



**Universidade do Minho**  
Instituto de Educação

Maria Margarida Duarte Vieira

## Planning Health in School: building a healthy eating and active lifestyle educational model

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**Planning Health in School: building a healthy eating and active lifestyle educational model**

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Specialty in Child Health

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To all the Portuguese children and adolescents



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This thesis reflects the culmination of a long journey of research and resilience and is dedicated to all Portuguese children for encouraging them to follow healthy behaviours so they can live longer and with better living conditions. However, I have never been by myself in this journey and there are many people I shall thank for their distinct contributions to this study.

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## **Planning Health in School: building a healthy eating and active lifestyle educational model**

### **ABSTRACT**

**Objective:** The general purpose of this research work was to create an educational health promotion model, called “Planning Health in School” programme (PHS-pro), and evaluate its effect among school grade-6 children. This PHS-pro was developed aiming to fill the lack of preventive programmes in Portugal and find effective strategies to reduce obesity rates in Portuguese children. The PHS-pro was designed based on the Transtheoretical Model of Change and integrated eight learning modules to guide children towards healthy eating and active living. The following five specific research goals to evaluate the PHS-pro were the core of this research: 1) effectiveness on children’s nutritional status, eating and physical activity habits and knowledge; 2) changes in eating behaviours throughout learning modules; 3) long-term effects on a pair of twins; 4) economic costs of programme’s implementation; 5) process evaluation from the participants’ views.

**Methods:** To evaluate the effectiveness of the PHS-pro, a non-randomized control group pretest-posttest study was conducted. A total of 449 children of four elementary schools of a Portuguese Municipality were enrolled and divided into two groups, intervention group (IG) and control group (CG). The PHS-pro was applied to the IG. Anthropometric measurements were performed, and eating habits, physical activity and food basic knowledge data collected before and after the programme implementation. To study how children changed their eating behaviours over the PHS-pro intervention, a repeated time-series design was carried out using food records and attitudes, preferences and expectations were analysed through participatory activities. It was also evaluated the PHS-pro impact on a pair of obese twins carried out in three evaluation moments (baseline, after PHS-pro and 12 months later) by analysing: the nutritional status assessed by the anthropometric measurements; food records and questionnaire answers collected eating behaviours and physical activity. To estimate the costs of the PHS-pro implementation, a standard economic evaluation was conducted and the results compared with the direct costs of treating obese adults in Portugal. To evaluate the overall programme implementation, a process evaluation was undertaken regarding children and teachers’ views obtained by questionnaires and focus group. A SWOT analysis was also performed.

**Results:** The PHS-pro was effective in improving anthropometric outcomes leading to a better children nutritional status and healthier lifestyle behaviours. In fact, the IG showed significant reductions in waist circumference and waist-to-height ratio followed by an increased height compared with the CG. Furthermore, fruit and vegetables daily intakes

increased, and soft drink consumption significantly decreased in IG children compared with CG. Also, physical activity time increased significantly in IG, while it decreased significantly in the CG. Substantial changes were found on eating behaviours throughout the eight learning modules programme, supported by children's new attitudes and expectations. Significant changes were observed with higher consumption of vegetable soup, milk products and fruit, while high-energy dense food, and soft drink consumption significantly decreased. No positive healthy effects were found on the consumption of fried food, water, vegetables and bread. The case study conducted with the twins, who were considered obese according to Cole and collaborators' standards before the PHS-pro onset, showed that at the end of the PHS-pro they improved their attitudes, behaviours and anthropometric parameters; results also showed that while the boy remained in the obese category, the girl moved from the obese to the overweight one. Furthermore, at follow-up time (12 months after PHS-pro ended), although there was a slight increase in the anthropometric parameters in both twins, none of them returned to their baseline values, and the girl kept her nutritional status in the overweight category. Therefore, PHS-pro promoted positive changes on twins and had at least one-year long-term effect. Regarding the PHS-pro costs, the cost-benefit analysis showed to be a cost saving programme, being a beneficial investment to prevent childhood obesity. The PHS-pro costs were estimated as 36.14€/child per school year, which is much lower than treating one obese adult in Portugal (3849.15€/year; Ribeiro 2010). Moreover, scaling up the programme to a larger population, it allows to lower the intervention costs to 18.18€/child, which is even more economically feasible. The overall intervention had good acceptance and compliance regarding its educational components, with a high participation rate which achieved the entire sample. Teachers confirmed children's views and were very enthusiastic about extending the PHS-pro to other school grades.

**Conclusion:** The behavioural-change model used in PHS-pro revealed to be an appropriate methodology to prevent the rise of childhood overweight and obesity. Anthropometric measures, eating behaviours, physical activity, attitudes and knowledge towards a healthy lifestyle improved. However, such programme model, implemented as a sole effort during a one school year does not change health behaviours endlessly, thus a long-term implementation of PHS-pro should be ensured. To conclude, this research demonstrated that the PHS-pro methodological approach and its strategies are promising for promoting healthy behaviours among children, contributing to prevent obesity.

**Keywords:** health promotion, school-based intervention, transtheoretical model  
quasi-experimental, childhood obesity

## **Planear Saúde na Escola: construir um modelo educativo de alimentação saudável e um estilo de vida ativa**

### **RESUMO**

**Objetivo:** Esta investigação teve como objetivo principal criar um modelo educativo para a promoção da saúde, denominado programa “Planear Saúde na Escola” (PSE), e avaliar os seus efeitos em crianças do 6º ano de escolaridade. O PSE procurou desenvolver estratégias eficazes para diminuir a prevalência da obesidade infantil e contribuir para o desenvolvimento de programas de prevenção em Portugal. Este programa foi desenvolvido com base no Modelo Transteórico de Mudança de Comportamento e integrou oito módulos educativos para orientar as crianças na adoção de hábitos alimentares saudáveis e um estilo de vida ativa. Na avaliação do PSE estabeleceram-se cinco objetivos específicos: 1) avaliação da eficácia sobre o estado nutricional das crianças, seus hábitos alimentares, atividade física e conhecimentos sobre alimentação; 2) avaliação das alterações ocorridas no comportamento alimentar ao longo dos módulos educativos; 3) avaliação dos efeitos a longo-prazo em dois gémeos obesos; 4) avaliação dos custos de implementação do programa; 5) avaliação do processo de implementação pelas perspectivas dos participantes.

