple testing (*continued*).

Country	Belgium	Bulgaria	France	Greece	Portugal	Romania	Netherlands	TOTAL
Corrected overall critical p-value	**0.00210526**	**0.00105263**	**0.00052632**	**0.00053763**	**0.00842105**	**0.00421053**	**0.00315789**	**0.02157895**
Energy balance related-behaviour								
Performing EBRB together with the child	0	0	0	0	1	0	0	0
Habit to eat fruit daily	0	0	0	0	0	0	0	0
Parental demand	0	0	0	0	0	0	1	1
Parental allowance	0	0	0	0	0	0	0	1
Home availability	0	0	0	0	1	0	0	1
Parental facilitation	0	0	0	0	0	0	0	1
Determinants of vegetable consumption								
Parental knowledge on recommendations	0	0	0	0	1	0	0	1
Active encouragement	0	0	0	0	0	0	0	0
Performing EBRB together with the child	0	0	0	0	0	0	0	1

Appendix 6. Corrected critical p-values after adjustment for multiple testing (*continued*).

Country	Belgium	Bulgaria	France	Greece	Portugal	Romania	Netherlands	TOTAL
Corrected overall critical p-value	**0.00210526**	**0.00105263**	**0.00052632**	**0.00053763**	**0.00842105**	**0.00421053**	**0.00315789**	**0.02157895**
Energy balance related-behaviour								
Habit to eat vegetables daily	0	0	0	0	0	0	0	1
Parental demand	0	0	0	0	0	0	0	0
Parental allowance	0	0	0	0	0	0	0	1
Home availability	0	0	0	0	1	0	0	1
Parental facilitation	0	0	0	0	0	0	1	1
Determinants of fruit juices consumption								
Home availability	0	0	0	0	0	0	0	0
Paying attention/monitoring	0	0	0	0	0	0	0	0
Parental allowance 1	0	0	0	0	0	0	0	0
Parental allowance 2	0	0	0	0	0	0	0	0
Negotiating	0	0	0	0	0	0	0	0

Appendix 6. Corrected critical p-values after adjustment for multiple testing (*continued*).

Country	Belgium	Bulgaria	France	Greece	Portugal	Romania	Netherlands	TOTAL
Corrected overall critical p-value	**0.00210526**	**0.00105263**	**0.00052632**	**0.00053763**	**0.00842105**	**0.00421053**	**0.00315789**	**0.02157895**
Energy balance related-behaviour								
Communicating the health belief 1	0	0	0	0	0	0	0	0
Communicating the health belief 2	0	0	0	0	0	0	0	1
Avoid negative modelling	0	0	0	0	0	0	0	0
Nagging behaviour	0	0	0	0	0	0	0	0
Parental self- efficacy to retain rules	0	0	0	0	0	0	0	0
Rewarding/comforting practice	0	0	0	0	1	0	0	1
Conducting energy-balance related behaviour together with the child	0	0	0	0	0	0	0	1

Appendix 6. Corrected critical p-values after adjustment for multiple testing (*continued*).

Country	Belgium	Bulgaria	France	Greece	Portugal	Romania	Netherlands	TOTAL
Corrected overall critical p-value	**0.00210526**	**0.00105263**	**0.00052632**	**0.00053763**	**0.00842105**	**0.00421053**	**0.00315789**	**0.02157895**
Energy balance related-behaviour								
Determinants of soft drinks consumption								
Home availability	0	0	0	0	1	1	0	1
Paying attention/monitoring	0	0	0	0	0	0	0	0
Parental allowance 1	0	0	0	0	0	1	0	1
Parental allowance 2	0	0	0	0	0	0	0	0
Communicating health belief 1	0	0	0	0	0	0	0	0
Communicating health belief 2	0	0	0	0	1	0	0	0
Avoid negative modelling	0	0	0	0	0	0	0	1
Nagging behaviour	0	0	0	0	0	0	0	0
Parental self- efficacy to retain rules	0	0	0	0	0	0	0	0

Appendix 6. Corrected critical p-values after adjustment for multiple testing (*continued*).

Country	Belgium	Bulgaria	France	Greece	Portugal	Romania	Netherlands	TOTAL
Corrected overall critical p-value	**0.00210526**	**0.00105263**	**0.00052632**	**0.00053763**	**0.00842105**	**0.00421053**	**0.00315789**	**0.02157895**
Energy balance related-behaviour								
Rewarding/comforting practice	0	0	0	0	0	0	0	0
Conducting energy-balance related behaviour together with the child	0	0	0	0	0	1	0	1
Determinants of television exposure								
TV in child's bedroom	0	0	0	0	1	1	1	1
TV on during meal time	0	0	0	0	0	0	0	1
Paying attention/monitoring	1	0	0	0	0	0	0	1
Parental allowance 1	0	0	0	0	0	0	0	1
Parental allowance 2	0	0	0	0	0	0	0	1
Negotiating	0	0	0	0	0	0	0	1
Avoid negative modelling	0	0	0	0	0	0	1	1

Appendix 6. Corrected critical p-values after adjustment for multiple testing (*continued*).

Country	Belgium	Bulgaria	France	Greece	Portugal	Romania	Netherlands	TOTAL
Corrected overall critical p-value	**0.00210526**	**0.00105263**	**0.00052632**	**0.00053763**	**0.00842105**	**0.00421053**	**0.00315789**	**0.02157895**
Energy balance related-behaviour								
Nagging behaviour	0	0	0	0	0	0	0	1
Parental self- efficacy to retain rules	0	0	0	0	0	0	0	0
Rewarding/comforting practice	0	0	0	0	0	0	0	0
Performing energy-balance related behaviour together with the child	1	0	0	0	0	1	0	1
Communicating health belief 1 (TV and PC exposure)	0	0	0	0	0	0	0	0
Communicating health belief 2 (TV and PC exposure)	0	0	0	0	0	0	0	0
Determinants of computer exposure								
Paying attention/monitoring	0	0	0	0	0	0	0	0

Appendix 6. Corrected critical p-values after adjustment for multiple testing (*continued*).

Country	Belgium	Bulgaria	France	Greece	Portugal	Romania	Netherlands	TOTAL
Corrected overall critical p-value	**0.00210526**	**0.00105263**	**0.00052632**	**0.00053763**	**0.00842105**	**0.00421053**	**0.00315789**	**0.02157895**
Energy balance related-behaviour								
Parental allowance 1	0	0	0	0	0	0	0	0
Parental allowance 2	0	0	0	0	0	0	0	0
Negotiating	0	0	0	0	0	0	0	1
Avoid negative modelling	0	0	0	0	0	0	0	1
Nagging behaviour	0	0	0	0	0	0	0	0
Parental self- efficacy to retain rules	0	0	0	0	0	0	0	0
Rewarding/comforting practice	0	0	0	0	0	0	0	0
Performing energy-balance related behaviour together with the child	0	1	0	0	0	0	0	1

Appendix 6. Corrected critical p-values after adjustment for multiple testing.

Country	Belgium	Bulgaria	France	Greece	Portugal	Romania	Netherlands	TOTAL
Corrected overall critical p-value	**0.00210526**	**0.00105263**	**0.00052632**	**0.00053763**	**0.00842105**	**0.00421053**	**0.00315789**	**0.02157895**
Energy balance related-behaviour								
Situation specific habit for soft drinks consumption								
During the weekend	0	0	0	0	0	0	0	1
Breakfast	0	0	0	0	0	0	0	0
At Lunch	0	0	0	0	0	0	0	1
At Dinner	0	0	0	0	0	0	0	0
At school	0	0	0	0	0	0	0	0
While watching TV	0	0	0	0	0	0	0	0
As a thirst quencher between me	0	0	0	0	0	0	0	0
During\after sports	0	0	0	0	0	0	0	0
At birthdays\parties	0	0	0	0	0	0	0	0

Appendix 6. Corrected critical p-values after adjustment for multiple testing (*continued*).

Country	Belgium	Bulgaria	France	Greece	Portugal	Romania	Netherlands	TOTAL
Corrected overall critical p-value	**0.00210526**	**0.00105263**	**0.00052632**	**0.00053763**	**0.00842105**	**0.00421053**	**0.00315789**	**0.02157895**
Energy balance related-behaviour								
Situation specific habit for fruit juices consumption								
During the weekend	0	0	0	0	0	0	0	0
Breakfast	0	0	0	0	1	0	0	0
At Lunch	0	0	0	0	0	0	0	0
At Dinner	0	0	0	0	0	0	0	0
At school	0	0	0	0	0	0	0	0
While watching TV	0	0	0	0	0	0	0	1
As a thirst quencher between meals	0	0	0	0	0	0	0	0
During\after sports	0	0	0	0	0	0	0	0
At birthdays\parties	0	0	0	0	0	0	0	0

Chapter 5

Inequalities in energy-balance related behaviours and family environmental determinants in European children: Changes and sustainability within the EPHE evaluation study.

Mantziki K, Renders CM, Vassilopoulos A, Radulian G, Borys JM, du Plessis H, Gregório MJ, Graça P, de Henauw S, Handjiev S, Visscher TLS, Seidell JC.

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Abstract

Increasing social inequalities in health across Europe are widening the gap between low and high socio-economic status groups, notably in the prevalence of obesity. Public health interventions may result in differential effects across population groups. Therefore, the EPHE (EPODE for the Promotion of Health Equity) project analysed the added value of community-based programmes, based on the EPODE (Ensemble Prévenons l'Obésité Des Enfants-Together Let's Prevent Obesity) model, to reduce socio-economic inequalities in energy balance-related behaviours of children and their family-environmental related determinants in seven European communities. This study presents the changes between baseline and follow-up after the one-year interventions and their sustainability one year after. This is a prospective study with a one school-year intervention, followed by one year of follow-up. In all, 1266 children (age 6-8 years) and their families from different socio-economic backgrounds were recruited at baseline. For 1062 children, information was available after one year (T_1) and for 921 children after two years (T_2). A self-reported questionnaire was completed by the parents to examine the children's energy balance-related behaviours and family- environmental determinants. Socio-economic status was defined by the educational level of the mother. The Wilcoxon signed-rank test for paired data was used to test the differences between baseline and intermediate, and between intermediate and final, measurements for each of the socio-economic status groups. Post-intervention effects in energy-balance related behaviours showed the following improvements among the low socio-economic status groups: increased fruit consumption (Netherlands), decreased fruit juices amount consumed (Romania) and decreased TV

time on weekdays (Belgium). Whereas in only the latter case the behavioural change was accompanied with an improvement in a family-environmental determinant (monitoring the time the child watches TV), other improvements in parental rules and practices related to soft drinks/fruit juices and TV exposure were observed. A few of those effects were sustainable, notably in the case of Belgium.

Inequalities in obesity-related behaviours could be potentially reduced when implementing community-based interventions, tailored to inequality gaps and using the EPODE methodology. Within-group changes varied widely, whereas monitoring of interventions and process evaluation are crucial to understand the observed results.

Background

Tackling inequalities in overweight, obesity and related determinants is high on the political and public health agenda in many European countries [1-6]. Socio-economic inequalities in obesity cases may develop in early childhood and last throughout the later stages of life [7, 8], while childhood is a critical period for shaping future behaviours. Therefore targeting children and their parents to reduce these socioeconomic inequalities is of major importance. However, most studies assess the effects of interventions in reducing overall obesity levels instead of reducing obesity-related inequalities [9]. Consequently, studies reporting the types of interventions that are effective in reducing such inequalities -particularly in children- are scarce [3, 5, 6, 9, 10].

Public health interventions may particularly reach people with a relatively high income and education and they thereby may increase inequalities, despite being effective on the general population [9, 11-15]. This is defined as the 'intervention-generated inequality', which evolves from the 'inverse care law' [16], meaning that the groups/populations mostly in need of health care are the least likely to benefit from it [12, 15, 17]. It is possible that intervention-generated inequality may happen at several (if not at any) points of the planning and the implementation of an intervention (i.e. intervention efficacy, service provision or access, uptake, compliance) [6, 12, 14, 17]. Victora et *al.* demonstrated that the widening of the inequality gap by the newly introduced interventions occurs due to preferential uptake of the intervention by the most advantaged groups, before the narrowing of the inequality can take place [6, 18]. In the literature, several attempts have been made to explain this phenomenon by relating it to low compliance [14], the sources of being

disadvantaged [6, 18] and low participation rates [13]. Nevertheless, further research is needed to determine the specific components of interventions that result in intervention-generated inequalities [6, 17].

Several authors have attempted to specify which interventions may decrease or widen inequalities with regards to obesity. Existing evidence from universal interventions aiming at childhood obesity prevention is mixed. Bambra et *al.* systematically assessed the effectiveness of interventions to reduce inequalities in childhood obesity and concluded that school-based universal interventions, combining nutrition and physical activity knowledge activities had the potential to have a positive impact on low socioeconomic status children, if the interventions lasted for more than six months [19]. Other studies identified that community and/or school-based interventions were successful in reducing inequalities in obesity outcomes or did not increase them [12, 13, 15], especially when environmental change components were included [20]. Toybox, a kindergarten-based intervention aiming to increase physical activity- was only effective in the high socioeconomic kindergartens [21], whereas the "Health in Adolescents" study was effective in the middle and high education groups [11].

Another body of evidence suggests that interventions targeting the more/most disadvantaged are likely to reach the low socioeconomic groups and reduce inequalities, as long as they are strategically designed and implemented [17, 22, 23]. According to Laws et *al.*, targeted interventions demonstrated improvement in obesity-related outcomes in low socioeconomic status populations, although most of the reviewed research was of low quality [22]. The most recent reviews suggest that upstream, community-based and multilevel interventions are more likely to reduce inequalities in health, taking into account the involvement of

the hard-to-reach target groups, integrating their needs and wishes in the implementation strategies and delivering multiple interventions [12-14, 19, 22].

In response to that evidence and based on the reduction of health inequality in child obesity and overweight through the EPODE (Ensemble Prévenons l'Obésité Des Enfants-Together let's prevent obesity) approach [24-26], the EPHE (Epode for the Promotion of Health Equity) project was launched (http://www.ephestory.eu/).The overall aim of the EPHE project was to assess the impact and sustainability of EPODE to diminish inequalities in childhood obesity and overweight (Summary box 1). Based on scientific evidence [27-30], the EPHE scientific advisory board selected four behaviours related to obesity and overweight, which were addressed by the EPHE interventions: promotion of 1. Fruit and vegetable intake, 2. Tap water intake, 3. Active lifestyle and 4. Adequate sleep duration. The methods and framework of the EPHE project are summarised in Summary box 2 and the timeline is illustrated in figure 1.

The EPHE programmes developed community-based interventions (September 2013-May 2014) addressing the four behaviours and related determinants which were unhealthier in the low socio-economic status groups than in the high socio-economic status groups [31]. Therefore, the objectives of the current paper are: a) to assess changes in energy-balance related behaviours and family-environmental determinants within both the high and the low education groups by comparing the baseline (T_0) with the intermediate (T_1) measurements, after the termination of the interventions, after one year; b) to assess the sustainability of potential improvements identified after the interventions (T_1) a year after (T_2). The article focuses on changes in

behaviours and determinants related to the inequality gaps that were identified at the baseline measurement [33].

Methods and design

The EPHE evaluation study is based on one school-year of lifestyle interventions aimed at children and their parents, followed by one year of follow-up. The interventions were carried out in seven European countries. This study aims: a) to identify differences in energy balance-related behaviours and related family-environmental determinants, between high and low status socio-economic groups, b) to assess the potential decrease of inequality gaps after tailored interventions and c) to assess the sustainability of potential improvements a year after the termination of the interventions. More information about the identified health inequalities within the EPHE study can be found elsewhere [31].

Sample and recruitment

Seven community-based programmes, which are part of the Epode International Network and implement the EPODE approach, participate in the EPHE project: VIASANO (Belgium), EPODE (France), PAIDEIATROFI (Greece), Maia Healthy Menu (Portugal), SETS (Romania), JOGG (The Netherlands) HEALTHY KIDS (Bulgaria); the latter programme is part of the Nestlé's Healthy Kids programme and implements a similar approach to EPODE. Every programme participated in EPHE project through communities within an EPODE city.

Summary box 1. Objectives of the EPHE project.	**Summary box 2. Summary of the EPHE methods and framework.**
The EPHE project aims to analyse from 2012 to 2015: ▪ The added value of the implementation of an adopted EPODE approach for the reduction of socioeconomic inequalities in health implemented by 7 European community-based programmes, focusing on four energy balance-related behaviours (fruit and vegetable consumption, tap water intake, sedentary behaviour, sleep duration) and their family-environmental determinants. ▪ *Opportunities to sustain the implementation of EPHE best practices in other EU regions and member states via EU structural funds, focusing on the replicability and transferability, at a longer scale, of those to leverage the experience to develop action plans by member states and to make use of structural funds for the promotion of health equity* [33]. *EPHE worked at the community level in key settings to develop integrated action locally* [33].	▪ Seven European community-based programmes, following the EPODE or similar approach, participated in the EPHE project. ▪ The programmes recruited (at baseline) families with children aged between 6 to 9 years old from different socio-economic backgrounds, through schools. ▪ The programmes developed interventions for the whole population, each addressing the relevant inequality gaps identified at baseline [31]. ▪ Intervention target: to improve energy balance-related behaviours and their family-environmental determinants of low socio-economic status families with children 6-9 years old ▪ Evaluation of the interventions' effects after the intervention period and sustainability assessment a year after [33].

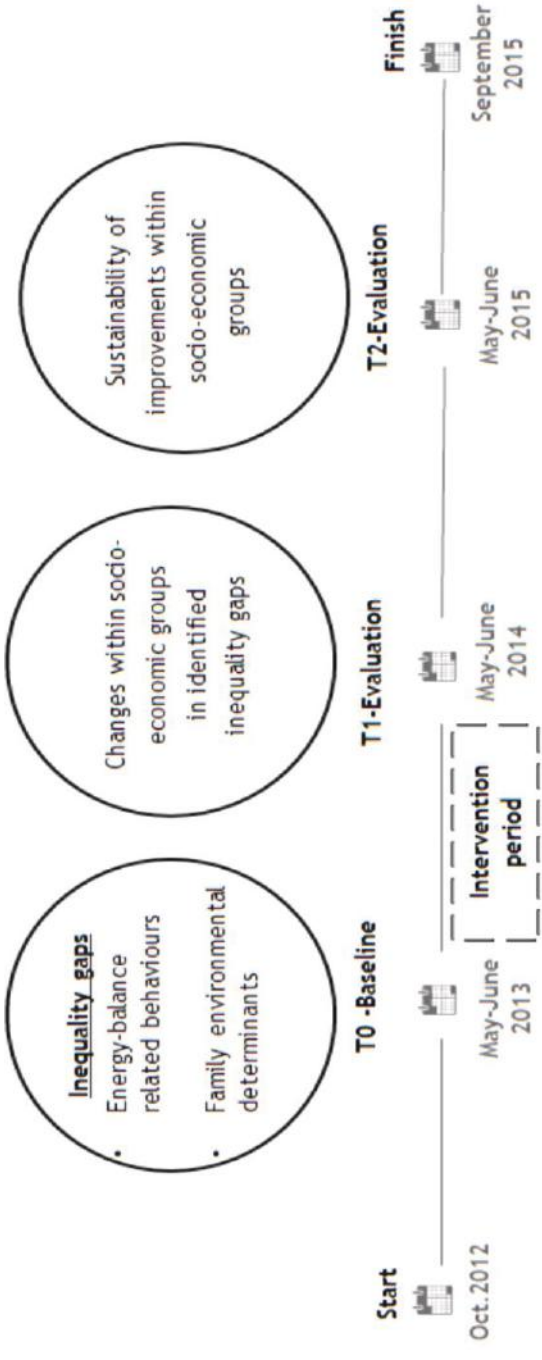

Figure 1. Timeline and objectives of the EPHE evaluation study.