**Métodos:** Para avaliar a eficácia do PSE realizou-se um estudo baseado no modelo pré-teste/pós-teste com grupo de controlo não aleatório. Participaram 449 crianças das quatro escolas EB 2/3 de um Município Português, distribuídas em dois grupos: grupo de intervenção (GI) e grupo de controlo (GC). A implementação do PSE realizou-se no GI. Os parâmetros antropométricos, os hábitos alimentares, a atividade física e os conhecimentos sobre alimentação foram obtidos antes e depois do PSE. As alterações no comportamento alimentar das crianças ao longo do PSE foram avaliadas através de um estudo de séries temporais com a aplicação de diários alimentares. Também foram analisadas as atitudes, as preferências e as expectativas sobre a alimentação saudável com atividades participativas. O impacto do PSE nos gémeos obesos foi avaliado em três momentos (antes do PSE, no pós PSE e doze meses depois) analisando: o estado nutricional por avaliação antropométrica e os dados do comportamento alimentar e da atividade física, através de diários alimentares e questionários. A avaliação dos custos do PSE, foi realizada com uma análise económica convencional e os resultados comparados com os custos diretos do tratamento da obesidade em Portugal. Para avaliar a implementação do programa, recolheram-se as perspectivas dos participantes através de questionários, por um grupo focal e uma análise SWOT.

**Resultados:** O PSE mostrou-se eficaz na melhoria das medidas antropométricas das crianças e dos seus comportamentos. O GI apresentou uma redução significativa no perímetro da

cintura, na razão cintura-estatura, acompanhadas por um aumento significativo da estatura, comparativamente com o GC. Também a ingestão diária de fruta e vegetais aumentou significativamente e o consumo de refrigerantes diminuiu no GI comparativamente com o GC. O tempo dedicado à atividade física aumentou significativamente no GI, enquanto no GC diminuiu significativamente. Encontraram-se alterações substanciais nos comportamentos alimentares durante os módulos educativos, apoiadas por novas atitudes e expectativas das crianças; observou-se um consumo significativamente superior de sopa de legumes, produtos lácteos e fruta, enquanto o consumo de produtos de elevada densidade energética e refrigerantes diminuíram significativamente. Não houve efeitos positivos no consumo de fritos, água, produtos hortícolas e pão. O estudo dos gémeos considerados obesos (Cole,2000) antes do PSE, mostrou melhorias nas atitudes, comportamentos e parâmetros antropométricos no pós PSE; o rapaz manteve-se na categoria de obeso, a rapariga passou da categoria de obesa para excesso de peso. Doze meses depois, os parâmetros antropométricos dos gémeos sofreram um ligeiro aumento, mas não voltaram a valores próximos dos registados antes do PSE e a gémea continuou na categoria excesso de peso. Portanto, o PSE promoveu alterações positivas nos gémeos e o efeito prolongou-se até um ano depois do seu término. Sobre os custos do PSE, a análise custo-benefício sugere ser um programa económico e um investimento para prevenir a obesidade infantil. O custo estimado de 36.14€/criança por ano escolar, um valor muito reduzido relativamente a tratar um adulto obeso em Portugal (3849.15€/ano; Ribeiro 2010). Além disso, ao implementar o programa a uma população maior, o efeito de escala permite baixar os custos para 18.18€/criança, tornando-se ainda mais viável. A intervenção obteve boa aceitação e adesão quanto aos componentes educacionais e alcançou um índice elevado de participação. Os professores validaram as perspectivas das crianças sobre o PSE e mostraram-se entusiasmados quanto à sua ampliação a outros anos lectivos.

**Conclusão:** O modelo de mudança de comportamentos utilizado no PSE revelou-se uma metodologia adequada para prevenir a obesidade infantil. Os parâmetros antropométricos, os comportamentos alimentares e a atividade física, as atitudes e os conhecimentos melhoraram. No entanto, este modelo aplicado apenas num ano escolar, não modifica comportamentos de modo permanente, e a implementação a longo prazo deve ser assegurada. Para concluir, a abordagem metodológica do PSE e suas estratégias demonstraram ser promissoras na promoção de comportamentos saudáveis, contribuindo para a prevenção da obesidade infantil.

**Palavras-chave:** promoção da saúde, intervenção escolar, modelo transteórico, desenho quasi-experimental, obesidade infantil

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## **ABBREVIATIONS**

AU\$	Australian Dollars
BMI	Body mass index
CG	Control group
FFQ	Food frequency questionnaire
F&V	Fruit and vegetable
HBSC	Health Behaviour in School-aged Children
HBM	Health Belief Model
24HR	24-hour dietary recall
HPO	Health Promoter Office
HPS	Health Promoting Schools
IUHPE	International Union of Health Promotion and Education
IG	Intervention group
LM	Learning module
PHS-pro	Planning Health in School programme
SCT	Social Cognitive Theory
TTM	Transtheoretical Model
UNCRC	United Nations Convention on the Rights of the Child
US\$	United States Dollars
WC	Waist circumference
WHtR	Waist-to-height ratio
WHO	World Health Organization
YRBS	Youth Risk Behaviour Survey





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## Chapter 1: General Introduction

*“Children are the living messages we send to a time we will not see.”*

John W. Whitehead, 1983

### 1.1 PROMOTING CHILDREN’S HEALTH, INVESTING IN THE FUTURE

Children are the best value to the future, the future of their families, the future of their cities, the future of their countries, and the human progress of our planet. All these scenarios, from a local or national perspective to a global picture, are constrained by the childhood development and capacities, wherein a healthy lifestyle, such as good nutrition and an active living have great impact (Tilman & Clark, 2014; WHO – World Health Organization, 2003; World Food Programme, 2007).

Establishing a healthy eating and an active lifestyle during childhood and adolescence are critical factors for children’s healthy growth and cognitive development as well as for contributing to a disease-free adulthood (Gidding et al., 2006; WHO – World Health Organization, 2005). The benefits of healthy diet together with regular physical activity are well documented. Research indicates that these two key-behaviours play an important role in the prevention of obesity and reduce risks for chronic diseases, including cardiovascular disease, diabetes type II, some types of cancer and osteoporosis (Lytle, 2014; WHO – World Health Organization, 2009a). Healthy eating and active living behaviours are also associated with the prevention of a great number of related obesity disorders during childhood. Obese children are more prone to experience mental health problems such as depression or anxiety, low self-esteem, bullying and behaviour problems than non-obese, and also exhibit a higher frequency of cardiovascular risk factors (high blood pressure, dyslipidemia, hypertension, insulin resistance) and other clinical consequences as asthma, type I diabetes and abnormalities of the foot structure (Alberga, Sigal, Goldfield, Prud'homme, & Kenny, 2012; Reilly & Kelly, 2011; Reilly et al., 2003). As children go through adolescence, they are most likely to be at risk for developing unhealthy diets, often arise together with physical inactivity (Armstrong & Welsman, 2006; Popkin, 2011; Sanchez et al., 2007). Behavioural patterns developed in adolescence are likely to remain into adulthood (Lake, Adamson, Craigie, Rugg-Gunn, & Mathers, 2009). Considering the substantial knowledge, promoting healthy

behaviours over child growth not only will decrease obesity epidemic and chronic diseases but also will reduce the costs and resources required for treatment (Dee et al., 2014; Lehnert, Sonntag, Konnopka, Riedel-Heller, & König, 2013; WHO – World Health Organization, 2005).

**Obesity** is currently considered the primary nutrition-related health concern for children (Lytle, 2014). A recent systematic analysis has shown a prevalence of overweight and obese children above 20%, being observed in both developed and developing countries (Ng et al., 2014). Previously, across Europe, a study of the International Obesity Task Force has found that 18% of children living in the European Union were overweight, and predicting a rise of 400.000 new cases of children each year (Novotny, 2008).

According to the last update of the World Obesity Federation (2014), more than 30% of Portuguese children are overweight or obese, being girls and boys, respectively, in second and fourth position of all the European countries. Two other previous Portuguese studies (Bingham et al., 2013; Padez, Mourao, Moreira, & Rosado, 2005) have found similar results. Therefore, the exiting data give a comprehensive overview of the dimension of the Portuguese situation, its trend and the expected consequences for the health care system. This evidence is strong enough to justify the research needs and priorities in Portugal, which should focus on strategies and effective solutions on the primary prevention level, allowing to ensure the benefits of health promotion: preventing the obesity risk, decreasing the development of chronic diseases risk in the next generations, increasing health savings and reducing costs (WHO – World Health Organization, 2005).

Currently, children are exposed to increased availability of processed **energy-dense foods**, generally high in fat, sugar and salt, but have low intakes of fruits, vegetables, whole grains and calcium-rich foods (Malik, Willett, & Hu, 2013; Martens, Van Assema, & Brug, 2005; Tilman & Clark, 2014). Furthermore, physical inactivity strongly influences children's daily energy expenditure. An inadequate diet is the only contributor for excessive consumption of calories to the daily imbalance between consumed and expended calories. Although physical inactivity and the low intake of fruit and vegetables are identified among the six leading global risks for mortality and chronic diseases, low intake of fruit and vegetable is definitely the major factor (Busse, 2010).

**Fruit and vegetables** provide a wide range of nutrients with high concentration of vitamins (vitamin C, folate, and pro-vitamin A), minerals (potassium, calcium, and magnesium), different bioactive compounds such as antioxidants, and are important sources of dietary fiber. Children should obtain most of these nutrients on a daily basis in order to

ensure a well-balanced diet (Liu, 2013; Slavin & Lloyd, 2012). The World Health Organization (WHO) recommends an average daily intake of 400 g fruits and vegetables (WHO – World Health Organization, 2003). Guidelines published by the World Cancer Research Fund/American Institute for Cancer Research also propose to eat at least five portions/servings every day, which is the equivalent of 400 g (Norat, Aune, Chan, & Romaguera, 2014). There is universal agreement on the growing importance of fruit and vegetable intake and its daily amount.

According to this, it is alarming to note that children's daily intake of fruit and vegetable (F&V) is well below recommended levels. The PRO GREENS cross-sectional survey reported the F&V intake of 11-year-old children in ten European countries, where Portugal was included. The mean consumption of total F&V was below the recommended levels in all countries, with merely 23.5% of children meeting the WHO recommendation. Results from Portugal showed that only 21% eat F&V daily (Lynch et al., 2014).

The international Health Behaviour in School-aged Children (HBSC) study is used to investigate trends among children of 11-, 13- and 15-years-old. Based on data from 2009/2010 and 2013/2014 surveys, the analyses on fruit consumption showed large proportions of children who reported not eating fruit at least once a day. In addition, in these two surveys, prevalence of daily fruit consumption decreased with increasing age: the first survey showed 42%, 36% and 31% for children of 11-, 13- and 15-years-old, respectively; in the last survey, the prevalence was 44%, 37% and 33%.

Portugal followed the international trend: daily fruit consumption decreased with the increasing age in both genders (Currie et al., 2012; Inchley & Currie, 2016). In the 2009/2010 survey, the Portuguese girls of 11-, 13- and 15-years-old presented results of 57%, 46 % and 39% in the prevalence of daily fruit consumption; these numbers decreased to 50%, 43% and 36% in the survey of 2013/2014; in the same age groups, boys had a slight overall decrease: 44%, 44% and 34% in the first survey and 43%, 39% and 34% in the last survey.

While the trend of fruit consumption remains under the WHO's recommended limits, soft drinks among children are increasing. **Soft drink** consumption is associated with an increased energy intake and weight gain contributing to raise the risk of obesity, metabolic syndrome, and type 2 diabetes (Barrio-Lopez et al., 2013; Malik et al., 2010). Furthermore, there is evidence indicating that soft drink intake is associated with lower intakes of milk, calcium, and other nutrients (Vartanian, Schwartz, & Brownell, 2007). Based on the HBSC survey data of 2013/2014, involving 42 countries in Europe and North America, the prevalence of daily soft drink consumption increased between ages 11 and 15. Children that

reported taking soft drinks at least once a day reached up to 15%, 18% and 19% for 11-, 13- and 15-years-old respectively, and boys reported to drink more soft drinks than girls. In this study, Portuguese children of 11-year-old showed a prevalence of consumption below the HBSC average, those of 13-years-old were comparable to HBSC average, but for children of 15-years-old the proportion is higher, with about 20% reporting to consume soft drinks every day (Inchley & Currie, 2016).

The public health guidelines for **free sugars** is less than 10% of the daily total energy (WHO – World Health Organization, 2003). The HELENA study aimed to describe food consumption among European adolescents between 12.5 and 17.5 years and found that the average intake of sweets was between 400g and 700g, including soft drinks, which highly exceeded the recommended levels. A sweet intake of 10% is between 200-270 kcal/day and would correspond to around 40–50g of chocolate, 60–80 g of candy gums or 450–650 ml of soft drinks (Diethelm et al., 2012).

In addition to the eating patterns particularly problematic above described, other current children's eating behaviours are a matter of concern: reduction of whole grains and an increase in highly processed foods and low quality foods, too much meat, meat products, white bread, fried chips and confectionery (Diethelm et al., 2012; Lytle, 2014). Indeed, the current environment where children live in, calls for great attention to the need of improving daily eating behaviours of young people and help them to move from knowledge and facts to action.