We aimed at recruiting a minimum of 150 families with children aged between 6 to 8 years old in every selected EPODE community with a similar variation regarding age and ethnicity per site. We obtained convenience samples which are not necessarily representative to the country, which was beyond the scope of this study. Each of the programmes conducted the recruitment through schools. The survey obtained a permission waiver from the Medical Ethics Committee of the VU University Medical Centre. In addition, permission to research in schools was acquired from the local community and/or school authorities, where necessary. More information about sampling and recruitment are described elsewhere [32].

EPHE intereventions

The EPHE programmes developed and implemented general community-based interventions for the selected behaviours towards the whole community, but primarily of children and parents, between September-December 2013. After the dissemination of the baseline results (September 2013), the programmes were instructed to conduct interventions tailored to the inequality gaps identified at baseline [31]. The EPHE Operational Board, comprising the national programme coordinators of each of the participant programmes, was responsible for the continuous training, empowerment and support of the local project managers of the communities, to design and implement the activities in accordance to the EPODE approach. Thus, the board held frequent meetings and contacts to facilitate competence building and approach transfer to the local level. Consequently, and as being the core of the EPODE approach, various community stakeholders were involved, such as municipal representatives, school personnel, health organisations *et cetera*. This active involvement of community actors was crucial for

implementing activities tailored to the community situation. To avoid stigmatization, all children of the communities (or schools in the case of the JOGG programme, municipality of Zwolle) were invited to participate to the activities, although these were tailored in behaviours and family environmental determinants, which were unhealthier in the low than in the high socio-economic status groups. However, due to time constrains the majority of the programmes were able to target only the energy-balance related behaviours and not the determinants. Examples of activities held within the EPHE project are games, workshops and educational materials on healthy diet, psychical activity and sleep. More information about the type of implemented activities, stakeholder involvement and implementation methods are included elsewhere [33].

Data collection

School teachers distributed the questionnaires, including an informed consent form, to the children who consequently delivered them to their parents, after the intervention period between May/June 2014 (T_1) and a year later, May/June 2015 (T_2). After a specified period of one to two weeks, the completed questionnaires were returned likewise to the teachers. Thereafter, the EPHE project managers collected the questionnaires from the schools and only the ones including a signed informed consent form were taken into consideration. In order to ensure the confidentiality of the data, a process to guarantee anonymity of participant families was applied [33].

EPHE parental questionnaire

It is well documented that a sustained positive energy balance in children is associated with several lifestyle behaviours, such as, low consumption of fruit and vegetables, high sugar intake, high fat intake, unhealthy

snacking, physical inactivity, high screen time and short sleep duration [27-30]. In addition studies have demonstrated associations between the family environment parental practices, rules and behaviours and the children's energy-balance related behaviours [34-36]. The EPHE scientific advisory board selected to address the following behaviours: fruit and vegetable intake, tap water intake, sugary beverages intake (i.e. fruit juices and soft drinks), screen exposure (i.e. television and computer) and adequate sleep duration. Furthermore, associated family-environmental determinants were assessed [34-36].

In order to assess differences in energy-balance related behaviours and their determinants among different socio-economic status groups (inequality gaps), a self-administered parental questionnaire was developed. The EPHE parental questionnaire was developed using items from relevant, validated questionnaires addressed in European populations: ENERGY parent and child questionnaires [34], the Pro-children child questionnaire [35] and its updated version PRO-GREENS [36], European Health Examination Survey questionnaire [38], European Social Survey questionnaire [40], United States Department of Agriculture questionnaire [39]. Additional items were constructed in the cases where, to our knowledge, no validated items or questionnaires existed.

Assessment of energy-balance related behaviours

The questionnaire assessed four energy-balance related behaviours of the child: 1. fruit and vegetable consumption; 2. soft drink/ fruit juices and water consumption; 3. TV or computer screen time and 4. sleep duration, as well as determinants related to the social and physical environment of the child, within the family setting. In order to keep the

length of the questionnaire within acceptable limits, we had to prioritise the many aspects of behaviour that could be relevant. The EPHE scientific advisory board decided (in consultation with experts) to keep sedentary behaviour as the indicator of physical activity. Other relevant aspects, which were not included, were snacks and meals (such as breakfast, lunch and dinner).

The consumption of fruits and vegetables was assessed by food frequency questions, referring to a usual week and measured on an 8-point Likert scale (1. Never - 8. Every day, more than twice a day) [32, 35, 36]. The consumption of fruit juices, soft drinks and diet soft drinks was measured by means of weekly frequency and amount consumed. The frequency was measured on a 7-point Likert scale (1. Never - 7. Every day, more than once a day) [32, 34]. The amount was measured by two items for fruit juices and three items for soft and diet soft drinks, assessing how many glasses (or small bottles; 250 ml), cans (330 ml) or big bottles (500 ml) the children drink [32, 34]. The amount was calculated by summing up the portions. In order to measure water consumption, two questions were constructed to measure the daily frequency (1. Never - 7. More than six times a day) and number of glasses consumed when drinking water (1. None - 6. five or more glasses). Sedentary behaviour is assessed by means of daily time spent in television (TV) viewing and time of computer (PC) use, for the week and the weekend days separately, measured on a 9-point Likert scale (1. Not at all - 9. 4.0 or more hours a day) [32, 34]. The total screen time was calculated by the sum of weekly (hours per weekday*5+hours per weekend day*2) TV and PC use. Furthermore, two questions informed by the ENERGY parent questionnaire assess the sleeping habits of the child (1. Sleeping routine; 2. Sleep duration per week/weekend-day) [32, 34].

Assessment of determinants

The determinants assessed refer to the social and physical family environment of the child. These were mainly assessed by one item and most of them were measured on a 5-point Likert-type scale (0. Never - 4. Always or -2. Fully disagree - 2. Fully agree), unless otherwise stated below and in the tables of this article; more details are described in Mantziki et *al*. [32]. The social environmental determinants are: a) for *fruit and vegetable* consumption, i. Parental demand (0. Never - 4. Yes, always), ii. Parental allowance (0. Never - 4. Yes, always), iii. Active encouragement (-2. Fully disagree - 2. Fully agree) and iv. Facilitating (0. Never - 4. Yes, always) and v. Parental knowledge on recommendations (1. no fruit – 8. 5 pieces per day [32, 35, 36]; b) for fruit juice/soft drink consumption and TV viewing/computer exposure, i. Paying attention/monitoring (0. Never - 4. Always), ii. Parental allowance (0. Never - 4. Always), iii. Negotiating (0. Never - 4. Always), iv. Communicating health beliefs (0. never - 4. always), v. Avoid negative modelling (0. never - 4. always), vi. Parental self-efficacy to manage child's intake (0. never - 4. always), vii. Rewarding/comforting practice (0. Never - 4. Always), viii. Conducting energy-balance related behaviour together with the child (1. Never- 8. Every day more than once; for TV viewing/computer time the scale is '0. Never - 4. Always') [32, 34]. The physical environmental determinants are: a) for the consumption of *fruit and vegetables,* i. home availability (0. Never – 4. Always) and ii. Situation specific habit (-2. Fully disagree - 2. Fully agree) [32, 35, 36] b) for *fruit juices/soft drinks* consumption, i. Home availability (0. Never - 4. Yes, always) and ii. Situation specific habit (1. Yes - 2. No) [32, 34]; and c) for *TV viewing\computer* exposure, i. Availability (1. Yes - 2. No) ii. Situation specific habit (TV on during mealtime) (1. Every day – 5. Never) [32, 34].

Socioeconomic measures

The socio-economic status indicators measured were parental employment status, perception of income position, parental educational level, parental sector of employment. The aforementioned variables are described in detail by Mantziki et *al* [32]. Knowing that maternal educational level has been classified as a good social factor explaining differences in nutritional outcomes in children [40-42], for the current study, the samples were divided into two groups based on the *educational level of the mother* (low-high). The educational level was assessed by a 6-point ordinal scale, measuring the years of education accomplished (1. Less than 6 years -6. More than 17 years; table 1). For each country's sample the median of the educational level was used as the cut-off point to define the educational level of the mother (low-high).

Statistical analysis

The Wilcoxon signed-rank test for the ordinal and McNemar's test of paired proportions for the binomial variables were used to detect differences in energy-balance related behaviours and determinants a. between T_0 and T_1 within the low and within the high education groups, for the variable where an inequality gap was identified at T_0; b. between T_1 and T_2 within both the low and high education groups, in the variables where an improvement was observed between T_0-T_1. The complete follow-up samples for were analysed, which differed in number between T_1 and T_2. Here we present medians and quartile ranges for the ordinal variables and percentages for the binomial variables, in order to illustrate the differences within both the low and high education groups. Knowing that the mean ranks produced by non-parametric tests are not always sufficiently informative and that differences in spread may be equally

important as differences in medians [43], further assessment of frequencies and distributions was explored. The results of the additional assessments are not presented in this article due the large amount of information. All analyses were conducted using the SPSS software v. 21.0 package (IBM Corp., Armonk, NY, USA).

Adjustment for multiple testing was conducted for the intermediate measurements (T_1), using the Benjamini and Hochberg method [44], using the Stata software v. 13 package (StataCorp. 2013. *Stata Statistical Software: Release 13*. College Station, TX: StataCorp LP).

Results

A total of 1061 children and their families were involved in the survey at the end of the interventions (T_1) and 921 in the final survey one year after the end of the interventions (T_2). Due to missing data in the variable 'educational level of mother', finally 961 and 794 subjects were included in the analysis in T_1 and T_2 respectively (Table 1). On average, the percentage of those cases lost to follow-up at T_1 was 30%, whereas it increased to 34% at T_2. The dropout of the low education group was higher in nearly all countries in both follow-up periods, as illustrated in figures 2 and 3. Tables 2-5 present only the changes in behaviours that differed between children from low and high socio-economic background (inequality gaps) at baseline [31]. Similarly the respective changes in determinants are presented in Appendices 1-5.

Table 1. Socio-demographic characteristics of the EPHE population per country after the interventions and (T_1) and after one year (T_2).

Country	Gender		Age child (years)	Age of mother [b]		Educational level mother		Total n [a]
	Boys (%)	Girls (%)	Mean (SD)	<30 (%)	>30 (%)	High (%)	Low (%)	
			T_1					
Belgium	82 (51,6)	77 (48,4)	7,62 (,52)	18 (14,0)	113 (86,0)	73 (45,6)	87 (54,4)	160
Bulgaria	71 (46,1)	83 (53,9)	8,68 (,50)	5 (4,0)	122 (96,0)	116 (75,3)	38 (24,7)	154
France	37 (35,2)	68 (64,8)	6,87 (,73)	22 (22,6)	55 (77,4)	41 (39,0)	64 (61,0)	105
Greece	67 (51,1)	64 (48,9)	8,32 (,63)	2 (1,8)	108 (98,2)	70 (53,4)	61 (46,6)	131
Portugal	90 (48,9)	94 (51,1)	7,87 (,76)	12 (7,3)	152 (92,7)	86 (46,7)	98 (53,5)	184
Romania	89 (55,6)	71 (44,4)	8,31 (,49)	21 (15,9)	111 (84,1)	86 (53,1)	76 (46,9)	162
The Netherlands	28 (43,1)	37 (56,9)	8,51 (,65)	1 (1,9)	53 (98,9)	46 (70,8)	19 (29,2)	65
Total	468 (48,0)	498 (52,0)	8,02 (,82)	81 (9,9)	732 (90,1)	516 (53,8)	444 (46,2)	961

Table 1. Socio-demographic characteristics of the EPHE population per country after the interventions and (T_1) and after one year (T_2) (*continued*).

Country	Gender		Age child (years)	Age of mother [b]		Educational level mother		Total n [a]
	Boys (%)	Girls (%)	Mean (SD)	<30 (%)	>30 (%)	High (%)	Low (%)	
			T_2					
Belgium	69 (50,0)	69 (50,0)	8,5 (,50)	12 (10,0)	108 (90,0)	74 (53,2)	65 (48,6)	139
Bulgaria	60 (45,5)	72 (54,5)	8,98 (,12)	9 (7,5)	112 (92,5)	97 (72,4)	37 (27,6)	134
France	29 (35,8)	52 (64,2)	7,87 (,68)	12 (15,6)	65 (84,4)	32 (39,5)	49 (60,5)	81
Greece	53 (50,0)	53 (50,0)	8,88 (,33)	0 (0,0)	95 (100)	50 (46,7)	57 (53,3)	107
Portugal	73 (47,7)	80 (52,3)	8,64 (,48)	9 (6,3)	134 (93,7)	82 (53,6)	71 (46,4)	153
Romania	78 (54,2)	65 (45,1)	8,94 (,23)	6 (4,4)	129 (95,6)	77 (53,5)	67 (46,5)	144
The Netherlands	16 (44,4)	20 (55,6)	8,89 (,32)	0 (0,0)	36 (100)	27 (75,0)	9 (25,0)	36
Total	378 (47,9)	411 (52,1)	8,70 (,52)	6,9	93,1	53,7	46,3	794

a: Total number of subjects that were followed-up and provided information for the educational level of the mother'; the number reflects the subjects included in the analysis .

b: The analysis includes the age of the mother only when the mother was the respondent; the age of the second parent was not assessed; Response categories: 1= Below 20, 2= 21-24, 3= 25-30, 4= 31-35, 5= 36-40, 7= Above 40. Number of subjects included in "age of mother" per country were a. at T_1 :Belgium=129, Bulgaria=127, France=97, Greece=110, Portugal=164, Romania=132, The Netherlands=54, Total=813; b. at T_2 : Belgium=116, Bulgaria=121, France=73, Greece=86, Portugal=136, Romania=120, The Netherlands=54, Total=684

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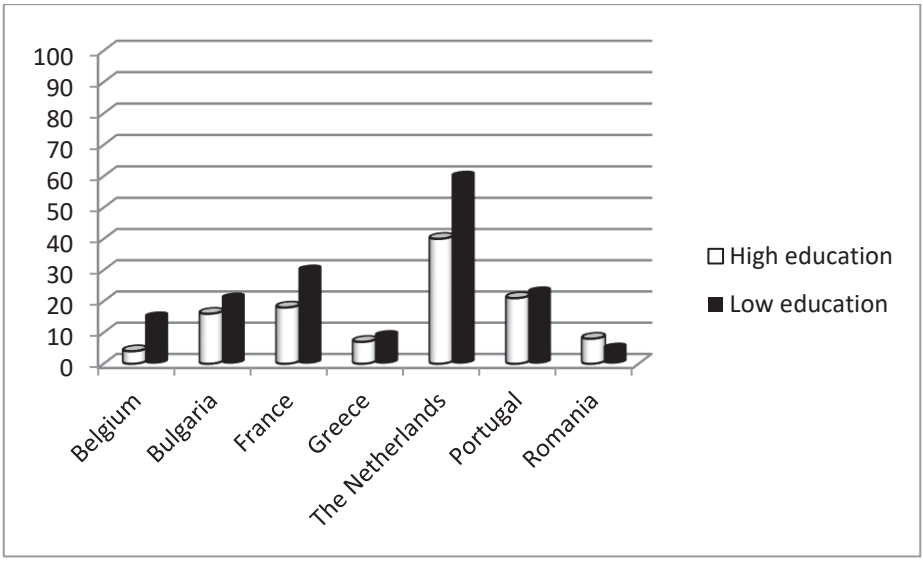

Figure 2. Percentage of population lost-to follow-up at T_1 per educational group per country

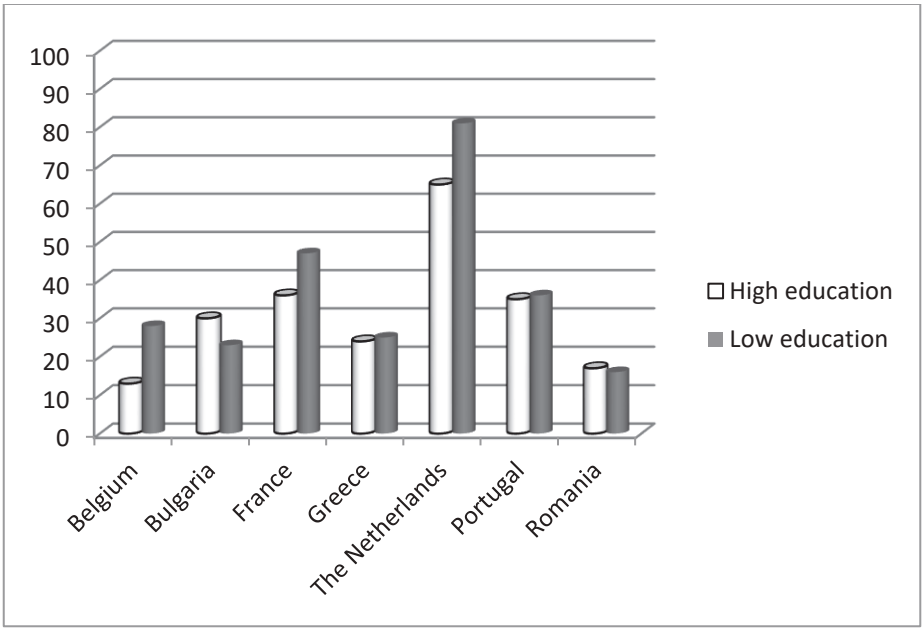

Figure 3. Percentage of population lost-to follow-up at T_2 per educational group per country

Given the large amount of data, we chose to discuss the statistically significant changes only. In addition, considering the second objective of the study- to assess the sustainability of the improvements that occurred between pre and post-intervention period, Table 6 and Appendix 6 illustrate the sustainability of such changes.

Changes in energy balance-related behaviours and their sustainability

Tables 2 to 5 shows changes in dietary intake, beverage intake, screen exposure and sleep hours, respectively, between the pre- and post-intervention period. Some behaviours were improved among the low socio-economic status groups, reducing the inequality gaps between children from low and high socio-economic background that were identified at baseline. However, a few worsening trends were observed as well within both the low and the high educational groups at T_1; besides that, few of the improved changes were sustained at T_2.

More specifically, the frequency of fruit intake increased significantly within the Dutch low education group (Table 2), reaching the same frequency as in the high education group. A small, but statistically significant decrease in the consumption of fruit juices was seen within the Romanian low education group (Table 3). TV time during weekdays decreased among the Belgian children from the low educational group (Table 4). Moreover, computer time both during weekdays and during weekend days increased significantly within the Bulgarian high education group, resulting in higher screen exposure during the week (Table 4). Computer time during weekends also increased in the Romanian sample, however, within the low education group (Table 4). No notable changes were found with respect to sleep hours (Table 5).

A year after the interventions, two of the aforementioned changes were sustained, namely the increased fruit intake among the Dutch low education group and the decrease of TV time spent on weekdays among the Belgian low education status group (Table 6).

Changes in determinants of energy balance-related behaviours and their sustainability

Similarly to the behavioural changes, we found a few statistically significant changes related to inequality gaps identified at baseline in the determinants of the assessed behaviours, within the low and within the high education groups in all countries, and again few of the reduced gaps were sustained.