**Physical inactivity** is another health concern during children development, strongly contributing to overweight and obesity, and increasing non-communicable diseases in adults, such as coronary heart disease, type 2 diabetes, and breast and colon cancers with a negative impact on life expectancy (Lee et al., 2012; Sawyer et al., 2012; WHO – World Health Organization, 2009a). Additionally, children are not only exposed to sedentary environments (transportation, communications, domestic-entertainment technologies), which demand low levels of energy expenditure (Owen, Healy, Matthews, & Dunstan, 2010), but at same time they have excessively increased the amount of time spent with other class of sedentary activities: television viewing, computer use, video games, and smartphones (Rideout, Foehr, & Roberts, 2010). The older children are the ones that spend more time in front of a screen (Rideout et al., 2010).

Physical inactivity and sedentary behaviours are two separate problems as proposed by Owen (2010, p. 1) with his statement “too much sitting is distinct from too little exercise”. It is, therefore, necessary to ensure an integrated approach to deal with the two issues.



Findings presented in the HBSC survey of 2013/2014 (Inchley & Currie, 2016) have concluded that only a minority of children between ages of 11 and 15 respected the recommendation of 60 minutes per day of moderate-to-vigorous physical activity, and in general levels declined with the increasing age: 25% of 11-years old children; 20% and 16% for ages of 13 and 15. Portugal reported lower values with averages of 21%, 16% and 12% for 11-, 13- and 15-years old, respectively. The worst case was found in Portuguese girls with average values that dropped from 16% (girls of 11-years old) to 6% (girls of 13-years) and 5% (girls of 15-years-old), and compared with the HBSC girls' average of 21%, 15% and 11% respectively.

In relation to **sedentary behaviours**, the HBSC study obtained results of screen-time behaviours such as watching television for two or more hours on weekdays, which reflect very clear the current pattern. The HBSC total average is 50% for 11-year-olds, ascending to 62% for 13-year-olds and 63% for 15-year-olds. Average values of Portugal were in line with the global results of this last survey, although children of 15-year-olds reported a better result (53%) compared with the HBSC total average (63%).

Regular physical activity produces physical, mental, and social benefits, such as bone health, weight maintenance, self-esteem and lowered stress levels, decreasing the risk of cardiovascular diseases, breast cancer and other beneficial effect on the immune system (Hallal, Victora, Azevedo, & Wells, 2006). Therefore, promotion of physical activity is a health priority for children, and should be combined with the suitable management of children sedentary behaviours. Schools offer the best strategic opportunity to engage children for accomplish recommendation of 1 hour of moderate or vigorous intensity activity each day (Hallal et al., 2006) both to add more physical education lessons and guide children in reducing screen-time behaviours to < 2 hours per day (Strong et al., 2005).

In short, engaging children to healthy behaviours, such as healthy eating and active living behaviours over childhood and adolescence are likely to be maintained into adulthood. Nevertheless, this process should be an ongoing approach for guiding young people to healthy lifestyles, leading to positive and robust health outcomes, which will determine the long-term health and well-being.

## **1.2 SCHOOL SETTING: MAKING THE TRANSITION FROM KNOWLEDGE TO ACTION**

The school setting has been identified as the most appropriate environment to promote health behaviours among children and developed interventions programmes to change lifestyles behaviours (Katz, 2009; Marks & Marks, 2008).

The strong argument for health interventions in schools is that children can be reached there with relatively less effort and ensured global coverage. There are, however, more advantages: (i) children spend the larger part of the day at school, and for about nine months per year, reflecting the importance of school in children's life; (ii) children usually eat at least one meal and two snacks in the five weekdays, which can influence the eating patterns and the way of living; (iii) the school allows combining education and health, and these two components can interact, and be cooperative for learning and promoting health, but also have effective results such as health knowledge and skill improvement; and (iv) the school can provide the opportunity for children to be physically active and eat healthy foods (Foster et al., 2008; Katz, 2009; St Leger, 2004; WHO - World Health Organization, 1997), and so it may serve as a model or example of good practices. St Leger (2004, p. 408) proposed “ use the school as an ongoing setting where health is created, supportive environments are built, partnerships made and many skills are learned”.

Since the Ottawa Charter for Health Promotion, several documents were released across the world to coordinate the health and education perspectives for promoting health in schools. A representative example of this was the “Guidelines for Promoting Health in School” organized by the International Union of Health Promotion and Education (IUHPE) to encourage the starting of a health promotion agenda in schools, in order to inform governments, schools, non-government organizations, teachers, parents and students about effective school health programmes, and standardized the basic principles and components of a school approach for health (IUHPE - International Union of Health Promotion and Education, 2009).

A considerable body of evidence indicates school-based intervention programmes as the most appropriate approach to educate young people and promote healthy habits to reduce rates of overweight and obesity (Katz, 2009; Williams et al., 2013). Based on the available studies, it is becoming more widely recognized that obesity prevention in schools can be effective, without causing adverse outcomes and raises health equity (Waters et al., 2011).

On this basis, schools have the appropriate environment to provide the knowledge, as

well as support children to be able to choose healthy foods and know what they are eating, in order to make the transition from knowledge into action for changing unhealthy behaviours.

### **1.3 THE BEHAVIOUR CHANGE PROCESS AND THE THEORETICAL BASES**

Multiple and interacting factors influence children eating behaviours and their food choices, and are currently organized in four complex levels linking biology, personal behaviour and the environment (Contento, 2008). Following this rationale, theory and research for increasing effectiveness of school-based programmes have switched to a behavioural focus instead of a knowledge-based focus (Hoelscher, Evans, Parcel, & Kelder, 2002). Although, knowledge is seen as one of the determinants of food choice with a positive impact on eating behaviours, it is a quite small contributor in altering such behaviours, and by itself rarely leads to behaviour change (Baranowski, Cullen, Nicklas, Thompson, & Baranowski, 2003; Sigman-Grant, 2002). Nutrition knowledge and its recommendations of what, how and why to eat healthfully is a resource of most importance, but is not enough to create immediate changes on children behaviours, as hundreds of studies have already reported (Contento, 2008; Story, Neumark-Sztainer, & French, 2002).

Interventions designed to change behaviours should be theory based or using theoretical constructs, given that a growing body of evidence has showed that are more effective than those lacking a theoretical base (Glanz & Bishop, 2010). Over the last three decades, several theories and models have been used to explain human behaviour and develop effective ways in both prevention and management of chronic diseases (Coleman & Pasternak, 2012).

In recent years, the most often used theories have been the Social Cognitive Theory, the Health Belief Model and the Transtheoretical Model (Painter, Borba, Hynes, Mays, & Glanz, 2008). The Social Cognitive Theory (SCT) is the update version of the Social Learning Theory and assumes that human behaviour is the product of the dynamic interplay of personal, behavioural, and environmental influences (McAlister, Perry, & Parcel, 2008). According to the basic premise of SCT, people learn from watching behaviours and actions of others, and from the results of those actions, as well as with their own experiences (Glanz & Bishop, 2010; Spahn et al., 2010). The extent to which SCT has been used as theoretical framework to developing programmes for children is reported by Glanz (2010) and previously by Hoelscher et al. (2002).

The Health Belief Model (HBM) was developed in the 1950s and is one of the first models used in promoting health behaviours, such as prevention and detection programmes: e.g. mammography screening, influenza vaccines, sexual risk behaviours and injury prevention, where beliefs are as important or more important than overt symptoms (Glanz & Bishop, 2010). HBM is based on the premise that for behaviour change to succeed, people must perceive that a change in a specific behaviour will result in a strong positive health-related outcome (Carpenter, 2010). Individual's perception and assessment of risk are the two key aspects to the application of this model. Children and adolescents find perceptions of risk in a different manner and risk-taking is considered a challenge in these ages. In addition, children find it hard to recognize the long-term effects of unhealthy behaviours. Considering that HBM seems to neglect important aspects of children's behaviours, this model may not be particularly effective in predicting behaviours in young people (Naidoo & Wills, 2009).

The Transtheoretical Model (TTM) proposes behaviour change as a process, in which individuals progress through six stages (precontemplation, contemplation, preparation, action, maintenance, and termination), and change is seen neither as a linear progress nor as an isolated event (James O Prochaska, Redding, & Evers, 2008). This model was developed by Prochaska and DiClemente and is more commonly referred to as the 'stages of change' model (Armitage, 2009). TTM offers an understanding of how people develop a new behaviour and improve skills and self-efficacy, by assessing the stage of readiness for change, and providing a set of processes of change or strategies to be applied in the designing of health interventions (James O Prochaska, Norcross, & DiClemente, 2013). TTM has been applied to multiple health-related behaviours and has demonstrated to be effective and a flexible model for promoting behaviour changes, particularly in healthy eating, physical activity, and fruit and vegetable intake (Armitage, 2009; Glanz et al., 1998; S. S. Johnson et al., 2008; James O Prochaska et al., 1994).

#### **1.4 HEALTH PROMOTION PROGRAMMES: AN OVERVIEW OF THE CURRENT RESEARCH**

The interconnection between knowledge and action has been implemented in health promotion programmes all over the world. For a successful change concerning the human behaviour, the knowledge has to become in actions, which are converted in positive behaviours. Health promotion programmes follow the development process of designing, implementing and evaluating with the great purpose of finding the right strategy for the right

time and right context. This research has not the purpose of reviewing in detail the extensive literature about this subject, but draws attention to the most relevant health promotion programmes published in the scientific literature.

In a summary reported by WHO (2009b) of a systematic review of evidence on school-based interventions were highlighted three intervention with a focus on diet and physical activity: CATCH, Pathways and Know Your Body. These programmes showed significant improvements in knowledge, attitudes, behaviours, and physical and clinical outcomes. Also Katz (2009) published a systematic review, where nineteen studies were analysed, and he concluded that school-based interventions had significant effects on children's weight. Previously, Kropski (2008) reviewed fourteen studies on overweight and health behaviours and twelve studies reported significant improvement in at least one measure of dietary intake, physical activity and sedentary behaviour.

More recently, the Cochrane review of childhood obesity prevention examined a broad range of programmes, and found strong evidence to support beneficial effects of programmes targeted to children aged 6 to 12 years (Waters et al., 2011). Furthermore, another review evaluated 67 studies related to the World Health Organization's Health Promoting Schools (HPS) framework (which is an approach to promoting health in schools that addresses the whole school environment) and showed that some interventions based on the HPS framework can be effective at improving a number of health outcomes in children: body mass index (BMI), physical activity, physical fitness, fruit and vegetable intake (Langford et al., 2014).

In Portugal, a review by Gaspar and colleagues (2013) under "The European Project Tempest", made a comprehensive and systematic overview of the programs and policies in the context of obesity prevention in children and adolescents in the country. The review included 20 programmes/policies implemented between 2002 and 2009. Although most reported programmes/policies 'aim was increasing knowledge about the prevalence of obesity in children and young people and the practice of physical activity and healthy eating habits, few programmes referred having an intervention purpose for promoting behaviour changes. Besides, these programme/policies reported extremely varied characteristics, including settings and target populations. Based on the review of the 20 programmes, the authors concluded that, in general, the studies focused on the relationship between risk factors and obesity, but did not introduce new or specific strategies for preventing overweight and obesity. Moreover, such programmes and policies have several limitations: they did not include an process evaluation to allow publishing their results; the methodologies and results

cannot be accessed; there is a limited number of publications and literature related to such programmes and policies.

In addition to this review there is evidence of a successful Portuguese prevention programme addressed to primary-school, involving children between 6 and 12 year-old, showing an adequate research process for initiating national anti-obesity programmes (Rosário, 2012).

In 2004, the Portuguese Health Ministry has launched an Information Circular (Ministério da Saúde, 2004) stating the national needs of long-term strategies for the prevention and effective management of obesity. This was followed by a new Normative Circular (Ministério da Saúde, 2005) approving the “National Anti-Obesity Programme” but, against all expectations, this document (Direcção Geral de Saúde, 2005) did not provide guidelines for the development of prevention programmes.

A recent literature review regarding behavioural interventions for preventing childhood obesity in Portugal identified 29 programmes between 2001 and 2015 to promote both healthy eating, and physical activity (Filipe, Godinho, & Graça, 2015). Several programmes of this review have been implemented for several years, however there is a lack of several elements of most importance for its effectiveness: appropriate theoretical framework on behavioural focus, methodological strategies and measured outcomes, process evaluation to allow publishing their results.

In brief, health programmes and projects to tackle obesity in Portuguese population, in particular for children and adolescents, are scarce and weak. “Where the danger is, also grows the saving power” is an adaptation of a quote from the German poet Friedrich Hölderlin made by Hubert Reeves (Reeves, 2014). Accordingly to this, once obesity in children is a great danger for their health and future, one should give increased attention to programmes for improving the nutritional status and health behaviours, which must be supported by the scientific methodological process to find better strategies with better results for proper health promotion.

## **1.5 NEEDING TO CHANGE, WANTING TO CHANGE, AND BEGINNING THE CHANGE**

Portuguese children need to make changes in the way they are eating and living to prevent the health risks and consequences as already above-mentioned and supported by the Portuguese studies and reports on the prevalence of overweight and obesity.

Science and research play a significant role in improving lives, and in this case can make a substantial contribution to watch over the children and keep them safe. Currently, it is expected children have at least 12 years of education at school, which leaves room for education and intervention activities, to provide them with knowledge and skills for their lives, which can be seen as an ongoing process that can be improved over the school years, and each year should be considered a golden opportunity to guide children in a healthy grow up. Occasional or isolated actions to promote health behaviours will make little or no difference; however implementing programmes designed to improve multiple behaviours consistently over childhood might change children's future, as previously referred.