In particular, no noteworthy changes were observed related to the determinants of fruit and vegetable consumption (Appendix 1). Parental practices related to the consumption of fruit juices improved in families with a low educational status background in Belgium (parental allowance), Greece (negotiate parental allowance) and Portugal (rewarding/comforting practice; Appendix 2). The latter was sustained a year after the interventions (Appendix 6).

For the determinants of soft drinks consumption, the observed effects were mixed. As illustrated in Appendix 3, in France the children of highly educated mothers complained more often when soft drinks were not allowed (nagging), whereas Romanian parents from a low educational background increased the frequency of drinking soft drinks in the presence of their child (avoid negative modelling; Appendix 3) compared to baseline. In contrast, a noteworthy change in Portugal was observed, namely the decreased home availability of soft drinks within the low

education group (Appendix 3), which was maintained a year after the interventions (Appendix 6).

More changes were observed in the determinants of screen exposure. Parental practices and rules improved in some countries within families from a low educational background (i.e. increased monitoring of child's TV time (Belgium), increased efficacy to control TV exposure of the child (Greece), decreased allowance of TV watching (Portugal) (Appendix 4), except in the Netherlands (avoid less often computer use in the presence of the child) (Appendix 5). Among the high education group, parental negotiation for the allowed TV time increased in France, indicating less strict rules (Appendix 4). All of the aforementioned improvements within the low education group were being sustained a year after the interventions (Appendix 6).

Results (T_1) after multiple testing adjustments

Adjustments for multiple testing resulted in critical p-values lower than 0.05 (ranging from 0.000316 to 0.002532), as initially set by the authors (Appendix 7). Consequently, fewer of the differences found within the education groups of each of the samples (based on α=0.05) were significant, based on the adjusted lower threshold (Appendix 7). As an illustration, the statistically significant differences within the Portuguese low education status group were initially 3 and after the adjustments this was reduced to 1 (Appendix 7). It was noteworthy that the decrease of TV time during weekdays among the Belgian low education group remained statistically significant (Appendix 7).

Table 2. Within-group comparison of median values and quartiles (q_1-q_3) between T_0-T_1 for weekly dietary intake per education group.

Fruit consumption (frequency/week) [1]				
	T_0		T_1	
Education level / **Country**	High	Low	High	Low
Portugal	7 (6-7)	6 (5-7)	7 (6-7)	6 (5-7)
Romania	6 (4-6)	5 (4-6)	6 (4-6)	6 (4-6)
The Netherlands	6 (6-7)	**5 (4-6)[a]**	6 (6-7)	**6 (5-7)[a]**
Salad/grated vegetables consumption (frequency/week) [1]				
	T_0		T_1	
Education level / **Country**	High	Low	High	Low
Portugal	6 (4-7)	5 (4-7)	6 (5-7)	6 (4-6)
Cooked vegetables consumption (frequency/week) [1]				
	T_0		T_1	
Education level / **Country**	High	Low	High	Low
Portugal	7 (6-7)	6 (5-7)	7 (6-7)	6 (5-7)
Romania	5 (4-6)	4 (3-6)	5 (4-6)	4 (4-6)

Comparison between the educational groups of each country and the total sample with Wilcoxon signed rank test. Rounded values are presented.

1: Response categories: **1**.Never **2**.Less than one day per week **3.**One day per week **4**.2-4 days a week **5**.5-6 days a week **6.**Every day, once a day **7.**Every day, twice a day **8.**Every day, more than twice a day

a: significant within-group difference at.01

Table 3. Within-group comparison of median values and quartiles (q_1-q_3) T_0-T_1 for weekly beverage intake per education group.

	Fruit juices frequency[1]			
	T_0		T_1	
Education level / **Country**	High	Low	High	Low
Romania	4 (3-6)	4 (2-4)	4 (3-4)	3 (3-4)
	Fruit juices amount (ml)[2]			
	T_0		T_1	
Education level / **Country**	High	Low	High	Low
Belgium	500 (250-580)	580 (500-750)	500 (250-580)	580 (250-830)
Bulgaria	580 (500-830)	830 (580-1160)	580 (540-830)	580 (250-830)
Romania	580 (250-830)	**580 (580-1060)**[a]	580 (250-830)	**580 (580-580)**[a]
The Netherlands	250 (250-500)	250 (250-580)	500 (250-580)	500 (250-580)
	Soft drinks frequency[1]			
	T_0		T_1	
Education level / **Country**	High	Low	High	Low
Portugal	2 (1-3)	3 (2-3)	2 (1-3)	2 (2-3)
Romania	2 (1-3)	3 (2-4)	2 (1-3)	3 (2-4)

Table 3. Within-group comparison of median values and quartiles (q_1-q_3) T_0-T_1 for weekly beverage intake per education group (*continued*).

	Soft drinks amount (ml)[2]			
	T_0		T_1	
Education level / **Country**	High	Low	High	Low
Portugal	250 (125-580)	580 (250-580)	250 (250-580)	580 (250-580)
Romania	580 (125-915)	1000 (500-1160)	580 (250-1080)	580 (250-1080)

Comparison between the educational groups of each country and the total sample with Wilcoxon signed rank test. Rounded values are presented.
a: significant within-group difference at .01. ¡: Inequality gap between the low and high education groups only at T1
1: Response categories: **1**.Never **2**.Less than once a week **3.**Once a week **4**.2-4 days a week **5**.5-6 days a week **6.**Every day, once a day **7.**Every day, more than once a day
2: The indicated amounts are derived from the sum of the respective question items; J3a and J3b and K3a, K3b and K3c for fruit juices amount and soft drinks amount respectively [31]. The variables are categorical with specific values of ml in each category

Table 4. Within-group comparison of median values and quartiles (q_1-q_3) T_0-T_1 for screen exposure per education group.

TV weekdays (h/day)[1]				
	T_0		T_1	
Education level / **Country**	High	Low	High	Low
Belgium†	3 (2-4)	**5 (3-6)[a]**	3 (3-4)	**4 (3-5)[a]**
France	3 (2-4)	4 (3-4)	4 (1-4)	4 (3-5)
Greece	3 (2-4)	4 (3-4)	3 (2-4)	3 (3-4)
Portugal^	3 (2-4)	3 (3-4)	3 (3-4)	3 (3-4)
Romania^	3 (3-4)	4 (3-6)	3 (3-5)	4 (3-6)
TV weekend days (h/day) [1]				
	T_0		T_1	
Education level / **Country**	High	Low	High	Low
Belgium†	5 (4-7)	7 (5-8)	5 (4-7)	6 (4-7)
France	5 (4-7)	6 (4-8)	4 (4-6)	5 (4-7)
Portugal	5 (4-6)	6 (4-7)	5 (4-6)	6 (4-7)
PC weekdays (h/day) [1]				
	T_0		T_1	
Education level / **Country**	High	Low	High	Low
Belgium†	1 (1-2)	2 (1-3)	1 (1-2)	2 (1-3)
Bulgaria	**2 (2-3)[a]**	3 (2-3)	**3 (2-3)[a]**	3 (2-3)
PC weekend days (h/day) [1]				
	T_0		T_1	
Education level / **Country**	High	Low	High	Low
Bulgaria	**3 (2-4)[a]**	4 (3-5)	**4 (3-5)[a]**	4 (3-4)
Romania^	4 (2-5)	**3 (1-5)[b]**	4 (3-6)	**5 (3-6)[b]**

Table 4. Within-group comparison of median values and quartiles (q_1-q_3) T_0-T_1 for screen exposure per education group (*continued*).

	Total screen time (h/week)[2]			
	T_0		T_1	
Education level / **Country**	High	Low	High	Low
Belgium†	12.5 (9-19)	19.5 (12-25)	12 (9-18)	17 (11-22.8)
Bulgaria	**18 (12-26)[a]**	23.50 (13.5-30)	**20.5 (13.5-29)[a]**	24 (16-30)
France	14 (9-24)	17.5 (11-22.5)	10 (16-22)	18.3 (11.4-23)
Greece	13.5 (9.5-20.5)	18 (13-22.5)	13.5 (9.5-20)	18.5 (13.5-26)
Portugal^	14.5 (10-20)	17 (11-23)	15 (12-22)	17 (12.5-22.5)

Comparison between the educational groups of each country and the total sample with Wilcoxon signed rank test. Rounded values are presented.

1: Response categories: **1.**Not at all **2.**30 min/day **3.**1 h/day **4.**2h/day **5.**2,5 h/day **6.**3 h/day **7.**3,5 h/day **8.**4 or more h/day

2: The indicated amounts of hours are derived from the sum of the respective question items for TV (T1a and T1b) and PC time (T4a and T4b) [31]. The variables are categorical with specific values of hours in each category.

^: the variables PC time for weekdays and weekend-days are measured with an extra response category for 1,5 h/day (coded as 4); as such the items include 9 response categories. This does not apply for the results of the total sample.

†: the variables TV/PC time for weekdays and weekend-days are measured with an extra response category for 1,5 h/day (coded as 4); as such the items include 9 response categories. This does not apply for the results of the total sample.

a, b: significant within-group difference at .01 and .001 respectively

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Table 5. Within-group comparison of median values and quartiles (q_1-q_3) T_0-T_1 for sleep hours per educational group.

Sleep duration weekdays (h/day) [1]				
	T_0		T_1	
Education level / **Country**	High	Low	High	Low
Portugal	3 (2-3)	2 (2-3)	3 (2-3)	2 (2-3)
The Netherlands	3 (3-3)	3 (2-3)	3 (3-3)	3 (3-3)
Sleep duration weekend days (h/day) [1]				
	T_0		T_1	
Education level / **Country**	High	Low	High	Low
The Netherlands	3 (3-3)	3 (2-3)	3 (3-3)	3 (3-3)

1: Response categories: **1.** 6 hours or less/ per night **2.**7 hours/ per night **3.**8 hours/ per night **4.**9 hours/ per night **5.**10 hours/ per night **6.**More than 10 hours per night.

Table 6. Within-group comparison of median values and quartiles (q_1-q_3) between T_1-T_2 for energy-balance related behaviours per education group.

Fruit consumption (frequency/week) [1]				
	T_1		T_2	
Education level / **Country**	High	Low	High	Low
The Netherlands	7 (6-7)	6 (5-7)	7 (6-7)	6 (4-6)
Fruit juices amount (ml)[2]				
	T_1		T_2	
Education level / **Country**	High	Low	High	Low
Romania	580 (250-830)	**580 (250-580)[b]**	580 (580-830)	**580 (580-830)[a]**
TV time weekdays (h/day)[3]				
	T_1		T_2	
Education level / **Country**	High	Low	High	Low
Belgium†	3 (2-4)	4 (3-5)	3 (2-4)	4 (3-5)

Comparison between the educational groups of each country and the total sample with Wilcoxon signed rank test. Rounded values are presented.

1: Response categories: **1**.Never **2**.Less than one day per week **3.**One day per week **4**.2-4 days a week **5**.5-6 days a week **6.**Every day, once a day **7.**Every day, twice a day **8.**Every day, more than twice a day

2: The indicated amounts are derived from the sum of the respective question items; J3a and J3b and K3a, K3b and K3c for fruit juices amount and soft drinks amount respectively [31]. The variables are categorical with specific values of ml in each category.

3: Response categories: **1.**Not at all **2.**30 min/day **3.1 h/day 4.**2h/day **5.**2,5 h/day **6.**3 h/day **7.**3,5 h/day **8.**4 or more h/day

†: the variables TV/PC time for weekdays and weekend-days are measured with an extra response category for 1,5 h/day (coded as 4); as such the items include 9 response categories.

a, b: significant within-group difference at .01 and .001 respectively

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Discussion

After a one school-year (8/9-months) intervention period aiming at reducing inequality gaps between low and high socio-economic status children and their families in health behaviours and determinants, an improvement of three energy-balance related behaviours among the low socio-economic status groups was observed, namely an increase of fruit consumption (Netherlands), decrease in the amount fruit juices consumed (Romania) and decrease of TV time on weekdays (Belgium). Whereas in only the latter case was the behavioural change accompanied by an improvement in a family-environmental determinant (monitoring the time the child watches TV), other improvements in parental rules and practices related to soft drinks/fruit juices and TV exposure were observed. These results, however, cannot be exclusively attributed to the EPHE interventions, given that causality is not analysed in this study.

Our results are supported by two systematic reviews, which found positive changes in intervention studies targeting behavioural changes, such as increase of physical activity and fruit and vegetable intake, decrease of screen time and intake of sugary beverages [19]. Most of these effective interventions were targeted at the low socio-economic status population, whereas only one was universal as the EPHE ones [19]. With regard to the changes we found in parental practices, observed primarily within the low socio-economic status groups, the improved values were similar or inclined towards the ones of the subjects of the respective high socio-economic status groups. These positive changes contradict the commonly observed phenomenon of the intervention-generated inequality [9, 11-15, 17]. Thus it seems that it is possible

through universal interventions to reach, improve and even sustain the improvement of parental practices, including in low socio-economic status groups. This may even be related to sustained changes in behaviour, as indicated by the sustained decrease in TV time on weekdays (Belgium), which may in turn be associated with the sustained increase in monitoring the child's time spent watching television.

Nevertheless, a few statistically significant and usually small changes were observed in the assessed outcomes between the pre- and post-intervention period within the low socio-economic status groups and even fewer were sustained one year after. Consequently, some of the inequality gaps were decreased and sustained, but not all of them. One reason for this, apparently, was the short preparation time for designing the interventions, which impeded the programmes to implement those interventions targeted at inequality gaps in the determinants, as initially intended. Another reason was probably the short duration of the interventions and consequently their low intensity to be able to result in sustainable behaviour change. Two reviews concluded that intervention studies, of moderate to high quality, improved energy-balance-related behaviours when implemented for more than six months, whereas community-based interventions delivered universally also reduced obesity-related outcomes of other kinds in all population groups in the long-term (>6 months) [9, 19]. Furthermore, a widening of inequalities was prevented through a multi-level, community capacity-building approach, in the medium to longer period (≥6 months) [9, 19]. It is worth mentioning the Fleurbaix–Laventie Ville Sante´ study, based on the EPODE approach, which showed a reduction in obesity prevalence in the lower socio-economic status group compared to the respective control group, only after conducting 12 years of community-based interventions

[26]. Furthermore, Magneé et *al* concluded from their assessement of universal interventions, that socio-economic inequalities in physical activity, diet or prevention of obesity are most likely to be reduced through intensive community level interventions, underlining the importance of tailoring interventions to the needs of low socio-economic status populations [13]. Whereas we considered the tailoring as selecting behaviours and determinants of behaviours that differed and therefore should be our target, the literature shows that tailoring should involve an investigation of the target population [45-47] and require participation of the target population in the development of interventions [48]. This was not possible in the EPHE project because of time constrains.

Strengths and limitations

To our knowledge, this is the first evaluation study that provides data on socio-economic inequalities in family-environmental determinants associated with energy-balance related behaviours across a wide variety of European countries. Translation and back translation procedures in the development of the questionnaires enabled comparisons of the study results across countries. The cross-cultural character of the sample enables the exploration of inequalities in factors that have been strongly associated with childhood obesity. Such studies may be especially important in the light of the rapidly changing economic circumstances in many parts of the Europe. In addition, our results provide new insight into energy-balance behaviours and their determinants, which should be the focus for the development of effective interventions aimed at reducing inequalities in childhood obesity.

However, our study has certain limitations. For the purpose of the EPHE evaluation study, the participant programmes were selected on the basis

of towns or locations that were already actively involved with EPODE. They may not be representative of the countries in which they are located and may have resulted in the selection of towns where already ongoing community-based interventions had resulted in changes in behaviour. In addition, the schools from which the samples were recruited were selected based on accessibility and convenience criteria. The results of this study must be therefore interpreted and generalized with caution. Moreover, the higher drop-out of subjects from the low education group may have impeded the power of this study to detect significant effects after the interventions and/or their potential sustainability.

In addition the population of the middle socio-economic status group was divided among the population of high and low socio-economic status, due to the small number of subjects in the lowest educational category. Thus the ability to detect big differences among the cohorts might be limited. Another weakness of this study could be that we used the educational level of the mother as a proxy for socio-economic status, instead of using a wider set of indicators. Although the parental education level has been characterised as an adequate socio-economic indicator by relevant and more elaborative studies [40-42], this still reduces the strength of detecting absolute inequalities. It is important to mention that the power of the associations observed is decreased, due to loss-to-follow-up, especially in the Dutch sample, of which the size was considerably reduced. Furthermore this study reports selectively on the statistically significant changes, which were considerably reduced after adjustments for multiple testing.

Yet, we consider our results important as they give indications that improvements in lifestyle behaviours among low socio-economic status

groups are possible. Moreover it seems that small changes may contribute to tackling the public health problem of obesity on population level.

Moreover, the data were self-reported and recall bias and/or socially desirable answers are possible as in nearly all large scale community interventions. Besides, a disadvantage of using the same questionnaire across all countries was that not all items are as relevant for all countries. Furthermore, errors from the constructed items are possible, given that they were not validated. In addition, this is an effect evaluation, which did not use a control group. Thus, conclusions about causality cannot be drawn, the effects cannot be exclusively attributed to the interventions, and neither can conclusions on the quality of the interventions that were carried out be drawn.

Implications for public health practice

The results of our study seem to support the view that improvement in energy-balance related behaviours and parental rules and practices in the low socio-economic status populations is feasible by implementing interventions designed on the basis of studied gaps, and tailored to the behaviours and determinants that differed between low and high socio-economic status families, within an existing health promotion programme that is already targeting the whole population. However the short duration leads to only moderate favourable changes, besides the very low potential to sustain improvement.

Implications for public health research

Inequalities in family environmental determinants- such as parental rules and availability of fruit, vegetables, sugary-sweetened beverages and screens in the personal space of the child- may be addressed with more

success by upstream, high intensity, long-term and multi-level interventions. Therefore further studies including the use of a control group are needed, to establish the ability of such interventions to reduce inequalities in obesity-related determinants and behaviours. Further studies could assess whether existing social-marketing strategies could help or whether such strategies should be intensified when aiming at reducing socio-economic gaps.

Conclusions

The improvements in behaviours and determinants observed among children of both high and low socio-economic status, indicate that inequalities in obesity-related behaviours could be potentially reduced when implementing community-based interventions universally delivered, targeting those behaviours and determinants where inequalities exist, and being developed according to the EPODE approach. The results showed large variability in the observed changes after the implemented interventions, while the monitoring of interventions and process evaluation is crucial to understand the observed results. Future research is necessary, evaluating more tailored interventions and upstream and environmental interventions that require targeted health policies.

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Appendix 1. Within-group changes (T_0-T_1) in median values (q_1-q_3) in the determinants of fruit and vegetable consumption.