Children must be guided to adopt healthful behaviours. To achieve these behaviours, children must perceive the importance of their active participation and that this active participation has to be authentic so they want to change and get involved in the changing process.

## **1.6 PURPOSE AND STRUCTURE OF THE THESIS**

In order to give an answer and find effective strategies to reduce overweight/obesity rates in Portuguese children and adolescents throughout preventive actions, an educational programme called 'Planning Health in School' (PHS-pro) was designed, implemented and evaluated for the expected positive changes on children's eating behaviours and lifestyle. In this research the educational programme was designed to be applied in a school setting, which integrated healthy eating and active living issues with children's active participation motivating them to healthier behaviours, and with the support of teachers and families.

The main propose of this research is to describe the development and the implementation process, to evaluate the effectiveness, feasibility and cost-benefits of the PHS-pro intervention.

The specific objectives and the structure of the thesis are as follows:

1. To describe the PHS-pro designing and implementation processes, as described in Chapter 2 of this thesis - "Planning Health in School" programme: a stepwise process to building children's healthy eating and active living habits" (*Study 1*).
2. To investigate the effectiveness of the programme on children nutritional in non-randomized control group pretest-posttest study. Thus, Chapter 3 "Effectiveness of the "Planning Health in School" programme (PHS-pro): guiding children to adopt healthy habits, improving nutritional status" (*Study 2*) describes the research design, the

recruitment of participants and the effectiveness of the PHS-pro on anthropometric measures of children of the intervention group compared to the control group.

3. To evaluate the effects of the PHS-pro focused on several key-behaviour changes: fruit and vegetables consumption, soft drink and high-energy dense food consumption, physical activity in the intervention group, as presented in Chapter 4 “Children learn, children do! Results of the “Planning Health in School”, a behavioural-change programme” (*Study 3*).
4. To evaluate the impact of the programme on the nutritional status of two obese twins, as described in Chapter 5 “The impact of the “Planning Health in School” programme on two obese adolescent twins: a case study” (*Study 4*).
5. To determine the costs and benefits of the PHS-pro, a primary prevention programme, for preventing overweight and obesity in children, involving the entire population (the healthy and the at risk groups), as shown in Chapter 6 “Costs and benefits of the “Planning Health in School” programme” (*Study 5*).

The final Chapter 7 discusses the main findings, strengths and limitations of the PHS-pro intervention, as well as directions for future research and practical implications that arose from this work, especially in the national scene.



## Chapter 2

### *Study 1: “Planning Health in School” programme: a stepwise process to building children’s healthy eating and active living habits*

#### **ABSTRACT**

Few interventions have been successful in promoting healthy eating and active living among children with effective changes on anthropometric health outcomes. Furthermore, well-designed interventions involving multiple strategies and converting the knowledge already available into action are needed for preventing childhood obesity. An educational programme called ‘Planning Health in School’ programme (PHS-pro) was designed, implemented and evaluated for contributing in the prevention of obesity in childhood. The PHS-pro intended to improve Portuguese grade- 6 children’s eating habits and other lifestyle behaviours towards healthier nutritional status.

This study describes the step-by-step development of the PHS-pro, i.e. the research design, the theoretical support, the educational components and the process evaluation of the intervention. The implementation of the PHS-pro was analysed by the participants’ views and their inputs on the several components of the intervention.

The major strength of this study was the theoretical support of the programme grounded on the Transtheoretical Model (TTM) and the stages of change, which were applied on the overall planning of the PHS-pro. Additionally, the application of the participatory methodology enabled to engage children and meet their needs, assuming them as active participants for their own change process.

The findings of this study are of great value for improvements to be incorporated in future applications of the PHS-pro. Likewise, participants’ suggestions must be considered in the designing of future interventions aiming to be effective strategies.

The PHS-pro showed to be important from the health promotion perspective because it examined dynamically new approaches and has opened new pathways to take action in the prevention of overweight and obesity among children.

**Keywords:** health promotion, school-based intervention, transtheoretical model, participatory method approach, obesity prevention

## 2.1 BACKGROUND

Unhealthy eating and sedentary habits have been associated with excessive adiposity, which reflects in the increasingly rates of overweight and obesity, being considered the greatest epidemic of the twenty-first century across countries, genders, ethnicities and all age groups (Malik et al., 2013). The large numbers of overweight and obese children in the European population are already exceeding the 20% (Branca, Nikogosian, & Lobstein, 2007) forecasting major implications for the public health and related healthcare costs in the future. Portugal is following the European obesity trend (Bingham et al., 2013; Leitaó, Rodrigues, Neves, & Carvalho, 2011; Padez et al., 2005).

The consequences of being overweight and obese during childhood development are well documented, showing a general risk in psychological and physical health, such as depression or anxiety, low self-esteem, bullying and behaviour problems as well as high blood pressure, dyslipidemia, hypertension, insulin resistance plus other clinical consequences as asthma, type I diabetes and abnormalities of foot structure (Alberga et al., 2012; Reilly et al., 2003). Furthermore, a large body of evidence indicates that obesity in youth imposes an even larger burden in adulthood with significant increase risk of premature mortality with substantial and adverse long-term consequences as cancer, cardiovascular diseases and diabetes (Reilly & Kelly, 2011).

Changing the course of the current situation implies taking action with effective interventions, by helping children changing their behaviours to healthy food choices and a regular physical activity habits. Since, the release of the European Health Report 2005 (WHO – World Health Organization, 2005) with the recommendation for renewing efforts to promote children’s health, a great deal of attention has been given to the prevention of obesity and to effective intervention evidence based. However, only few interventions showing successful promoted dietary and physical activity changes among children or being effective at reducing adiposity by anthropometric health outcomes have been identified in the last update of Cochrane review (Waters et al., 2011). In addition, there is a lack of well-designed long-term interventions involving multiple strategies, converting the knowledge already available into action (Baranowski, Cerin, & Baranowski, 2009; Lobstein et al., 2015). As far as we know, Portuguese interventions for preventing obesity during the children development by using a controlled study design are scarce (Coelho et al., 2008; Gaspar et al., 2013; Rosário, 2012).

## 2.2 OBJECTIVES OF THE STUDY

With the purpose of preventing the rise of overweight and obesity in Portugal, a specific educational programme was designed and called ‘Planning Health in School’ programme (PHS-pro). This school-based intervention was planned to be applied at individual level, to develop skills on children, guide them towards healthy behaviours and encourage to be active participants in their own changing processes.