Determinants by country	**Fruit consumption**			
	T_0		T_1	
Education group / **Belgium**	High	Low	High	Low
Home availability *Never (0) - yes, always (4)*	3 (3-4)	3 (2-4)	4 (3-4)	3 (3-4)
Education group / **Bulgaria**	High	Low	High	Low
Parental allowance *Never (0) - yes, always (4)*	4 (4-4)	4 (3-4)	4 (4-4)	4 (4-4)
Education group / **Greece**	High	Low	High	Low
Habit to eat fruit/vegetables daily *(-2) fully disagree-(2) fully agree*	1 (0-1)	1 (1-2)	1 (1-2)	1 (0-2)
Education group / **Portugal**	High	Low	High	Low
Performing EBRB together with the child *Never (0) - yes, always (4)*	2 (1-2)	2 (1-2)	2 (2-2)	2 (1-2)
Home availability *Never (0) - yes, always (4)*	4 (3-4)	3 (3-4)	4 (3-4)	3 (3-4)
Education group / **Romania**	High	Low	High	Low
Facilitating *Never (0) - yes, always (4) (F31)*	2 (2-3)	2 (2-3)	2 (2-3)	2 (2-3)
Home availability *Never (0) - yes, always (4)*	4 (3-4)	3 (2-4)	4 (3-4)	3 (2-4)

Appendix 1. Within-group changes (T_0-T_1) in median values (q_1-q_3) in the determinants of fruit and vegetable consumption (*continued*).

Determinants by country	T_0		T_1	
Education group / **The Netherlands**	High	Low	High	Low
Parental Demand *Never (0) - yes, always (4)*	3 (3-4)	3 (3-3)	3 (3-4)	3 (2-4)
Determinants by country	**Vegetable consumption**			
	T_0		T_1	
Education group / **Greece**	High	Low	High	Low
Parental knowledge on recommendations *None (1) - 5 or more pieces/portions per day (8)*	5 (4-5)	4 (4-5)	4 (4-5)	4 (3-5)
Education group / **Portugal**	High	Low	High	Low
Parental allowance *Never (0) - yes, always (4)*	3 (3-4)	3 (3-4)	3 (3-4)	3 (3-4)
Facilitating *(F31)* *Never (0) - yes, always (4)*	3 (3-4)	3 (2-3)	3 (3-4)	3 (2-3)
Parental knowledge on recommendations *None (1) - 5 or more pieces/portions per day (8)*	5 (5-6)	5 (5-6)	5 (5-6)	5 (4-6)
Home availability *Never (0) - yes, always (4)*	3 (3-4)	3 (2-4)	3 (3-4)	3 (3-4)
Education group / **Romania**	High	Low	High	Low
Performing EBRB together with the child *Never (0) - yes, always (4)*	2 (1-2)	2 (2-2)	2 (2-2)	2 (2-2)
Facilitating *(F31)* *Never (0) - yes, always (4)*	3 (3-4)	3 (2-3)	3 (3-3)	3 (2-3)

Appendix 1. Within-group changes (T_0-T_1) in median values (q_1-q_3) in the determinants of fruit and vegetable consumption (*continued*).

Determinants by country	T_0		T_1	
Education group / **The Netherlands**	High	Low	High	Low
Facilitating *Never (0) - yes, always (4) (item F31)*	4 (3-4)	3 (3-4)	4 (3-4)	4 (3-4)
Habit to eat fruit/vegetables daily *(-2) fully disagree - (2) fully agree*	2 (1-2)	2 (1-2)	2 (1-2)	2 (1-2)

Comparison within the educational groups of each country with Wilcoxon signed rank test.
Rounded values are presented.
T_0-T_1: changes between pre and post-intervention period.

Appendix 2. Within-group changes (T_0-T_1) in median values (q_1-q_3) in the determinants of fruit juices consumption.

Fruit juices consumption				
Determinants by country	T_0		T_1	
Education level / **Belgium**	High	Low	High	Low
Parental allowance *never (0) - always (4)*	2 (1-3)	**3 (2-4)[c]**	2 (1-3)	**2 (1-3)[c]**
Education level / **France**	High	Low	High	Low
Nagging behaviour *never (0) - yes, always (4)*	0 (0-0)	0 (0-1)	0 (0-0)	0 (0-1)
Education level / **Greece**	High	Low	High	Low
Negotiating *never (0) - always (4)*	2 (1-3)	**3 (2-4)[b]**	2 (0-3)	**2 (1-3)[b]**
Education level / **Portugal**	High	Low	High	Low
Rewarding/comforting practice *never (0) - always (4)*	0 (0-0)	**0 (0-1)[a]**	0 (0-0)	**0 (0-1)[a]**
Education level / **Romania**	High	Low	High	Low
Paying attention/monitoring *never (0) - always (4)*	3 (3-4)	3 (2-4)	4 (3-4)	3 (2-4)
Parental self- efficacy to retain rules *never (0) - always (4)*	0 (0-1)	1 (0-2)	0 (0-1)	0 (0-2)

Appendix 2. Within-group changes (T_0-T_1) in median values (q_1-q_3) in the determinants of fruit juices consumption (*continued*).

Determinants by country	T_0		T_1	
Education level / **The Netherlands**	High	Low	High	Low
Parental self- efficacy to retain rules *never (0) - always (4)*	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-1)
Rewarding/comforting practice *never (0) - always (4)*	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
Nagging behaviour *Never (0) - yes, always (4)*	0 (0-0)	0 (0-0)	0 (0-1)	0 (0-2)

Comparison within the educational groups of each country with Wilcoxon signed rank test. Rounded values are presented.
T_0-T_1: changes between pre and post-intervention period
a,b,c: significant within-group differences at .05, .01 and .001 respectively

Appendix 3. Within-group changes (T_0-T_1) in median values (q_1-q_3) in the determinants of soft drinks consumption.

	Soft drinks consumption			
Determinants by country	T_0		T_1	
Education level / **France**	High	Low	High	Low
Nagging behaviour *Never (0) - yes, always (4)*	**0 (0-0)[b]**	0 (0-0)	**0 (0-1)[b]**	0 (0-0)
Education level / **Portugal**	High	Low	High	Low
Performing EBRB together with the child *Never (0) - always (4)*	2 (1-2)	2 (2-3)	2 (1-3)	2 (2-3)
Nagging behaviour *Never (0) - yes, always (4)*	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)
Home availability *never (0)-always (4)*	1 (1-2)	**2 (1-2)[a]**	1 (1-2)	**1 (1-2)[a]**
Education level / **Romania**	High	Low	High	Low
Parental allowance *never (0) - always (4)*	1 (0-2) 0 (0-1)	1 (1-2) 1 (0-2)	1 (1-1) 1 (0-1)	2 (1-2) 1 (0-2)
Avoid negative modelling *never (0) - always (4)*	3 (2-4)	**2 (1-3)[a]**	3 (1-4)	**2 (0-3)[a]**
Performing EBRB together with the child *Never (0) - always (4)*	2 (1-3)	3 (2-3)	2 (1-2)	3 (2-4)
Home availability *never (0)-always (4)*	1 (0-2)	1 (1-2)	0 (0-1)	1 (1-2)

Appendix 3. Within-group changes (T_0-T_1) in median values (q_1-q_3) in the determinants of soft drinks consumption (*continued*).

Determinants by country	T_0		T_1	
Education level / **Bulgaria**	High	Low	High	Low
Home availability *never (0) - always (4)*	1 (0-2)	2 (0-2)	1 (0-2)	1 (0-3)

Comparison within the educational groups of each country with Wilcoxon signed rank test. Rounded values are presented.
T_0-T_1: changes between pre and post-intervention period.
a,b: significant within-group differences at .05 and . 01respectively.

Appendix 4. Within-group changes (T_0-T_1) in median values (q_1-q_3) in the determinants of television (TV) exposure.

Determinants by country	**TV exposure**			
	T_0		T_1	
Education group / **Belgium**	High	Low	High	Low
Paying attention/monitoring *never (0)-always (4)*	3 (2-4)	**3 (1-4)**[a]	3 (2-4)	**3 (2-4)**[a]
Performing EBRB together with the child *Never (0)- every day, more than once a day (7)*	2 (2-3)	3 (2-3)	2 (2-3)	3 (2-3)
TV in child's bedroom *yes **(%)***	14,0	31,0	8,3	29,0
TV on during mealtime *Every day (1)-never (6)*	1 (1-5)	1 (1-4)	2 (1-5)	1 (1-3)
Education group / **Bulgaria**				
TV in child's bedroom *yes **(%)***	43,0	55,8	49,6	58,1
Education group / **France**	High	Low	High	Low
Negotiating *never (0)-always (4)*	**0 (0-3)**[a]	2 (0-3)	**2 (0-3)**[a]	1 (0-3)
Performing EBRB together with the child *Never (0)- every day, more than once a day (7)*	2 (2-3)	3 (2-3)	2 (2-3)	3 (2-3)

Appendix 4. Within-group changes (T_0-T_1) in median values (q_1-q_3) in the determinants of television (TV) exposure (*continued*).

Determinants by country	T_0		T_1	
Education group / **Greece**	High	Low	High	Low
TV on during meal time *every day (1)-never (6)*	5 (3-5)	4 (2-5)	4 (3-5)	4 (3-5)
Parental self- efficacy to manage child's exposure *never (0)-always (4)*	1 (0-1)	**1 (0-2)**[a]	1 (0-1)	**1 (0-1)**[a]
Education group / **Portugal**	High	Low	High	Low
Rewarding/comforting practice *never (0)-always (4)*	1 (0-1)	1(0-2)	0 (0-1)	1 (0-2)
Parental allowance *never (0)-always (4)*	2 (1-2)	**2 (2-3)**[a]	2 (1-2)	**2 (1-2)**[a]
Nagging behaviour *Never (0)-yes, always (4)*	0 (0-1)	1 (0-2)	0 (0-1)	1 (0-1)
TV on during meal time *every day (1)-never (6)*	1 (1-5)	1 (1-2)	1 (1-5)	1 (1-3)
TV in child's bedroom *yes **(%)***	36,7	73,7	34,8	73,7
Education group / **Romania**	High	Low	High	Low
Parental allowance *never (0)-always (4)*	3 (2-3)	2 (2-3)	2 (2-3)	2 (2-3)
Negotiating *never (0)-always (4)*	2 (1-3)	2 (0-2)	2 (1-4)	2 (0-3)
Performing EBRB together with the child *Never (0)- every day, more than once a day (7)*	**2 (2-3)**[b]	2 (2-3)	**2 (1-3)**[b]	3 (2-3)
TV in child's bedroom *yes **(%)***	47,0	75,3	49,4	71,0

Appendix 4. Within-group changes (T_0-T_1) in median values (q_1-q_3) in the determinants of television (TV) exposure (*continued*).

Determinants by country	T_0		T_1	
Education group / **The Netherlands**	High	Low	High	Low
Paying attention/ monitoring *never (0)-always (4)*	3 (3-3)	3 (2-3)	3 (3-4)	3 (3-4)
Parental allowance *never (0)-always (4)*	2 (2-3)	2 (2-3)	2 (2-3)	3 (2-3)
Avoid negative modelling *never (0)-always (4)*	2 (1-3)	2 (0-3)	2 (1-3)	2 (0-2)
TV in child's bedroom *yes **(%)***	4,4	26,3	6,5	15,7

Comparison within the educational groups of each country with Wilcoxon signed rank test. Rounded values are presented.

T_0-T_1: changes between pre and post-intervention period

a,b: significant within-group differences at .05 and .01 respectively

Appendix 5. Within-group changes (T_0-T_1) in median values (q_1-q_3) in the determinants of computer (PC) exposure.

Determinants	**PC exposure**			
by country	T_0		T_1	
Education level / **Belgium**	High	Low	High	Low
Performing EBRB together with the child *Never (0)- every day, more than once a day (7)*	1 (0-2)	2 (0-2)	1 (0-2)	1 (1-3)
Nagging behaviour *Never (0)-yes, always (4)*	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
Education level / **Bulgaria**	High	Low	High	Low
Performing EBRB together with the child *Never (0)- every day, more than once a day (7)*	1 (0-2)	1 (0-3)	1 (0-2)	2 (1-2)
Education level / **France**	High	Low	High	Low
Nagging behaviour *Never (0)-yes, always (4)*	0 (0-0)	0 (0-1)	0 (0-0)	0 (0-1)
Education level / **Romania**	High	Low	High	Low
Negotiating *never (0)-always (4)*	3 (1-3)	2 (0-3)	3 (0-3)	2 (0-3)

Appendix 5. Within-group changes (T_0-T_1) in median values (q_1-q_3) in the determinants of computer (PC) exposure (*continued*).

Determinants by country	T_0		T_1	
Education level / **The Netherlands**	High	Low	High	Low
Negotiating	3 (3-4)	3 (2-4)	3 (2-4)	3 (3-4)
never (0)-always (4)				
Avoid negative modelling	2 (1-3)	**2 (2-3)[a]**	2 (1-3)	2 **(0-2)[a]**
never (0)-always (4)				

Comparison within the educational groups of each country with Wilcoxon signed rank test. Rounded values are presented.
T_0-T_1: changes between pre and post-intervention period
a: significant within group differences at .05

Appendix 6. Within-group changes (T_1 - T_2) in median values (q_1-q_3) in determinants per behaviour.

Determinants by country	**Fruit juices consumption**			
	T_1		T_2	
Education level / **Belgium**	High	Low	High	Low
Parental allowance *never (0)-always (4)*	2 (1-3)	2 (1-3)	2 (1-3)	3 (1-3)
Education level / **Greece**	High	Low	High	Low
Negotiating *never (0)-always (4)*	**2 (0-2)[a]**	**2 (1-3)[a]**	**2 (1-3)[a]**	**3 (2-4)[a]**
Education level / **Portugal**	High	Low	High	Low
Rewarding/comforting practice *never (0)-always (4)*	0 (0-0)	0 (0-1)	0 (0-0)	0 (0-1)
Determinants by country	**Soft drinks consumption**			
	T_1		T_2	
Education level / **Portugal**	High	Low	High	Low
Home availability *never (0)-always (4)*	1 (1-2)	1 (1-2)	1 (1-2)	1 (1-2)
Determinants by country	**TV exposure**			
	T_1		T_2	
Education group / **Belgium**	High	Low	High	Low
Paying attention/monitoring *never (0)-always (4)*	3 (2-4)	3 (2-4)	3 (3-4)	3 (2-4)

Appendix 6. Within-group changes (T_1 - T_2) in median values (q_1-q_3) in determinants per behaviour (*continued*).

Determinants by country	T_1		T_2	
Education group / **Greece**	High	Low	High	Low
Parental self- efficacy to manage child's exposure *never (0)-always (4)*	**1 (0-1)[a]**	1 (0-1)	**1 (0-2)[a]**	0 (0-1)
Education group / **Portugal**	High	Low	High	Low
Parental allowance *never (0)-always (4)*	**2 (1-2)[a]**	2 (1-2)	**1 (1-2)[a]**	2 (1-3)

Determinants by country	**PC exposure**			
	T_1		T_2	
Education level / **The Netherlands**	High	Low	High	Low
Avoid negative modelling *never (0)-always (4)*	2 (1-3)	2 (0-2)	2 (0-2)	2 (1-3)

Comparison between the educational groups of each country with Wilcoxon signed rank test. Rounded values are presented.

T_1-T_2: changes between post-intervention and follow-up (a year after) period

a, b, c : significant within-group differences at .05, .01 and .001 respectively

Additional file 7. Corrected critical p-values after adjustment for multiple testing (T_1).

Country	Belgium	Bulgaria	France	Greece	Portugal	Romania	Nether-lands
Differences within the high education group							
Corrected overall critical p-value / **Energy balance related-behaviour**	**0.002521**	**0.002532**	**0.000316**	**0.000316**	**0.000316**	**0.002215**	**0.000316**
Fruit consumption	0	0	0	0	0	0	0
Salad or grated vegetables	1	0	0	0	0	0	0
Raw vegetables frequency	0	0	0	0	0	0	0
Cooked Vegetables	0	0	0	0	0	0	0
Water frequency	0	0	0	0	0	0	0
Fruit juices frequency (per	0	0	0	0	0	0	0
Fruit juices' amount	0	0	0	0	0	0	0
Soft drinks frequency	0	0	0	0	0	0	0
Soft drinks amount	0	0	0	0	0	0	0
TV weekdays	0	0	0	0	0	0	0
TV weekend days	0	0	0	0	0	0	0
PC weekdays	0	1	0	0	0	0	0
PC weekend days	0	0	0	0	0	0	0
Total screen time	0	0	0	0	0	0	0
Sleep hours-Week days	0	0	0	0	0	0	0
Sleep hours-Weekend days	0	0	0	0	0	0	0
Determinants of fruit consumption							
Parental knowledge on recommendations	0	0	0	0	0	0	0
Active encouragement	0	1	0	0	0	0	0
Performing EBRB together	0	0	0	0	0	0	0
Habit to eat fruit daily	0	0	0	0	0	0	0
Parental demand	0	0	0	0	0	0	0
Parental allowance	0	0	0	0	0	0	0
Home availability	0	0	0	0	0	0	0
Parental facilitation	0	0	0	0	0	0	0
Determinants of vegetable consumption							
Parental knowledge on recommendations	0	0	0	0	0	0	0
Active encouragement	0	1	0	0	0	0	0
Performing EBRB together	0	1	0	0	0	0	0
Habit to eat vegetables daily	0	0	0	0	0	0	0
Parental demand	0	0	0	0	0	0	0
Parental allowance	0	0	0	0	0	0	0
Home availability	0	1	0	0	0	0	0
Parental facilitation	1	0	0	0	0	0	0

Additional file 7. Corrected critical p-values after adjustment for multiple testing (T_1, *continued*).

Determinants of fruit juices consumption							
Home availability	0	0	0	0	0	0	0
Paying attention/monitoring	0	0	0	0	0	0	0
Parental allowance$_1$	0	0	0	0	0	0	0
Parental allowance$_2$	0	0	0	0	0	0	0
Negotiating	0	0	0	0	0	0	0
Communicating the health	0	0	0	0	0	0	0
Communicating the health	0	0	0	0	0	0	0
Avoid negative modelling	0	0	0	0	0	0	0
Nagging behaviour	0	0	0	0	0	0	0
Parental self- efficacy to	0	0	0	0	0	0	0
Rewarding/comforting	0	0	0	0	0	0	0
Conducting energy-balance related behaviour together	0	0	0	0	0	0	0
Determinants of soft drinks consumption							
Home availability	0	0	0	0	0	0	0
Paying attention/monitoring	0	0	0	0	0	0	0
Parental allowance$_1$	0	0	0	0	0	0	0
Parental allowance$_2$	0	0	0	0	0	0	0
Communicating health belief$_1$	0	0	0	0	0	0	0
Communicating health belief$_2$	0	0	0	0	0	0	0
Avoid negative modelling	0	0	0	0	0	0	0
Nagging behaviour	0	0	0	0	0	0	0
Parental self- efficacy to	0	0	0	0	0	0	0
Rewarding/comforting	0	0	0	0	0	0	0
Conducting energy-balance	0	0	0	0	0	0	0
Determinants of television exposure							
TV in child's bedroom	0	0	0	0	0	0	0
TV on during meal time	0	0	0	0	0	0	0
Paying attention/monitoring	0	0	0	0	0	0	0
Parental allowance 1	0	0	0	0	1	0	0
Parental allowance 2	0	0	0	0	0	0	0
Negotiating	0	0	0	0	0	0	0
Avoid negative modelling	0	0	0	0	1	0	0
Nagging behaviour	0	0	0	0	0	0	0
Parental self- efficacy to	0	0	0	0	0	0	0
Rewarding/comforting	0	0	0	0	0	0	0
Performing energy-balance	0	0	0	0	0	0	0
Communicating health belief 1 (TV and PC exposure)	0	0	0	0	0	0	0
Communicating health belief 2 (TV and PC exposure)	0	0	0	0	0	0	0

Additional file 7. Corrected critical p-values after adjustment for multiple testing (T_1, *continued*).

Determinants of computer exposure							
Paying attention/monitoring	0	0	0	0	0	0	0
Parental allowance 1	0	0	0	0	0	0	0
Parental allowance 2	0	0	0	0	0	0	0
Negotiating	0	0	0	0	0	0	0
Avoid negative modelling	0	0	0	0	0	0	0
Nagging behaviour	0	0	0	0	1	0	0
Parental self- efficacy to retain rules	0	0	0	0	0	0	0
Rewarding/comforting practice	0	0	0	0	0	0	0
Performing energy-balance related behaviour together	0	0	0	0	0	0	0
Country	**Belgium**	**Bulgaria**	**France**	**Greece**	**Portugal**	**Romania**	**Nether-lands**
Differences within the low education group							
Corrected overall critical p-value / **Energy balance related-behaviour**	**0.002521**	**0.002532**	**0.000316**	**0.000316**	**0.000316**	**0.002215**	**0.000316**
Fruit consumption	0	0	0	0	0	0	0
Salad or grated vegetables	0	0	0	0	0	0	0
Raw vegetables frequency	0	0	0	0	0	0	0
Cooked Vegetables	0	0	0	0	0	0	0
Water frequency	0	0	0	0	0	0	0
Fruit juices frequency (per	0	0	0	0	0	0	0
Fruit juices' amount	0	0	0	0	0	0	0
Soft drinks frequency	0	0	0	0	0	0	0
Soft drinks amount	0	0	0	0	0	0	0
TV weekdays	1	0	0	0	0	0	0
TV weekend days	0	0	0	0	0	0	0
PC weekdays	0	0	0	0	0	1	0
PC weekend days	0	0	0	1	0	1	0
Total screen time	0	0	0	0	0	0	0
Sleep hours-Week days	0	0	0	0	0	0	0
Sleep hours-Weekend days	0	0	0	0	0	0	0
Determinants of fruit consumption							
Parental knowledge on recommendations	0	0	0	0	0	0	0
Active encouragement	0	1	0	0	0	0	0
Performing EBRB together with the child	0	0	0	0	0	0	0
Habit to eat fruit daily	0	0	0	0	0	0	0
Parental demand	0	0	0	0	0	0	0
Parental allowance	0	0	0	0	0	0	0
Home availability	0	0	0	0	0	0	0
Parental facilitation	0	0	0	0	0	0	0

Additional file 7. Corrected critical p-values after adjustment for multiple testing (T_1, *continued*).

Determinants of vegetable consumption							
Parental knowledge on recommendations	0	0	0	0	0	0	0
Active encouragement	0	1	0	0	0	0	0
Performing EBRB together with the child	0	1	0	0	0	0	0
Habit to eat vegetables daily	0	0	0	0	0	0	0
Parental demand	0	0	0	0	0	0	0
Parental allowance	0	0	0	0	0	0	0
Home availability	0	0	0	0	0	0	0
Parental facilitation	0	0	0	0	0	0	0
Determinants of fruit juices consumption							
Home availability	1	0	0	0	0	0	0
Paying attention/monitoring	0	0	0	0	0	0	0
Parental allowance 1	1	0	0	0	0	0	0
Parental allowance 2	1	0	0	0	0	0	0
Negotiating	0	0	0	0	0	0	0
Communicating the health	0	0	0	0	0	0	0
Communicating the health	0	0	0	0	0	0	0
Avoid negative modelling	0	0	0	0	0	0	0
Nagging behaviour	0	0	0	0	0	0	0
Parental self- efficacy to	0	0	0	0	0	0	0
Rewarding/comforting	0	0	0	0	0	0	0
Conducting energy-balance	0	0	0	0	0	0	0
Determinants of soft drinks consumption							
Home availability	0	0	0	0	0	0	0
Paying attention/monitoring	0	0	0	0	0	0	0
Parental allowance 1	0	0	0	0	0	0	0
Parental allowance 2	0	0	0	0	0	0	0
Communicating health	0	0	0	0	0	0	0
Communicating health	0	0	0	0	0	0	0
Avoid negative modelling	0	0	0	0	0	0	0
Nagging behaviour	0	0	0	0	0	0	0
Parental self- efficacy to	0	0	0	0	0	0	0
Rewarding/comforting	0	0	0	0	0	0	0
Conducting energy-balance	0	0	0	0	0	0	0
Determinants of television exposure							
TV in child's bedroom	0	0	0	0	0	0	0
TV on during meal time	0	0	0	0	0	0	0
Paying attention/monitoring	0	0	0	0	0	0	0
Parental allowance 1	0	0	0	0	0	0	0
Parental allowance 2	0	0	0	0	0	0	0
Negotiating	0	0	0	0	0	0	0
Avoid negative modelling	0	0	0	0	0	1	0
Nagging behaviour	0	0	0	0	0	0	0

Additional file 7. Corrected critical p-values after adjustment for multiple testing (T_1, *continued*).

Parental self- efficacy to	0	0	0	0	0	0	0
Rewarding/comforting	0	0	0	0	0	0	0
Performing energy-balance related behaviour together	0	0	0	0	0	0	0
Communicating health belief 1 (TV and PC exposure)	0	0	0	0	0	0	0
Communicating health belief 2 (TV and PC	0	0	0	0	0	0	0
Determinants of computer exposure							
Paying attention/monitoring	0	0	0	0	0	0	0
Parental allowance 1	0	0	0	0	0	0	0
Parental allowance 2	0	0	0	0	0	0	0
Negotiating	0	0	0	0	0	0	0
Avoid negative modelling	0	0	0	0	0	0	0
Nagging behaviour	0	0	0	0	0	1	0
Parental self- efficacy to	0	0	0	0	0	0	0
Rewarding/comforting	0	0	0	0	0	0	0
Performing energy-balance	0	0	0	0	0	0	0

Multiple testing adjustment by the Benjamini and Hocheberg method [44].
0=the adjusted p-value is higher than the corrected critical p-value. **1=** the adjusted p-value is lower than the corrected critical p-value.
T_1: Post-intervention follow-up, after one school year intervention period.

Chapter 6

Water consumption in European children: Associations with intake of fruit juices, soft drinks and related parenting practices.

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Submitted

Abstract

High intake of fruit juices and soft drinks contributes to excessive weight gain and obesity in children. Furthermore, parenting practices play an important role in the development of children's dietary habits. The way parents play this role in the development of their children's choices of beverages is still unclear. Therefore, the objectives of this study were to assess the associations: 1. of both fruit juices and soft drinks consumption with water consumption of children and 2. between parenting practices towards fruit juices and soft drinks and water consumption of children. Cross-sectional data from 6-8 year old children from seven European communities (n=1187) were collected. Associations among fruit juices, soft drinks, the respective parenting practices and the child's water consumption were assessed by parental questionnaires. The consumption of water was inversely associated with that of soft drinks but not with the one fruit juices. The child's water intake was favourably influenced when stricter parenting practices towards soft drinks were adopted (e.g. less parental allowance, low home availability and high parental self-efficacy in managing intake). There was less influence observed as regards parenting practices towards fruit juices. Fruit juices were consumed more often than soft drinks. Parenting practices discouraging the consumption of soft drinks may increase the child's water consumption. Moreover, the perception according to which fruit juices and/or drinks are healthy might encourage children to consume these beverages in the place of water.

Introduction

Over the past three decades, the prevalence of overweight and obesity has reached epidemic levels in children globally [1], while the impacts on health and the relevant economic burden affect individuals as well as the society as a whole [2]. In 2008, about 25% of the children in the European region (6-9 years old) were overweight or obese [3], and this percentage increased to about 33% in 2010 [4]. It was characterized as a "worrying increase" in the *European Action Plan on Childhood Obesity 2014-2020* [4].

It is now generally accepted that a high intake of free sugars contributes to excess weight gain, particularly regarding those sugars contained in beverages [5-13]. Currently, limiting the intake of free sugars to a maximum of 10% (and to 5% as conditional recommendation) of the total energy intake is highly recommended [12]. Sugary drinks, including – among others – soft drinks, energy drinks, fruit juices (100% juices included), are high in free sugar content [5-7, 9-11, 13]. With the exception of 100% fruit juices, which may contain vitamins and minerals, sugary drinks provide "empty" calories with no nutritional benefit and, thus, lead to low satiety response [7, 11, 14]. Consequently, high consumption of such drinks is not compensated by a decreased caloric intake from other foods or beverages, hence resulting in increased energy intake and weight gain [11, 14]. Moreover, high intake of sugary beverages has been also associated with tooth decay, hyperactivity and mental health problems in children and adolescents [15-19]. Therefore, soft drinks are increasingly perceived by parents as unhealthy, unlike fruit drinks and juices, which are considered as the "healthy" choice or a

healthier alternative to soft drinks [5, 7, 19], However the sugar content of fruit juices is very similar to that of sugar sweetened soft drinks..

Children's consumption of fruit juices and soft drinks in western countries has been increased considerably during the past decades [6, 7, 10, 15, 17, 19], while an increase in the intake of sugary beverages seems to occur during the period from childhood to adolescence [9]. For that reason, several intervention studies have examined the effects of the replacement of sugary beverages consumption by the consumption of water, in which a reduction in total calories [9, 20, 21], positive behavioural changes and weight loss have been demonstrated [20]. Nevertheless, discouraging children from drinking sugary drinks and switching to water is challenging, considering the many physical and social environmental factors that may influence their choices. It is well understood that parents play a key role in shaping the development of children's behaviours [6, 10, 16, 20-22]. Consequently, as parents are role models for their children, it is of crucial importance to influence parenting practices, beliefs and attitudes towards sugary drinks' consumption, as well as parental behaviours, so as to achieve behavioural change in children.

Although numerous studies have assessed the association of parental rules and practices regarding sugary fruit juices and/or soft drinks [10, 16, 19], little is known for the association between these practices and water consumption. Therefore, the objectives of the current study were to: 1. assess the associations of both fruit juices and soft drinks consumption with water consumption of children and 2. assess the associations between parenting practices towards fruit juices and soft drinks and the water consumption of children.

Materials and methods

This study is part of the two-year prospective evaluation study of the EPHE (Epode for the Promotion of Health Equity) project, the methodology and aims of which are described elsewhere [23].

Sample and recruitment

Seven community-based programmes, a part of the Epode International Network, which implemented the EPODE methodology, participated in the EPHE project: VIASANO (Belgium), EPODE (France), PAIDEIATROFI (Greece), Maia Healthy Menu (Portugal), SETS (Romania), JOGG (The Netherlands), HEALTHY KIDS (Bulgaria); the latter programme is part of Nestle's Healthy Kids programme and implemented a methodology similar to EPODE's. Every programme is represented by one or two communities. We aimed at recruiting a minimum of 150 families with children in the age group of 6-8 years in every selected community, with a similar variation, regarding age and ethnicity, per site. The participants were recruited from several schools and the permission to carry out the study in schools was acquired from the local community and/or school authorities, where necessary. More information about the sampling and recruitment processes as well as the response rates of the baseline measurements are described elsewhere [23, 24].

Data collection

The EPHE parental questionnaire [23], a self-administered questionnaire based on relevant, validated questionnaires addressed in European populations [25-27] was used for the collection of data. Additional items regarding water consumption and related determinants were constructed, since, to our knowledge, no such validated items existed. The rationale and the development of the questionnaire are described in

detail elsewhere [23]. The questionnaires, including an informed consent, were distributed to the children at school and delivered to their parents, before and immediately after the intervention period. After a specified period of one to two weeks, the completed questionnaires were collected and only the ones including a signed statement of informed consent were taken into consideration. In order to assure the confidentiality of the data, a process that ensured the anonymity of the participant families was took place [23].

Measures

Beverage consumption

We defined as beverage consumption the intake of water, fruit juices and soft drinks. Water intake included water from the tap or from bottles (artesian well water, spring water, mineral water and sparkling water). Fruit juices included those made from both concentrated and 100% freshly blended fruit. As soft drinks were defined the carbonated drinks, fruit squash/cordials and sport and energy drinks. To assess the consumption of fruit juices and soft drinks, two items from a validated parental questionnaire [27] were used, measuring the weekly frequency on a 7-point Likert scale: 1. Never; 2. Less than once a day; 3. 2-4 times a week; 4. 5-6 times a week; 6. Every day, once a day; 7. Every day, more than once a day; 8. Every day, more than twice a day [23, 24]. To assess the water consumption, we constructed an item that measured its daily frequency on a 6-point Likert scale: 1. Never; 2.Less than once a day; 3. Once a day; 4.2-4 times a day; 5. 5-6 times a day; 6. More than 6 times a day.

Parenting practices regarding sugary beverages

The parenting practices measured were: i. paying attention\monitoring, ii. parental allowance, iii. negotiating, iv. communicating health beliefs regarding soft drinks, v. avoiding negative modelling, vi. parental self-efficacy to manage child's intake, vii. rewarding\comforting practice, viii. parent(s) drinking beverage together with the child and ix. home availability. Most parenting practices were assessed by one item using a 5 point Likert-scale: 0. Never; 1. Not often; 2. Sometimes; 3. Often; 4. Always. *Parental allowance* and *Communicating health beliefs regarding soft drinks* were measured by two items, using the same 5-point scale. The item labeled as *Parent drinking beverage together with the child* was assessed by using an 8-point Likert-scale: 1. Never; 2. Less than once a week; 3. 2-4 times a week; 4. 5-6 times a week; 6. Every day, once a day; 7. Every day, more than once a day; 8. Every day more than once a day. More details are described elsewhere [23, 24] and are presented in the table of Appendix 1.

Socio-demographic measures

Socio-demographic characteristics were measured in categorical scales: a. age of the respondent: 1. <20, 2. 20-24, 3. 25-30, 4. 31-35, 5. 36-40, 6. >41; b. age of the child: 1. 6 years, 2. 7 years, 3. 8 years, 4. 9 years and above; c. parental education level in years: 1. <6, 2. 6-8, 3. 9-11, 4. 12-14, 5. 15-17, 6. >17 [27]. The maternal educational level was used for the approximation of the socio-economic status (low-high).

Statistical analysis

Socio-demographic characteristics were described in terms of percentages (gender of child, age of mother, education level of mother) and means [SD (age of the child)], as presented in table 1.

For each country's sample, the median of the educational level was used as the cut-off point in order for the "educational level of the mother" (low-high) to be defined. The available data from the total baseline EPHE sample (May-June 2013) was used, in order to assess the associations between a. fruit juices consumption, b. soft drinks consumption, c. parenting practices towards fruit juices, d. parenting practices towards soft drinks and children's water consumption. For the purposes of this study, binary logistic regression models were adopted to calculate odds ratios and 95 percent confidence intervals (OR and 95% CI respectively). As was the dependent variable, the frequency of water consumption was dichotomized on the basis of the median (Md=5), due to skewed distribution, into low (<5-6 times a day) and high (>5-6 times a day or more) consumption. The independent variables were recoded into three categories in order for loss of information to be avoided. Specifically, the frequency of consumption of fruit juices and soft drinks was recorded as: 1. low frequency (<once a week), 2. moderate frequency (2-4 days a week), 3. high frequency (>5-6 days a week). Furthermore, the parenting practices were re-categorised into 3 categories: 1. low frequency (not often - never), 2. moderate frequency (sometimes), 3. high frequency (often - always). As shown in descriptive analyses published elsewhere [24], beverages consumption and parenting practices differed from country to country; and thus, tests regarding potential confounding and effect modification were carried out. The educational level of the mother was also assessed with respect to potential confounding and effect modification.

Results

Socio-demographic and descriptive characteristics

A total of 1266 children and their families were involved in the baseline survey. Due to missing data in the variable "educational level of mother", 1187 subjects were included in the analysis finally (table 1). Descriptive analysis showed that the highest frequency of water consumption occurred in the Bulgarian sample, whereas the samples from Belgium and the Netherlands yielded the lowest results (table 2). The highest frequency of fruit juices consumption was detected in the samples from Belgium and France, and the lowest in the Dutch sample (table 2). Moreover, soft drinks were consumed in the highest frequencies by the Belgian participants and in the lowest by the Greek participants (table 2).

Associations of fruit juice and soft drinks intake with water consumption

Figure 1 illustrates that the lower the frequency of sugary beverages consumption, the higher the odds for a child to consume water in high frequency. However, only the *low* frequency of soft drinks intake – and not the *moderate* one – was significantly associated with high water consumption frequency (figure 1a). The frequency of fruit juices consumption was not associated with the one regarding water (figure 1b). The education level of the mother and the country did not significantly modify the aforementioned associations, but they proved to be confounders.

Table 1. Socio-demographic characteristics of the EPHE population at pre and post-intervention periods.

Programme, *Country*	**Gender**		**Age child (years)**	**Age of mother [a]**		**Educational level mother**		**Total n[b]**
	Boys (%)	Girls (%)	Mean (SD)	<30 (%)	>31 (%)	High (%)	Low (%)	
VIASANO, *Belgium*	53.4	46.6	6.6 (0.6)	20.0	80.0	42.7	57.3	178
Healthy kids in Bulgaria, *Bulgaria*	46.8	52.7	8.0 (0.8)	8.7	90.1	74.3	25.7	187
EPODE Flandre Lys, *France^*	38.8	57.5	6.3 (0.6)	30.9	69.1	35.2	64.8	142
Paideiatrofi, *Greece^*	46.5	45.9	7.4 (0.7)	3.2	94.4	52.8	47.2	142
MAIA, *Portugal*	51.0	48.5	7.0 (0.7)	12.4	87.1	46.0	54.0	237
SETS, *Romania*	56.8	43.2	7.4 (0.5)	17.7	82.3	53.8	46.2	173
JOGG Zwolle, *The Netherlands*	47.3	52.7	7.8 (1.0)	6.5	90.7	61.3	38.7	124
Total	49.8	49.2	7.16 (0.9)	14.6	84.4	52.7	47.3	1183

a**:** The analysis includes the age of the mother only when the mother was the respondent; the age of the second parent was not assessed; Response categories: 1= Below 20, 2= 21-24, 3= 25-30, 4= 31-35, 5= 36-40, 7= Above 40. Number of subjects included in "age of mother" per country were: Belgium=150, Bulgaria=171, France=136, Greece=128, Portugal=208, Romania=147, The Netherlands=107, Total=1038; b: Total number of subjects that provided information for the "educational level of the mother" and were included in the analysis.