The primary aim of this research was to evaluate the efficacy of the programme by investigating the effects on the nutritional status and related measures, and behaviours improvements, as the eating behaviours, physical activity and leisure habits. Other aims were the evaluation of food knowledge, attitudes and participation among other aspects over the implementation of the programme. For the best evaluation of the PHS-pro, the use of mixed-methods approach by integrating quantitative and qualitative methods was required (R. B. Johnson, Onwuegbuzie, & Turner, 2007; Pommier, Guével, & Jourdan, 2010). Four central research questions to evaluate the PHS-pro are the core of the whole study:

- i) What were the effects of the PHS-pro on the nutritional status of children?
- ii) Which were the behaviours improvements (eating, physical activity habits) reached by children over the intervention?
- iii) What are the costs and benefits of implementing the PHS-pro?
- iv) How participants evaluated the implementation and perceived their participation? And what improvements should be done for future implementations?

Questions i), ii) and iii) are matter of Chapters 3, 4 and 6, respectively, of this thesis. In this Chapter 2, the analysis focuses on the research question iv): how participants evaluated the implementation and perceived their participation? And what improvements should be done for future implementations?

This chapter gives primary attention to the step-by-step development of the PHS-pro, describing the research design, the theoretical support, the educational components and the process evaluation of the intervention. Advantages, constraints and limitations inherent to the implementation are also identified for future improvements.

## 2.3 RESEARCH DESIGN

### 2.3.1 Theoretical background

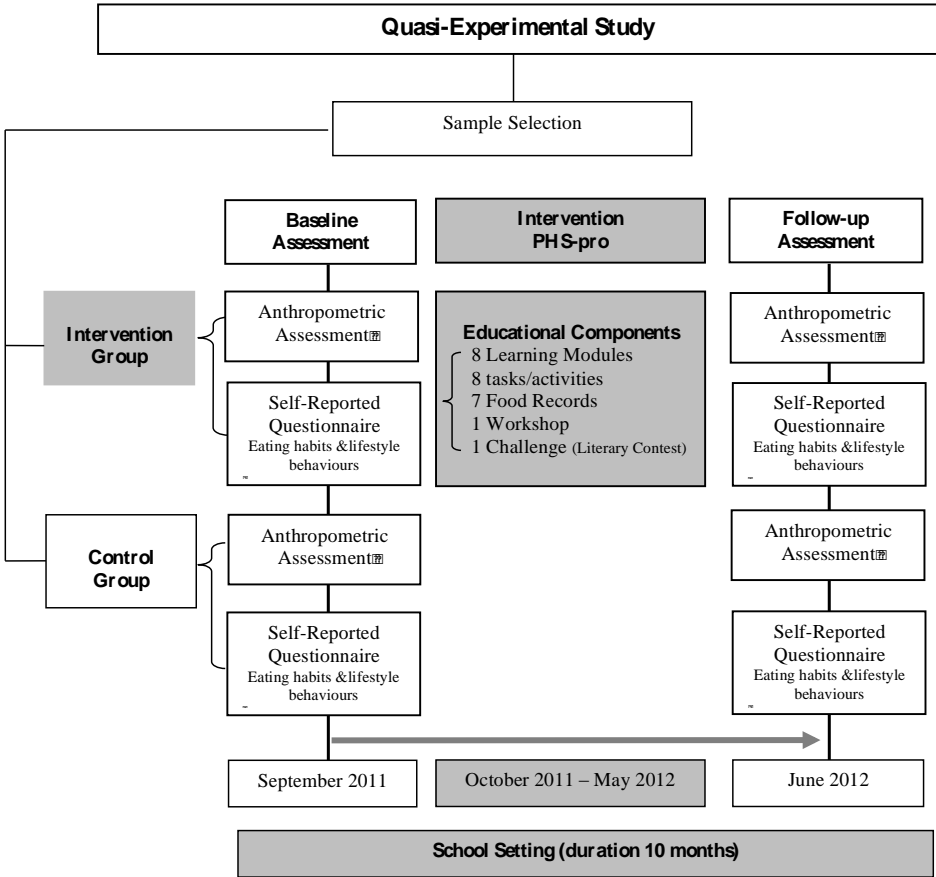
As referred above, healthy eating and daily physical activity have been identified as behaviour priorities for preventing obesity, and schools have been identified as the best settings to implement interventions to educate young people and promote healthy habits (Foster et al., 2008; Katz, 2009). Carvalho (2006) has stated that “knowledge is important, but for health behaviour changes, it is necessary to take into account people’s specific contexts and their own skills, to be able to switch, if they want, for healthier lifestyles”, adding that Prochaska & DiClemente model (1986, referred in Ewles & Simnett, 1999) with its conceptual framework provides practical guidance on the implementation of educational programmes that aim to promote behaviour changes in well-defined situations. More recently, Prochaska, Redding & Evers (2008) have explained the stages of change and the core constructs of the Transtheoretical Model (TTM), demonstrating how TTM based approaches are effective for changing multiple health behaviour risks, including eating behaviours (J. O. Prochaska et al., 2005; van Sluijs, van Poppel, & van Mechelen, 2004). The TTM dictates behaviour change as a process, in which individuals progress through several stages of change, and change is seen neither as a linear progress nor an isolated event (Prochaska et al., 2005).

Therefore, the TTM provides an appropriate framework to build up the educational programme that we called ‘Planning Health in School’ or PHS-pro, which was designed with specific strategies throughout preventive actions, implemented and evaluated for the expected positive changes on children’s eating and sedentary behaviours. This PHS-pro was constructed for children, expecting they would progress through the five stages identified by Prochaska and his collaborators (1997; 2005; 2008): (i) *precontemplation* - no intention to change behaviour or take action in the near future, unawareness of their problems; (ii) *contemplation* – aware of unhealthy habits, interest and intention to change in the next 6 months; (iii) *preparation* – intending to take action in the next 30 days; (iv) *action* – making changes and visible modifications on specific behaviours targets along 6 months; (v) *maintenance* – working to continue and consolidate healthy habits. In addition, the core constructs of TTM (processes of change, decision balance, self-efficacy) were applied for supporting progress change across stages and facilitate behaviours’ change over the PHS-pro (James O Prochaska et al., 2013; James O Prochaska & Velicer, 1997).

As far as we know, this programme is the first of its kind to apply the principles of TTM for developing skills towards healthy behaviours among Portuguese children. Details on its application are shown below.

**2.3.2 Conceptual framework**

The conceptual framework of the research is presented in Figure 2.1, which shows two groups (intervention and control groups), two assessments (baseline and follow-up) and the educational components for the development of the PHS-pro in the intervention group only (from October 2011 to May 2012).