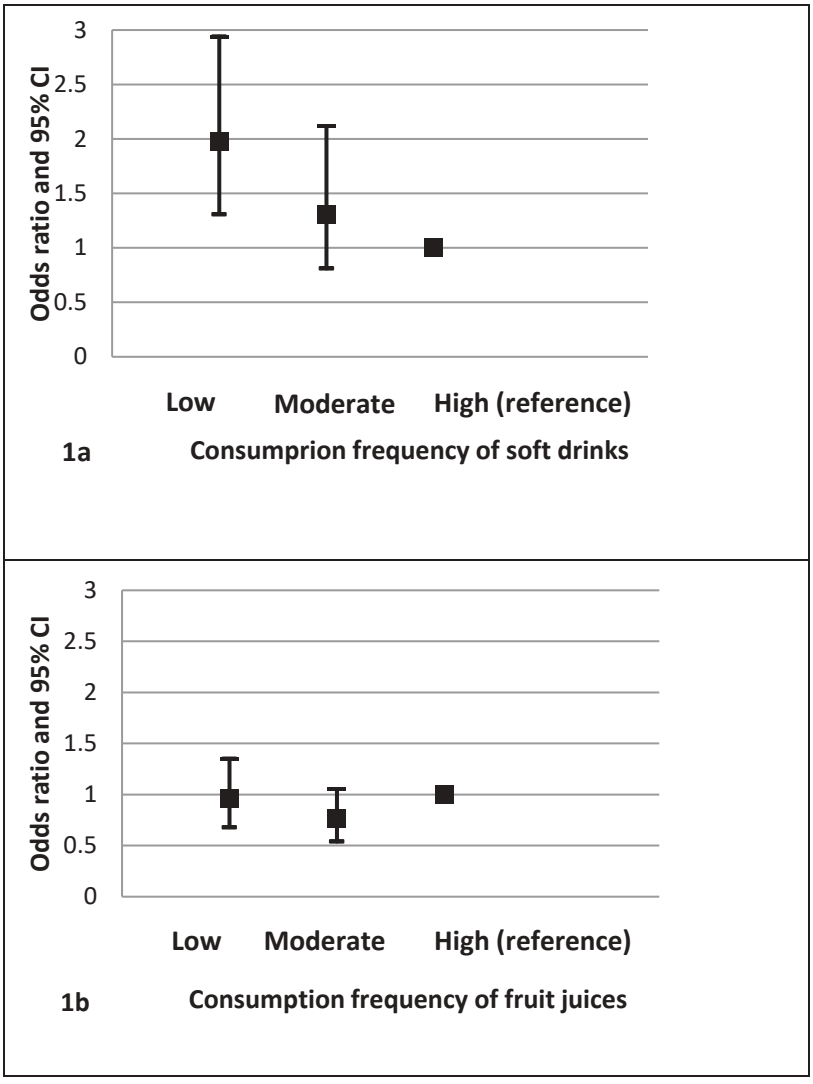

Figure 1. Odds ratios (95% CI) for the frequency of sugary beverages' consumption in relation to water consumption (high vs low), adjusted for the country and educational level of the mother.

Associations between parenting practices towards sugary beverages and children's water consumption

The relation between parenting practices and water consumption frequency was confounded by country; therefore the regression models were adjusted for the country level. Mothers' education level proved to be an effect modifier for some of the associations between parenting practices towards sugary beverages and water consumption frequency. However, stratified analysis showed small differences between the education-defined groups (results not shown). In tables 3 and 4, the associations between frequency of water intake and parenting practices regarding fruit juices and soft drinks, are presented. The associations indicate that when parents monitored their child's fruit juices/soft drinks consumption in moderate frequency, their children were less likely to consume water in high frequency (i.e. 5 or more times) compared to the children of parents who monitored their fruit juices/soft drinks intake in high frequency.

In addition, children of parents with high self-efficacy in managing the child's intake of fruit juices and soft drinks were 1.83 (95% CI: 1.04-3.20) and 2.44 (95% CI: 1.26-4.73) times, respectively, more likely to consume water 5 or more times a day compared to the ones having parents with low self-efficacy. Another finding was that when parents told *sometimes* their children that fruit juices make him/her fat, their children were less likely (OR 0.63; 95% CI 0.41-0.98) to drink water in high frequency compared to the cases when parents communicated the belief *often/always*. Moreover, the low and moderate parental allowance to drink soft drinks was associated with a higher possibility for the child to drink water in higher frequency than the high parental allowance. Furthermore, when children were communicated a health belief in low

frequency, they were less likely to consume water 5 or more times a day compared to the children whose parents had communicated the health belief to them in high frequency.

Table 2. Rounded median values and quartiles (q_1-q_3) for weekly beverage intake per country.

Programme, *country*	**Water frequency[1]**	**Fruit juices frequency[2]**	**Soft drinks frequency[2]**
VIASANO, *Belgium*	4 (4-5)	6 (4-6)	4 (2-5)
Healthy kids in Bulgaria, *Bulgaria*	6 (5-6)	4 (3-5)	2 (1-4)
EPODE Flandre Lys, *France*	4 (4-5)	6 (4-6)	3 (2-5)
Paideiatrofi, *Greece*	5 (5-6)	4 (4-5)	1 (1-2)
MAIA, *Portugal*	5 (4-6)	4 (2-4)	2 (1-3)
SETS, *Romania*	5 (5-6)	4 (3-5)	2 (2-4)
JOGG Zwolle, *The Netherlands*	4 (3-4)	3 (2-5)	3 (2-6)
Total	5 (4-6)	4 (3-6)	2 (1-4)

1: Response categories: **1**.Never **2**.Less than once a day **3.**Once a day **4**.2-4 times a day **5**.5-6 times a day **6.**More than 6 times a day.
2: Response categories: **1**.Never **2**.Less than once a week **3.**Once a week **4**.2-4 days a week **5**.5 6 days a week **6.**Every day, once a day **7.**Every day, more than once a day.

Table 3. Associations between parental practices on fruit juices and water consumption (high vs low).

		Odds Ratios (95% CI)
Parenting practice	**Frequency category[1]**	**OR (95% CI)**
Paying attention/monitoring	Low	0.92 (0.63-.1.35)
	Moderate	**0.57 (0.38-0.86)[b]**
	High	*Reference*
Parental allowance (If child asks for fruit juices, the parent will allow)	Low	1.33 (0.86-2.07)
	Moderate	1.20 (0.88-1.64)
	High	*Reference*
Parental allowance (Child allowed to have fruit juices whenever (s)he wants)	Low	1.28 (0.92-1.78)
	Moderate	1.14 (0.82-1.58)
	High	*Reference*
Negotiate	Low	0.92 (0.68-1.23)
	Moderate	0.95 (0.66-1.36)
	High	*Reference*
Communicate health belief (Telling the child that fruit juices are not good for him/her)	Low	1.01 (0.72-1.41)
	Moderate	0.73 (0.50-1.07)
	High	*Reference*
Communicate health belief (Telling the child that fruit juices make her/him fat)	Low	0.80 (0.56-1.15)
	Moderate	**0.63 (0.41-0.98)[a]**
	High	*Reference*

Table 3. Associations between parental practices on fruit juices and water consumption (high vs low; *continued*).

	Odds Ratios (95% CI)	
Parenting practice	**Frequency category[1]**	**OR (95% CI)**
Avoid negative modelling	Low	1.01 (0.72-1.44)
	Moderate	0.87 (0.55-1.39)
	High	*Reference*
(lack of) Parental efficacy	Low	**1.83 (1.04-3.20)[b]**
	Moderate	1.84 (0.92-3.53)
	High	*Reference*
Rewarding	Low	1.36 (0.61-3.03)
	Moderate	1.71 (0.67-4.38)
	High	*Reference*
Parents drinking fruit juices together with the child [2]	Low	0.93 (0.66-1.30)
	Moderate	1.11 (0.73-1.69)
	High	*Reference*
Home availability	Low	1.08 (0.72-1.61)
	Moderate	0.93 (0.67-1.30)
	High	*Reference*

Binary logistic regression. All associations are adjusted for country level.
1: Categories included in the frequencies: Low= (0) never - (1) not often, Moderate= (2) sometimes, High= (3) often - (4) always.
2: Categories included in the frequencies: Low= (1) never - (3) once a week, Moderate= (4) 2-4 times a week, High= (5) 5-6 times a week - (7) every day, more than once a day.
a, b: significance at the level of 0.05 and 0.01 respectively.

Table 4. Associations between parental practices on soft drinks and water consumption (high vs low).

		Odds Ratios (95% CI)
Parenting practice	**Frequency [1]**	**OR (95% CI)**
Paying attention/monitoring	Low	1.0 (0.62-1.63)
	Moderate	**0.42 (0.22-0.79)[b]**
	High	*Reference*
Parental allowance (If child asks for soft drinks, parent will allow)	Low	**3.22 (2.09-4.95)[c]**
	Moderate	**2.56 (1.64-3.99)[c]**
	High	*Reference*
Parental allowance (Child allowed to have soft drinks whenever (s)he wants)	Low	**2.21 (1.39-3.50)[b]**
	Moderate	1.74 (0.99-3.09)
	High	*Reference*
Communicate health belief (Telling the child that soft drinks are not good for him/her)	Low	**0.58 (0.37-0.92)[a]**
	Moderate	0.85 (0.59-1.24)
	High	*Reference*
Communicate health belief (Telling the child that soft drinks make her/him fat)	Low	**0.67 (0.50-0.90)[b]**
	Moderate	0.82 (0.56-1.20)
	High	*Reference*
Avoid negative modelling	Low	0.87 (0.63-1.20)
	Moderate	0.88 (0.60-1.29)
	High	*Reference*
(lack of) Parental efficacy	Low	**2.44 (1.26-4.73)[b]**
	Moderate	1.42 (0.66-3.06)
	High	*Reference*
Rewarding	Low	0.85 (0.18-4.01)
	Moderate	0.57 (0.10-3.17)
	High	*Reference*

Table 4. Associations between parental practices on soft drinks and water consumption (high vs low; *continued*).

		Odds Ratios (95% CI)
Parenting practice	**Frequency[1]**	**OR (95% CI)**
Parents drinking soft drinks together with the child[2]	Low	1.37 (0.91-2.05)
	Moderate	**0.55 (0.32-0.96)[a]**
	High	*Reference*
Home availability	Low	**2.23 (1.58-3.13)[c]**
	Moderate	**1.56 (1.05-2.23)[c]**
	High	*Reference*

Binary logistic regression. All associations are adjusted for country level.
1: Categories included in the frequencies: Low=(0) never - (1) not often, Moderate= (2) sometimes, High= (3) often - (4) always
2: Categories included in the frequencies: Low=(1) never - (3) once a week, Moderate= (4) 2-4 times a week, High= (5) 5-6 times a week - (7) every day, more than once a day
a,b,c: significance at the level of 0.05,0.01 and 0.001 respectively

Discussion

This study demonstrated that children who exhibited a low (<once a week) frequency of soft drinks consumption as well as the ones with a moderate one (1-4 times a week) were more likely to drink water in high frequency (>5-6 times a day). Moreover, fruit juices consumption was not associated to water consumption. In addition, the children's frequency of water intake was strongly influenced by parenting practices on soft drinks– such as monitoring of child's intake – and by communicating their health beliefs as well as, remarkably, by parental allowance, parental efficacy and home availability. The associations regarding the parents' practices towards fruit juices and water consumption were weaker and significant only with respect to

monitoring the child's intake and the parental efficacy to retain rules as well as communicating the health belief. Although the parental education level has been associated with sugary beverages in several studies [16, 19, 28, 29], it was not associated with water frequency in our study, and, additionally, the associations between parenting practices and water consumption did not differ a lot per education group. Finally, in all EPHE samples, fruit juices were found to be consumed more often than soft drinks, as shown in other studies as well [15, 30].

To the best of our knowledge, this is the first study that assessed the influence of parenting practices related to sugary beverages on the water consumption of their children, whereas a growing mass of evidence demonstrates that parenting practices and/or rules influence children's consumption of sugary beverages. Van Grieken et *al.* showed that a. home availability, b. difficulty to limit the child's consumption, c. discouraging sugary beverages consumption by the child d. not allowing the child to consume sugary beverages and e. the habit to limit child's consumption were primary parental practices associated with sugary beverages consumption of children [29]. Relevant studies examining the child's micro-environment, yielded similar findings [10, 16, 19, 28]. The relatively weak influence of parenting practices towards fruit juices on child's water consumption can possibly be explained by the perception according to which, although their sugar content is similar, fruit juices and/or drinks are more healthy compared to soft drinks [5, 7].

Methodological considerations

This study used data obtained from communities of seven different countries in the European region in order to explore trends in beverage consumption and their association with parenting. The cross-sectional

sample, a result of high participation rates (65-97.5%) [24], enabled us to explore the influence of parenting practices related to common sugary beverages on the daily frequency of children's water intake. By assessing fruit juices and soft drinks separately and distinguishing the parenting practices into the ones that influence fruit juices and the ones that impact soft drinks consumption, it was made possible to detect the differing behavioural, consumption and possibly perception patterns of parents and their children regarding the two distinguished categories of sugary beverages. A strength is that, in addition to weekly consumption of fruit juices and soft drinks, we assessed also the daily consumption of water, which is rarely measured. Furthermore, sugary beverages consumption and parenting practices were assessed through validated question items, which yielded moderate to good intraclass correlation coefficients [31]. Nevertheless, the consumption of beverages was self-reported and the same applies to the parenting practices. Therefore, socially desirable answers and recall bias cannot be ruled out. Finally, this is an observational study and, as a result, conclusions about causality cannot be drawn.

Implications to Public Health Practice.

Interventions aiming to promote healthy lifestyles in children often include attempts to reduce the intake of sugary beverages. Such interventions may benefit from addressing parenting practices and behaviours. Empowering parents to shape a healthy family environment for the child as well as promote water consumption instead of sugary beverages is highly recommended. Finally, increasing awareness, especially among parents, regarding the sugars contained in all kinds of fruit juices and the related unfavourable health impact is of high importance.

Conclusions

The current study showed that low consumption of soft drinks – and not of fruit juices –is associated with high water consumption in children. Furthermore, parenting practices towards both fruit juices and soft drinks are associated with the water intake of the children, irrespective of their socio-economic status. Specifically discouraging the consumption of soft drinks may increase water consumption. Moreover, the "healthy" perception of fruit juices/drinks might encourage children to consume these instead of water. Therefore, parenting practices and behaviours seem to be important targets to be addressed in an effort to shape healthy dietary behaviours in children, considering also that the parents are the ones who determine the family environment with respect to food

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Appendix

Appendix 1. Parenting practices towards sugary beverages consumption as assessed in the EPHE questionnaire.

Parental practice	Questionnaire item
Monitoring	I pay attention to the amount of fruit juice that my child drinks
Allowing consumption	1. If my child asks for fruit juice, I will give it to him/her
	2. My child is allowed to take fruit juice whenever (s)he wants
Negotiating	I negotiate with my child on how much fruit juice/soft drinks (s)he is allowed to drink
Communicate health belief	1. How often do you tell your child that fruit juices are not good for him/her?
	2. How often do you tell your child that fruit juices make him/her fat?
Avoid negative modelling	If I would like to drink fruit juice I would restrain myself because of the presence of my child
Parental efficacy to manage child's intake	If I prohibit my child from drinking fruit juice, I find it difficult to stick to my rule(s) if (s)he starts negotiating

Appendix 1. Parenting practices towards sugary beverages consumption as assessed in the EPHE questionnaire (*continued*).

Parental practice	Questionnaire item
Rewarding/comforting practice	I give fruit juices to my child as a reward or to comfort him/her
Drink fruit juices together with the child[2]	How often do you or your spouse drink fruit juices together with your child?
Home availability	There are fruit juices available at home for my child

Chapter 7

General discussion

INTRODUCTION

In this thesis, I aimed at analysing the EPODE approach at three levels in order to:

1. gain more insight into the implementation of the EPODE approach *at the level of programmes*;

2. explore, *at the level of populations*, the effects of EPODE-like programmes on improving behaviours and related determinants, especially in low socio-economic status groups;

3. assess, *at the level of individuals*, whether there is an association between parenting practices towards sugary beverages and the child's water consumption.

The analyses were based on the four levels of action of the EPODE programme theory. These four levels, integrated into the EPODE logic model (Figure 1), are:

a. the central organisation (coordination at the regional or national level),

b. the local organisation (coordination at the municipal level),

c. the community (advocacy, capacity-building and setting of action) and

d. the child (child's physical activity as well as dietary behaviour and BMI) [1, 2].

Three of the levels, namely central and local organisation and the community, were appraised, at the level of programmes (OPEN project). At the child level, energy-balance related behaviour change was assessed with a focus on low socio-economic status populations (EPHE project). In addition, at the level of the child, the association between parenting

practices towards sugary beverages and the child's water intake was also assessed.

Firstly, the main findings of the studies conducted for the purposes of this thesis are discussed, followed by reflection upon them. After that, the methodological strengths and weaknesses are presented. Finally, we discuss the research conducted in terms of its implications for future research, policy and practice.

SUMMARY OF THE MAIN FINDINGS

EPODE at the level of programmes

In **chapter 2**, we investigated whether it was possible to identify strengths and weaknesses of integrated community-based approaches (ICBAs, hereafter also referred to as 'programmes') targeting childhood obesity prevention, through systematic appraisal of these approaches. The systematic appraisal included specifically structured in-person interviews assessing elements of the EPODE pillars (OPEN tool) and an open-ended questionnaire, which assessed information related to the quality of the programmes in order to identify best practices (Good Practice Appraisal Tool or GPAT). Conducting a systematic appraisal through these tools enabled us to detect strong and weak elements related to the following components: political involvement and engagement; stakeholder involvement and public-private partnerships; implementation of interventions and campaigns; communication; scientific support, evaluation and dissemination. These components constitute key capacity-building factors for the implementation of ICBAs.

The assessed components and, accordingly, the programme's strengths and weaknesses differed among all the ICBAs assessed, due to their variable context. Differences in context were noted even between

EPODE-like programmes, including some of the programmes which implemented the EPHE interventions. More specifically, differences were observed with regard to: i. the level of action (national, local, or both) and the actions themselves, ii. the number of settings in which the EPODE approach was implemented within a community (one setting VS multiple settings targeted), iii. the number of people targeted, iv. the number of communities involved and v. the level of these communities' dependence on the central coordination in order to be able to run their actions. Most of these context elements (except for i., that is, the level of action) are related to the community level as integrated into the EPODE logic model (Figure 1).

Furthermore, in this thesis it was shown that the OPEN tool enabled identification of key information both on programme and intervention levels, compared to the GPAT which provided information regarding only the intervention level. In most cases the latter information set (from the GPAT) overlapped with or was complemented by the data yielded by the OPEN tool, which provided more detailed information. Nevertheless, it was shown that it is important to identify the strengths and weaknesses of the programme level in its specific context, in order to detect areas for improvement as regards the processes of the programme.

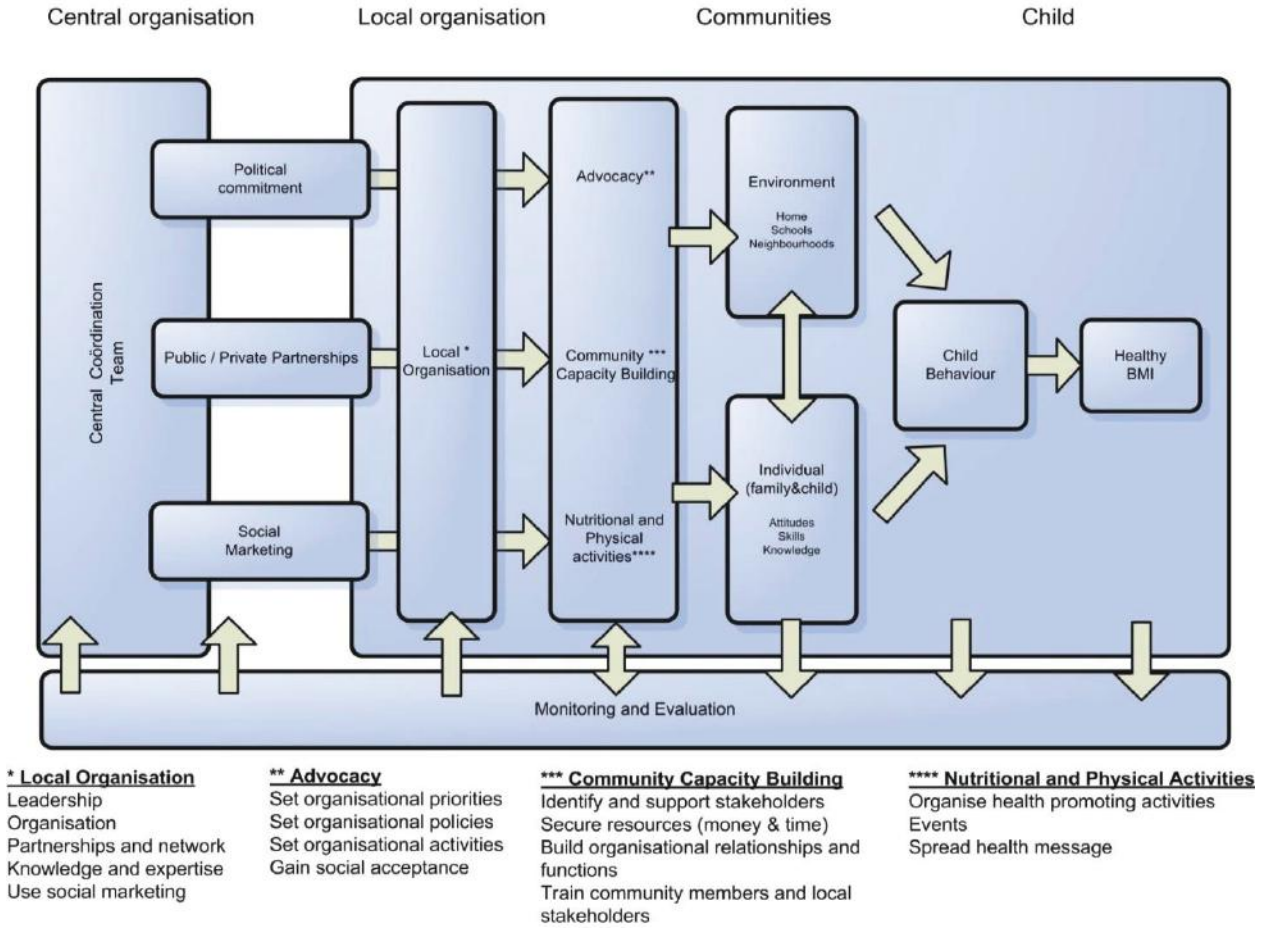

Figure 1. The EPODE logic model [2].

EPODE at the level of populations

The EPHE evaluation study included a 3-year longitudinal design (2013: pre-intervention; 2014: post-intervention; 2015: sustainability), as presented in **chapter 3**. In seven European countries, a medium-sized city (or municipality, in the case of big cities) with a wide range of socio-economic statuses was selected to recruit children in the age group of 6-8 years.Self-reported data, provided by the parents, was used for the assessment of four energy-balance related behaviours of children and associated family-environmental determinants (hereafter referred to as 'behaviours' and 'determinants'). The behaviours assessed were:

- fruit consumption
- vegetable consumption
- screen exposure (TV and PC separately)
- beverage consumption (water, fruit juices, soft drinks separately)
- sleep duration

Moreover, the determinants assessed were:

- parental facilitating (e.g. cutting up fruits for the child, serving vegetables during meals)
- parental allowance (e.g. allowing the child to eat fruit or to consume soft drinks whenever (s)he wants)
- parental monitoring (e.g. the time the child spends in screen activities, the amount of fruit juices consumed)
- child nagging (eg. Watching TV anyway, when parent prohibits it)
- parental knowledge on recommendations regarding fruit and vegetable intake
- parents performing behaviour together with the child (e.g. playing console games, eating fruit)

- parental demand (i.e. telling the child every day to consume fruit and vegetables)
- home availability (e.g. of vegetables, of soft drinks)
- parental encouragement (i.e. for consuming fruit and vegetables)
- negotiating with child (e.g. about the allowed time to spend on screen activities, the amount of fruit juices allowed to drink)
- parental self-efficacy (i.e. ease to retain the prohibition rules when child starts negotiating)
- rewarding and/or comforting (e.g. rewarding the child by offering soft drinks)
- communicating health belief (e.g. telling the child that soft drinks are not good for him/her)
- avoiding negative modelling (e.g. not watching TV when the child is present)

In **chapter 4**, the identified differences in behaviours and determinants (inequality gaps), between low and high socio-economic status groups per community site, are illustrated. We observed differences in favour of the high socio-economic status groups in fruit, vegetable and sugary beverages consumption as well as screen time, especially television viewing. Similarly, home availability and parenting practices favouring unhealthier lifestyle habits were more prevalent in the low than in the high socio-economic status groups, in most cases of all samples. However, though statistically significant, these differences in behaviours and determinants varied among the seven samples and they were rather small. These inequality gaps were recommended as targets for reducing the corresponding socio-economic differences.

Consequently, **chapter 5** presents the changes in the inequality gaps (as identified at baseline), presented in chapter 4, after interventions aiming to reduce them. The results indicated improvement of three behaviours among the low, whereas none among the high, socio-economic status groups. These behavioural improvements were the increase of fruit consumption (JOGG, The Netherlands), the decrease in the amount of fruit juices consumed (SETS, Romania) and the decrease of TV time on weekdays (VIASANO, Belgium). The increased values, signifying the improved behaviours, were similar or changed towards the ones of the subjects of the corresponding high socio-economic status groups. Similar improvements within the low socio-economic status groups, and less within the high ones, were observed in parenting rules and practices related to soft drinks and/or fruit juices as well as TV exposure in almost all EPHE sites. However, only one of the decreased differences was sustained a year after the interventions, namely the half hour decrease of TV time on weekdays, in the Belgian low socio-economic status group.

EPODE at the level of individuals

The third research question of this thesis was whether there is an association between parenting practices towards fruit juices as well as soft drinks and the children's water consumption. As demonstrated in **chapter 6,** the parenting practices towards soft drinks (for example, absence of strict rules and inadequate parenting practices) were strongly associated with a decreased frequency of the children's water intake. The respective associations between parenting practices towards fruit juices and water consumption were fewer and weaker. Moreover, an inverse association between consumption of soft drinks – and not of fruit juices – and consumption of water was observed. Interestingly, the socio-economic status did not influence the aforementioned associations.

REFLECTION ON THE MAIN FINDINGS

In line with the aim of this thesis, three main themes were distinguished: i) at the level of programmes, the systematic assessment of ICBAs, ii) at the level of populations, the assessment of the EPODE effectiveness in reducing differences in behaviours and determinants among low and high socio-economic status groups and iii) at the level of individuals, the influence of parenting practices towards sugary beverages on children's water consumption.

Analysis at the level of programmes: Assessment of ICBAs for preventing childhood obesity

In this thesis, we showed that it is possible to detect, through the use of a systematic appraisal, strong and weak elements of key components of ICBAs aimed at preventing childhood obesity. The following capacity-building factors and their specific elements were considered as key components: a) engagement and contribution of political and community stakeholders; b) creation of public-private partnerships; c) design, development and implementation of interventions; d) communication techniques to disseminate the health-promoting message; e) scientific support, monitoring and evaluation of the interventions and the programme itself; f) barriers and facilitating factors regarding the achievement of all the aforementioned. The monitoring of these key elements, through the use of the appraisal tools, combined with the subsequent reflection on the processes (weak and strong elements) can support further improvement of the ICBAs.

The components and elements appraised in our study are *consistent with* the international literature as regards tackling childhood obesity, where

the importance of "governmental commitment and leadership, long-term investment and engagement of the whole of society" has also been highlighted [3]. In addition, innovative techniques, such as social marketing, are increasingly used in obesity prevention efforts to trigger voluntary behavioural change [4-6]. Moreover, monitoring and evaluation of each step taken during the planning, design and implementation phases of a programme are well-known crucial factors. They particularly answer questions as to what has worked and what has not – and why – during the realisation of the programme [2, 7, 8]. To our knowledge, this is the first study that has carried out a systematic appraisal of elements embedded in key aspects of obesity prevention approaches.

Furthermore, it was shown that the assessed capacity-building factors differed from programme to programme, resulting in differences related to the community contexts, or the community level, as illustrated in the EPODE levels of action (figure 1). However, as depicted in figure 1, the EPODE levels of action are dynamically connected and the input of the previous levels is crucial for the subsequent ones. These findings are in line with the ones of Van Koperen et *al.* (2013) [2], and confirm that each level should be seen in relation to the previous ones. Interestingly, we found that this dynamic relationship among the processes of the programme applies also to other complex approaches.

Moreover, the specificities of the varying contexts of the programmes were detected, through the use of the OPEN tool. Insight into the context of programmes is essential for the right interpretation of the results concerning the key components. The OPEN tool is more flexible than the GPAT as regards acquiring detailed information on processes and on

contextual factors that influence the implementation of ICBA. Also, the OPEN tool has more flexible appraisal criteria than the GPAT, which are more sensitive to the diversity of the various ICBAs. More specifically, with regard to the GPAT tool, binary rating (i.e. a choice between 'yes' and 'no or not specified') does not give room to adapt the appraisal to the context situation in order to achieve a more comprehensive assessment. For example, the *item 15* (of the GPAT) assesses whether "possible adverse effects of the intervention were considered and minimised" and the ratings possible are "yes" or "no or not specified". The appraisal options provided do not distinguish between cases of minimising adverse effects in all interventions or in some interventions of the programme and, additionally, the significance of the effects considered cannot be assessed, because such significance cannot be expressed through plain "yes" or "no" answers. Moreover, many appraisal criteria (of the GPAT tool) have not been clearly specified, making it difficult to appraise the respective information through the binary scale. In contrast, the OPEN tool appraisal rating scales were further enriched during the analysis, resulting in a framework responding to the programmes' variability. Thus, the tool integrated more contextual information and allowed a more tailored appraisal. This does not imply necessarily that all other ICBAs can be appraised by adopting the same rating scales, but these scales may be adapted to suit different approaches. This first appraisal of EPODE-like programmes' implementation processes, next to other ICBAs, was facilitated mainly by the OPEN tool. However, correcting the shortcomings of the GPAT would turn it into a useful tool providing an overview of an ICBA, to function as a preliminary assessment, prior to the main, in-depth assessment of the

formation and implementation of the different programme components within the specific context.

Analysis at the level of populations: Effectiveness of EPODE approach to reduce differences in behaviours and determinants between low and high socio-economic groups

The design of the EPHE evaluation study

The EPHE evaluation study used data acquired from populations of seven different European countries to assess the outcomes of the EPHE selected community-based programmes aiming at reducing differences in behaviours and determinants among low and high socio-economic status groups. The rationale was that by targeting the determinants of unhealthy behaviour in the low socio-economic status populations these health behaviours would improve as well – particularly in the groups with low socio-economic status – and, consequently, the inequality gaps related to behaviours would decrease. To assess the potential changes in behaviours and determinants and their sustainability, a prospective design was adopted, including a) baseline, b) post-interventional measurements (one year later) and c) sustainability measurements (after one more year).

The EPHE evaluation study aimed to explore inequalities in risky lifestyle behaviours and related determinants and to evaluate potential effects of the EPHE interventions on the inequalities identified, in line with recommendations of widely accepted protocols for developing theory-based as well as evidence-based health promotion programmes [9, 10]. The evaluation was carried out using a pre-post intervention design, as this is considered to be a suitable alternative to the "gold standard" design of the randomised control trials (RCTs), when evaluating

population-based interventions [11]. Besides, RCTs are considered unsuitable for evaluating community-based interventions in real-life settings, actually making such a task impossible because of: the numerous unintentional environmental and/or contextual influences (e.g. economic or political); the high potential for contamination between control and intervention groups; the high likelihood of multiple coexisting health issues; the complex nature of causality in lifestyle behaviours; the number of interventions implemented and their complex pathways in influencing behaviour [8, 11-15]. The EPHE evaluation study is the first one designed to provide evidence of the EPODE approach on behavioural change specifically targeting the socio-economic context, as previous studies evaluated the EPODE approach only in terms of overweight [16, 17].

Socio-economic differences in behaviours and determinants between high and low socio-economic status groups: baseline, decrease and sustainability.

The baseline results from the EPHE sites showed that children with mothers of relatively high socio-economic status consumed fruits and/or vegetables more frequently than their peers whose mothers were of relatively low socio-economic status. The latter group of children had a higher intake of fruit juices and/or soft drinks and higher screen time as well. In line with our findings, several European studies have demonstrated that children of lower socio-economic status have unhealthier dietary habits and exhibit increased sedentary behaviour compared to their high socio-economic status peers [18-26].

In addition, differences in determinants of health behaviour were observed between the two socio-economic groups in our study, in all

EPHE sites. Specifically, parents from the low socio-economic status groups were more likely to adopt inadequate parenting practices, characterised by absence of strict rules and favouring unhealthy lifestyles, such as allowing the children to frequently watch TV as well as increased availability of soft drinks at home. Interestingly, there is little evidence available with regard to socio-economic differences in family-environmental determinants of lifestyle behaviours. Parenting rules and practices, such as lack of restrictions on TV watching and consumption of soft drinks as well as presence of screens in the child's bedroom and increased availability of soft drinks at home, have been statistically associated with high screen time and high intake of sugary drinks [22, 25]. Moreover, Van Ansem et *al.* (2014) found that high home availability and high parental consumption of sugary beverages mediated the association between maternal education level and the child's consumption of sugary beverages [26]. Holubcikova et *al.* (2016) also reported a positive association between the absence of eating-related parental rules and low educational level of parents [27]. This body of evidence, in combination with our results, suggests that targeting parenting rules and practices might help us to achieve positive behavioural change in children. Nevertheless, reaching parents – especially of lower socio-economic statuses – is a challenge.

The post-intervention measurements showed some improvements in behaviours and determinants, mostly in the low socio-economic status groups. The EPHE operational board was instructed (by the EPHE scientific board) to design interventions tailored to respond to the baseline differences between the low and high socio-economic status groups, and to especially focus on the determinants. However, given that the time-frame was limited, tailoring the interventions by taking into

account all the identified determinants was not feasible. The interventions were rather focused on promoting the healthy behaviours through activities directed to the children and only a small number of programmes included some activities for the parents or the whole family. The interventional activities were open to all children, without regard to their socio-economic status, over the course of a school year. The majority of the evidence, concerning effective strategies aiming to reduce inequalities in childhood obesity, points to either universal interventions, lasting more than 6 months and combining diet and physical activity knowledge with related activities [28], or targeted interventions, focusing on the low socio-economic status populations, which are strategically designed and implemented [29]. Positive behavioural changes – such as increase of physical activity as well as fruit and vegetable intake and decrease of screen time and intake of sugary beverages – have been reported by intervention studies targeted at low socio-economic status populations and by one universal study only [28]. The EPHE interventions were strategically designed to target the low socioeconomic status populations (selective prevention). However, they were open, so all the children could participate regardless of their socioeconomic status. Understanding which types of interventions targeted on the whole population are likely to successfully reach the low socio-economic status groups is of great importance. The reason is the commonly observed preferential uptake of interventions by the most advantaged groups, known as intervention-generated inequality [30-37]. According to our results, it seems to be possible, through universal interventions, to reach the disadvantaged groups, and to improve and even sustain improvements of their lifestyle behaviours and parenting practices. This may support our finding regarding the sustained decrease

in TV time on weekdays (Belgium), which may accordingly be associated with the sustained increase in monitoring the child's exposure on TV. However, more intensive and longer-term interventions are likely to be more effective.

Analysis at the level of individuals: Associations between parenting practices towards sugary beverages and the child's water intake

The analysis of the EPHE (baseline) data with respect to the individual level showed that inefficient parenting practices and absence of strict rules regarding the consumption of sugary beverages were strongly associated with a decreased frequency water consumption of the child. Furthermore, these associations were not influenced by parental education, a finding which contradicts results of other studies in which similar outcomes were assessed [22, 38-40]. Additionally, parenting practices towards sugary beverages have been consistently associated with the child's corresponding consumption. In particular, increased home availability, drinking sugary beverages together with the child, difficulty in limiting the child's consumption, and negative parental modelling were found to be associated with increased consumption on the part of the child [22, 26, 38, 39]. In contrast, more strict food rules – as well as discouraging and not allowing the child to consume sugary beverages – were associated with lower consumption of sugary drinks [38, 40].

Furthermore, the influence of parenting practices towards fruit juices on children's water consumption was smaller than the one exerted by parenting practices towards soft drinks. Also, fruit juices were consumed more frequently than soft drinks. The difference between consumption patterns regarding the two types of drinks may demonstrate the

perception according to which fruit juices and/or drinks are healthier beverages compared to soft drinks, whereas, in fact, even 100% fruit juices should be consumed in moderation due to their high content in natural sugars [41, 42].

METHODOLOGICAL CONSIDERATIONS

Strengths

This thesis presented the results of the first analyses regarding the EPODE approach at the level of programmes (chapter 2). Specifically, six EPODE-like programmes were thoroughly assessed in an effort to gain insight into the central and local organisation and community inputs, processes, activities and influences. These three levels of assessment provided new knowledge about key elements of the EPODE pillars, as approached or implemented by EPODE-like programmes realised in six different European countries (Belgium, France, Greece, Portugal, Romania, The Netherlands). Two different methods and, accordingly, two different tools were used for the data collection, namely in-person interviews using a structured question list and a questionnaire. Conducting interviews enabled us to ask for clarifications and details, which shed light on the context of the programmes and the underlying processes. All interviews were held in private spaces within the workplace of the interviewees, allowing them to talk freely and, hence, improving the quality of the data. As a result, a rich dataset has been acquired, helpful in identifying areas for improvement of processes in order to implement the EPODE approach more effectively. Moreover, to facilitate the objective interpretation of the data, three researchers, separately and independently, appraised the information, on condition that, when

disagreements occurred, these had to be discussed until consensus was reached. Furthermore, the assessment tool (OPEN tool) used for the interviews was a topic list based on the EPODE logic model and developed by the research group of the study described in chapter 2. Interestingly, the OPEN tool successfully identified strengths and weaknesses of non-EPODE ICBAs as well, thus providing evidence of its wider applicability, extending beyond the limits of EPODE-like programmes.

Another strength of this thesis relates to the EPHE evaluation study. This was the first study in which the effects of the EPODE approach were analysed in terms of behavioural outcomes. Other studies assessed the effectiveness by using the prevalence of obesity as an outcome [16, 17]. Apart from energy-balance related behaviours, we also explored determinants of these behaviours. The fact that these determinants were assessed with reference to the socio-economic status is another strength, as this has rarely been done before. Furthermore, the EPHE study demonstrated that inadequate parenting practices, associated with energy-balance related behaviours, were more prevalent in the low compared to the high socio-economic status groups from across a broad variety of European countries. The existing literature on these determinants is limited. Our study opened up an opportunity to look deeper into health inequalities, particularly in the European region where the socio-economic factors have been changing rapidly over the last years.

An additional strength of the EPHE evaluation study is that the assessment tool that measured behaviours and determinants was constructed using validated items in European populations, which yielded moderate to good intraclass correlation coefficient [43, 44]. It is

also worth mentioning the high baseline response rates and the moderate loss-to follow-up in almost all EPHE sites (average loss-to follow-up (%): T_1 = 30%; T_2 = 34%), illustrating the satisfactory commitment of most target groups.

Furthermore, this thesis includes a study concerning the association between parenting practices related to common sugary beverages and the daily frequency of children's water intake. To the best of our knowledge, this is the first study to do this. The methodological difficulties regarding the accurate measurement of actual water intake are numerous – e.g., high potential for report and recall bias when certain recording methods are used as well as overestimation or underestimation of parent-reported data – and, thus, it is rarely assessed in children. Although, through the assessment of the children's habitual daily consumption of water, these difficulties were not overcome, we were able, however, to explore the aforementioned associations. Moreover, we assessed fruit juices and soft drinks separately and distinguished between parenting practices into the ones which influence fruit juices' and the ones that have an impact on soft drinks' consumption. This assessment enabled us to detect the differing consumption patterns of children and possibly different parental perceptions regarding the two kinds of drinks.

Weaknesses

The studies of this thesis have some limitations as well. At the level of the analysis of programmes, the qualitative information, which depended on the context to a great extent, was quantified into scores. This quantification proved to be inadequate as it led to loss of information and made it difficult for the evaluators to interpret the programmes'

processes without additional context information. Furthermore, the (OPEN) tool had not undergone pilot testing and, thus, certain shortcomings became evident after the data collection and analysis. Hence, improvements are necessary in order to include assessment of more programme elements, so as to enhance the data quality and to reduce the burdens associated with the research and response processes. Moreover, there is a selection bias in this study, given that not all European ICBAs were included. However, we included programmes participating in the largest networks of integrated community-based approaches (EPODE International Network and IDEFICS) in Europe. In addition, recall bias, selection bias and socially desirable answers cannot be ruled out, as a result of the respondents' comprehension and judgement of the information retrieved from their memory and the subsequent selection of an answer [46].

At the level of populations, the EPHE evaluation study intended to be the evaluation of the EPHE interventions' effects, measuring the reduction of inequality gaps. However, the limited time-frame of the project constrained the scientific board from developing a more inclusive socio-economic indicator for more sensitive detection of absolute inequalities. Therefore, we used the educational level of the mother as a proxy for the socio-economic status. This may be a weakness of the study, as, most of the time, a combination of education, income and occupation is used, although the parental education level is considered to represent an adequate socio-economic indicator in public health nutrition research [47-49]. Furthermore, the pre-post intervention design did not incorporate a control group, a fact which might have undermined, to some extent, the validity of our results. Although we included a high socio-economic status group – against which we compared results – in

all the EPHE sites, this, however, cannot substitute a control group. Nevertheless, it is particularly difficult to include control groups in real-life settings, due to the high potential for unintended intervention effects (contamination), which are likely to occur during the recruitment and the measurement periods [8, 11-15].

Moreover, sampling bias is possible at the levels of analysis regarding the population and the individuals, because: 1. the programmes participating were selected on an EPODE or EPODE-like approach implementation basis; 2. it was a prerequisite for the participant city to already have a structure engaged in an EPODE programme; 3. the schools from which the samples were recruited were selected on the basis of accessibility and convenience criteria. Additionally, information bias, such as recall bias and socially desirable answers, might arise from the parent-reported data. Unfortunately, there is no 'gold standard' for measuring behaviours and determinants of children, and it is exceedingly difficult to use more elaborative methods, i.e. qualitative methods, in large-scale studies. Bias arising from the few constructed items (i.e. water intake frequency, water intake amount and determinants of water consumption) is also possible, since they were not validated, in contrast to the majority of the items included in the EPHE questionnaire. Finally, the EPHE design did not include any collection of information regarding the planning, design and implementation of the interventions per site. Although we are aware of the importance of process evaluation in attributing pre-post changes to the interventions delivered [2, 7, 15, 50, 51], we were obliged to focus on the effects, due to resource and time constraints. Thus, the EPHE results cannot be exclusively attributed to the respective interventions, also because causality was not analysed in this study.

RECCOMENDATIONS CONCERNING PUBLIC HEALTH RESEARCH

In this thesis, it was shown that differences in energy-balance related behaviours between low and high socio-economic status groups exist in various European communities (chapter 4). These differences can be addressed by EPODE-like programmes. However, further research is recommended on identifying absolute inequalities by using a country-specific socio-economic index, which will include multiple socio-economic indicators instead of mothers' educational level alone. In addition, the EPHE parental questionnaire is a frequency questionnaire mostly containing categorical (ordinal) data. These data posed difficulties in identifying and especially in reporting differences between the socio-economic status groups, since differences in spread were not “visible” in medians and quartile ranges. Therefore, we recommend that future studies use as many quantifiable variables as possible so as to be able to measure lifestyle behaviours. Furthermore, qualitative research would be more insightful, especially in identifying socio-economic differences regarding family-environmental determinants.

In addition, as discussed in chapter 5, process indicators are necessary for the interpretation of the observed effects of interventions. This is especially applicable to complex interventions or programmes implemented in the context of ICBAs, which incorporate more components than simple interventions. Process evaluations will determine the usefulness of the programme or intervention, in order for the goals to be reached, by answering questions as to who was involved, what and when has been done and how many of the intended activities and outputs were, respectively, implemented and achieved. Answers to

these questions enable reflection upon the methods used and they determine whether the programme or intervention should continue, expand, adapt or cease. A process evaluation is particularly recommended for the programmes using the EPODE approach, considering that insights in processes of such programmes are scarce, as also seen in the study presented in chapter 2 (results not discussed). For that reason, we recommend that evaluation studies of complex interventions and/or programmes integrate process evaluations into their evaluation plans. Moreover, as each of the EPODE pillars requires different capacity-building factors, programmes using the EPODE approach should integrate four different process evaluations, one for each pillar. It should be noted that these recommendations are relevant to practice as well, as programme evaluation is meant to "improve and not to prove" [50].

Although one should be cautious in interpreting them, the EPHE results indicate that interventions aimed at reducing inequalities in lifestyle behaviours of children might include targeting parenting practices and should be long-term as well. There were no common patterns observed among the different communities, regarding differences in parenting practices between low and high socio-economic status groups. Hence, we recommend that the relation between parenting practices and their influence on the child's behaviour be assessed in terms of the specific target population of the community, prior to deciding which of the parental behaviours and practices will be addressed by the interventions. Qualitative research, through participatory methods or by carrying out needs assessment, would provide additional insights to such an assessment.

Additionally, more research in order to better understand the targeted parents and/or children, socio-economically disadvantaged or not, can yield further insight about obstacles regarding their reach, engagement and behavioural change. In chapter 5, we observed higher drop-out rates among the low socio-economic status groups, in both measurement periods. Besides that, the study presented in chapter 2 revealed that the vast majority of the assessed programmes had not conducted any target group analysis (results not discussed). Recently collected data from those programmes (not presented in this thesis) showed that the use of target group analysis led to increased engagement of the corresponding groups. A target group analysis provides insights into the needs, wishes, strengths and talents of the target group. When these elements are taken into consideration, the chances to reach, engage and achieve behavioural change of the groups in question are increased and thus a target group analysis is highly recommended.

Moreover, the results presented in chapter 6 indicate that parenting practices towards sugary drinks should be targeted irrespective of socio-economic status. To prove this, however, experimental studies are needed.

IMPLICATIONS FOR PUBLIC HEALTH POLICY AND PRACTICE

Obesity is a complex issue and, therefore, requires integrated approaches. ICBAs, such as EPODE, seem promising as regards to preventing childhood obesity and decreasing related socio-economic inequalities. The reason is that engagement of the whole society is needed in order to deal with upstream environmental and behavioural drivers of the obesity epidemic [52-56]. Therefore, collaboration among community stakeholders is necessary, ranging from the local, regional

and national governments (e.g. municipal services, education) as well as the non-governmental and non-for-profit organisations and associations (e.g. sports associations, hospitals) to the private sector (especially, food-related retailers and companies). The qualitative data from the research, presented in chapter 2, showed that such collaboration was often missing due to conflicts of interests among the community stakeholders (results not discussed). Engagement and contributions at the political level were usually moderate, the backing of non-governmental and/or non-for-profit organisations and associations was often limited to moral support and private partnerships were restricted to monetary funding. Thus, fostering strong political commitment by stirring advocacy for the obesity-related issues and engaging all the municipal sectors in health-related policies is greatly needed. Furthermore, the integration of activities, material resources and the expertise of non-governmental and/or non-for-profit organisations as well as the exchange of experience on practices reaching and motivating the target group(s) would strengthen the implementation of the prevention activities all over the community. Moreover, collaboration with private partners is important not only because of its potential to increase a programme's capacities through funding; but especially for gaining more insight into the target group and possibilities to influence their behaviours and, most importantly, for changing the environment. Granted that the involvement of the private sector in ICBAs is criticized by many academics, public health professionals and the general public, the transparency of such agreements is of crucial importance as regards ensuring the integrity of the programmes.

Taking into account that few effects were sustained a year after the EPHE interventions (chapter 5), another issue to consider in public health

practice is how we can attain sustainable effects. One way to do this is to engage the stakeholders and the target population on the interventions and/or programmes in ways that develop a genuine sense of ownership.. This can be attained through the involvement of these groups in the planning, design and implementation phases of the integrated approach in a way that their needs and wishes are met, making good use of their strengths and talents. Target group analysis is a method that can play a key role in achieving a strong engagement, which is likely to lead to sustainable effects.

The future of an ICBA depends crucially on its effects. Considering that, in most cases, these can be clearly distinguished in the long run, it does not seem prudent to measure effects only in terms of the post-programme outcomes. It is therefore vital to systematically monitor and evaluate a programme's processes and gradual effects, which are equally important in order that decisions are made regarding the future of the programme. Systematic programme evaluation can lead to the improvement of the programme's quality and outcomes, through frequent assessments, monitoring and surveillance. Given the practical barriers (e.g. budget, time, personnel etc.), such systematic evaluation approach is very often not followed. Therefore, before all else, policy makers should demand and facilitate the means for systematic evaluations. In addition to this, it is equally important that policy makers advocate and/or provide the required resources and guidance for such comprehensive evaluation approaches.

CONCLUSIONS

The EPODE analysis at the level of programmes yielded useful information that can lead to further improvement of each specific

programme that was assessed. The analysis at the level of populations showed that the EPODE approach might be particularly successful in reaching populations of relatively low socio-economic status and subsequently reducing social inequalities in health-related behaviours. The analysis at the level of individuals illustrated the importance of parenting rules and practices regarding the children's behaviour. Thus, identifying family-environmental determinants of risk behaviours is important in order to better understand the mechanisms that shape such behaviours in the target population.

ICBAs seem to be suitable for the prevention of the obesity epidemic. EPODE is one of these promising approaches, although there is a clear need to optimise its implementation so as to respond to the local context. Adapting the EPODE approach according to each country's and community's specific contexts is a great challenge. The EPODE-like programmes run into numerous difficulties regarding: a. fostering political engagement and advocacy; b. establishing partnerships among and with stakeholders from various sectors; c. implementing interventions in multiple settings and performing target group analyses; d. carrying out thorough evaluations of their interventions and the programme itself. Thus, we still need to learn a lot about the best way to adapt the approach according to the local level. First, the difficulties encountered should be dealt with through a circular process of monitoring, reflecting and improving the methods used. Secondly, multi-stakeholder engagement and collaboration should be fostered in order to both create sustainable synergies in the community and more effectively trigger environmental change. Thirdly, the target groups should be involved in a way that develops a sense of ownership, in order for more sustainable effects to be achieved. This is particularly important

for the hard-to-reach populations, namely those with a low socio-economic background. These three elements seem to increase the chances to tackle not only childhood overweight and obesity, but also the related socio-economic inequalities.

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Summary

Introduction

Non-communicable diseases (NCDs) are the leading causes of death worldwide. Risk factors commonly associated with NCDs are related to lifestyle behaviours such as diet, physical activity, excessive alcohol consumption and smoking. The main NCD risk factors are largely preventable. However, prevention is very difficult, as NCD risk factors and related unhealthy lifestyles are highly influenced by upstream, social determinants related to distribution of power, money and resources. Obesity is one of the major preventable causes of NCDs, while the prevalence of childhood overweight and obesity has escalated over the past decades. Childhood overweight and obesity not only have become important risk factors for developing numerous serious metabolic diseases and psychosocial disorders, but they have also been major causes of comorbidities responsible for developing cardiovascular diseases and diabetes during adulthood. Childhood obesity is a complex issue as it is determined by numerous – micro as well as macro – environmental, individual and socio-economic factors. Therefore, to tackle the obesity epidemic, a socio-ecological approach is strongly recommended, and that is the basis on which the integrated community-based approaches (ICBAs) have been developed. An ICBA that showed promising effects with regards to reducing childhood obesity prevalence in France, the Fleurbaix-Laventie study, gave rise to the EPODE (which stands for 'Ensemble Prévenons l'Obésité Des Enfants' and translates to 'Together let's prevent childhood obesity') model.

Contents and main findings of the thesis

In **chapter 2**, we analyse the EPODE approach at the level of programmes. We investigate whether it is possible to identify strengths and weaknesses of integrated community-based approaches targeting childhood obesity prevention, through systematic appraisal of these approaches. The systematic appraisal includes specifically structured in-person interviews assessing elements of the EPODE pillars (OPEN tool) and an open-ended questionnaire, which assesses information related to the quality of the programmes in order to identify best practices (Good Practice Appraisal Tool or GPAT). Conducting a systematic appraisal through these tools offers the ability to detect strong and weak elements related to the following components: political involvement and engagement; stakeholder involvement and public-private partnerships; implementation of interventions and campaigns; communication; scientific support, evaluation and dissemination. These components constitute key capacity-building factors for the implementation of ICBAs.

In **chapters 3-5**, we analyse the EPODE approach at the level of populations. The methodology of the EPHE evaluation study, a 3-year longitudinal design comprising measurements in 2013 (pre-intervention), 2014 (post-intervention) and 2015 (sustainability), is presented in **Chapter 3**. In seven European countries, a medium-sized city (or municipality, in the case of big cities) with a wide range of socio-economic statuses is selected to recruit children in the age group of 6-8 years. After that, four energy-balance related behaviours of children and associated family-environmental determinants are assessed by means of a parental questionnaire.

In **chapter 4**, the identified differences in behaviours and determinants (inequality gaps), between low and high socio-economic status groups per community site, are illustrated. We observe differences in favour of the high socio-economic status groups in fruit, vegetable and sugary beverages consumption as well as in screen time, especially with regard to television viewing. Similarly, home availability and parenting practices favouring unhealthier lifestyle habits are more prevalent in the low than in the high socio-economic status groups, in most cases of all samples. However, though statistically significant, these differences in behaviours and determinants between the low and high socio-economic status groups are rather small and vary among the seven populations. These inequality gaps are recommended as targets for reducing the corresponding socio-economic differences.

Following that, **chapter 5** presents the changes in inequality gaps (as identified at baseline) illustrated in chapter 4, after interventions aiming to reduce them. The results indicate improvement of three behaviours among the low, whereas none among the high, socio-economic status groups. Similar improvements within the low socio-economic status groups – and less within the high ones – are observed in parenting rules and practices related to soft drinks and/or fruit juices as well as TV exposure in almost all EPHE sites. However, only one of the decreased differences is sustained a year after the interventions, namely the half hour decrease of TV time on weekdays, in the Belgian low socio-economic status group.

In **chapter 6**, we present an analysis carried out at the level of individuals. The research question is whether there is an association between individual parenting practices towards fruit juices as well as soft drinks and the children's water consumption. The parenting

practices towards soft drinks (for example, absence of strict rules and inadequate parenting practices) are strongly associated with a decreased frequency of the children's water intake. The respective associations between parenting practices towards fruit juices and water consumption are fewer and weaker. Moreover, an inverse association between consumption of soft drinks – and not of fruit juices – and consumption of water is observed. Interestingly, the socio-economic status does not influence the aforementioned associations.

Finally, the general discussion (**chapter 7**) includes a presentation of the main findings of this thesis, followed by critical reflection upon them, in which the strengths and weaknesses of the study designs come under consideration. In addition, we make research recommendations and discuss the implications for policy and practice.

Conclusions

The EPODE analysis at the level of programmes yielded useful information that can lead to further improvement of each specific programme that was assessed. Integrated community-based approaches seem to be suitable for the prevention of the obesity epidemic. EPODE is one of these promising approaches, although there is a clear need to optimise its implementation so as to respond to each specific local context. We detected three elements which, in all probability, can help us to overcome the challenges arising during the adaptation of the approach to a specific local context: 1. the difficulties encountered should be dealt with through a circular process of monitoring, reflecting and adapting the methods used; 2. multi-stakeholder engagement and collaboration should be fostered; 3. the target groups should be involved in a way that develops a sense of

ownership. These three elements seem to increase the chances to effectively tackle not only childhood overweight and obesity, but also the related socio-economic inequalities.

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Publication list

This Thesis

- **Mantziki K**, Vassilopoulos A, Radulian G, Borys JM, du Plessis H, Gregorio MJ, Graca P, de Henauw S, Handjiev S, Visscher TL , Seidell JC. Promoting health equity in European children: design and methodology of the prospective EPHE (Epode for the Promotion of Health Equity) evaluation study. *BMC public health* 2014, 14(1):303.

- **Mantziki K**, Vassilopoulos A, Radulian G, Borys JM, Du Plessis H, Gregorio MJ, Graca P, De Henauw S, Handjiev S, Visscher TL, Seidell JC. Inequities in energy-balance related behaviours and family environmental determinants in European children: baseline results of the prospective EPHE evaluation study. *BMC public health* 2015, 15(1):1203.

- Mantziki K, Renders CM, Vassilopoulos A, Radulian G, Borys JM, du Plessis H, Gregório MJ, Graça P, de Henauw S, Handjiev S, Visscher TLS, Seidell JC. Inequalities in energy-balance related behaviours and family environmental determinants in European children: Changes and sustainability within the EPHE evaluation study. *Int J Equity Health*. 2016;15(1):160

Book Chapters

- Borys JM, Graca P, Gregorio MJ, Handjiev S, **Mantziki K**, Moreno AL, Du Plessis H, Seidell JC, Vassilopoulos A, Visscher TL. *EPODE for the Promotion of Health Equity*. France: Lavoisier; 2015.

About the Author

Krystallia Mantziki was born on January 4th 1987 in Pireus, Greece. After graduating from high school in Lamia, she studied Public Health and Hygiene at the Technological Educational Institution (TEI) of Athens. In her final year she did her internship at the Directorate of Environmental Health and Sanitary Inspectorate of the central and south sector, Athens, Greece. There she decided to switch her specialization and also to pursue educational experience abroad. Therefore, she enrolled in the Nutrition and Health programme at Wageningen University and obtained her Masters of Science degree, with a major in Epidemiology and Public Health. She performed her MSc internship at Vrije Universiteit of Amsterdam, focusing on community-based interventions for preventing obesity. Seized by the research related to health promotion and obesity prevention, and she was encouraged to continue working in the field.

In 2013, she started working as a junior researcher at the department of Health Sciences of the Vrije Universiteit of Amsterdam, under the supervision of prof.dr.ir. Jaap Seidell. During this project she designed the evaluation study of the EPODE for the promotion of Health Equity (EPHE) project. At the same time she started her PhD project, entitled: "Integrated community-based approaches to prevent childhood overweight and obesity" which was also supervised by prof.dr.ir. Jaap C. Seidell and co-supervised by Dr. Carry M. Renders. In 2014, Krystallia started working on the Obesity Prevention though European Network (OPEN) project, for which she conducted the evaluation. In this project, she was responsible for carrying out the data collection, analysis and reporting.

In 2015, Krystallia was also involved in PHAROS organization, Utrecht, where she assisted a research related to strategies for tackling childhood obesity in low socioeconomic populations.