**Figure 2.1.** Conceptual framework of the research

The research design was based on the pre-test-post-test with non-equivalent control group, also referred as nonrandomized control group pretest-posttest design (Leedy, 1996;

Sousa, 2009). The quasi-experimental configuration is characterized by collecting measurements before and after the introduction of the experimental variable, which is, in this case, the implementation of the PHS-pro over a full academic year, allowing the evaluation of its effect, when compared with the non-equivalent control group.

The word “non-equivalent” refers to non-equivalence due to the lack of randomization (Fortin & Salgueiro, 2003). Random selection of children from different classes and different schools allocated between intervention and control group were not possible for the development of the research since the PHS-pro implementation would generate cohesion and synergy on participant subjects (Leedy, 1996), so randomization would create a bias caused by the daily contacts between subjects included in the group participating in the PHS-pro and subjects in the group not participating in it (Fortin & Salgueiro, 2003).

To carry out the research, a time frame of 18 months was settled, separated in two periods: *Phase 1*, a period of eight months, to prepare the detailed PHS-pro design and the specific programme with its components, as well as to address the overall preparation process with schools (from January to August 2011); *Phase 2*, corresponded to the academic year of 10 months (from September 2011 to June 2012) for the implementation of the educational programme and its evaluation.

## **2.4 PHASE 1: DESIGNING AND DEVELOPMENT OF THE EDUCATIONAL COMPONENTS, PROCESS EVALUATION OF THE PROGRAMME AND PREPARATION OF THE SCHOOL SETTING**

The starting point to achieve the purpose of promoting healthy eating and active living in children, was to set goals for the educational programme, based on international guidelines (WHO – World Health Organization, 2003): *(i)* adequate consumption of fruit and vegetables (F&V) five servings per day; *(ii)* decreasing high sugar food and beverage intake *(iii)* decreasing high fat and energy dense food consumption; *(iv)* one hour of physical activity and TV watching time below two hours per day.

Accordingly, to target these specific behaviours and to produce a robust cognitive, attitudinal and behavioural impact, a list of topics were developed based on these behaviours goals, converted in eight learning modules, and adapted to the TTM stages of change to be implemented over the intervention.

### **2.4.1 List of topics and learning modules design**

A list of 16 different topics about food, eating and active life habits plus a free-topic for an optional children's suggestion was prepared so that children would select eight topics (Appendix 2.1), according to the participatory methodology principles (Soares, Sarmiento, & Almeida, 2004).

Children's participation was highly considered for an efficient implementation of the programme. To ensure their active participation, children were asked which topics they were more interested in learning and developing to meet their own needs since they would be the major beneficiaries of the PHS-pro. In addition, the children's active role can help shape their own environment and enhance their skills, self-esteem and a higher consciousness, while promotes a democratic and decision-making process (Sinclair, 2004). In fact, the United Nations Convention on the Rights of the Child (UNCRC) has declared in its article 12 that the child "is capable of forming his or her own views freely in all matters affecting the child" (UN- United Nations, 2009).

The eight topics that children most voted were converted into eight learning modules, which constituted the core component of the PHS-pro. The learning modules were designed to carry clear, concise and positive messages (Lichtenstein, 2011; Van Assema, Martens, Ruiter, & Brug, 2001). Instead of teaching nutrition facts or giving advices like "eat this, not that", the central messages were based upon children's expressed needs to effectively engage them and communicated in a teen-friendly language for promoting interactive discussions. Therefore, children had the opportunity to influence the PHS-pro content and the learning process in a democratic and genuine participation (Simovska, 2012).

### **2.4.2 Applying the Transtheoretical Model of stages change**

As mentioned above (section 2.3.1), the Transtheoretical Model (TTM) offers an understanding of how people develop a new behaviour and improve skills and self-efficacy, by assessing the stage of readiness for change, and providing a set of processes of change or strategies to be applied in the designing of health interventions (James O Prochaska et al., 2013). It was the theoretical support to design the PHS-pro and how it was translated into practice as educational activities.

The core component of the intervention consisted of a set of eight learning modules, which followed the five-stages of TTM readiness, for moving children from inaction to action

or to maintenance, in order to a successful behaviours change. Therefore, based on the TTM constructs and processes of change, a conceptual framework was developed to each learning module to engage children to participate actively for increasing knowledge, developing competencies for decision-making on healthy food and active life habits. Table 2.1 provides detailed descriptions of the TTM stage stages and their respective core constructs, key strategies planned for the learning modules and the expected process of change.

The process of behaviours change was assessed through activities developed over the learning modules, and the progress on dietary behaviours was monitored through the application of a food record after each module, which provided individual feedback.

Following the recommendations of Kristal and colleagues (1999) the behaviour targets developed for the learning modules were a combination of general changes (e.g. avoiding fried foods) and specific changes (e.g. eating 3 fruits daily). Children’s stage of change was assessed to categorize the baseline stage in each class prior to the PHS-pro implementation. Children were asked whether they were seriously thinking about making changes in the next six months. Children’s baseline stage was categorized in four possibilities: *(i)* those with no plans to change any of the general behaviours presented were in precontemplation; *(ii)* those with plans to change without a commitment were in contemplation; *(iii)* those planning to change soon, in the next month, and set a behaviour goal were considered in preparation; *(iv)* children who reported trying to change and achieve the desire goal were in action/maintenance. These two stages (action and maintenance) were combined since the study had no time enough to assess children reporting the change for six months or longer. This procedure allowed evaluating the cognitive and behaviour engagement of children in the change process.

### **2.4.3 Measures and process evaluation**

Measures and process evaluation were conducted over one full school year (September 2011- June 2012) and multiple methods were required to determine overall effects of the PHS-pro, by comparing results of the PHS-pro intervention and control groups, as well as to capture the behaviour change of children participating in the intervention, from the beginning to the end of the PHS-pro implementation.

To compare groups, data collection involved anthropometric measures, food frequency consumption, lifestyle habits and food knowledge. To measure change behaviours produced during the programme for the intervention group only, data were collected using:



food records and feedback activities and questionnaires for children. In addition, it was conducted questionnaires and interviews for teachers. Table 2.2 summarises the process evaluation methods, participants involved in data collection and types of measurements.

Measurements were carried out at school in two evaluation times: baseline (September 2011; during the two initial school weeks) and follow-up (May/June 2012; during the two last school weeks). Each evaluation included: (i) nutritional status with an anthropometric assessment (ii) eating, physical and sedentary behaviours, and food knowledge score assessed by using a self-reporting questionnaire.

### ***- Anthropometric assessment***

Height, weight and waist circumference measures were collected during physical education lessons in sport clothes (shorts, t-shirt without footwear), using standard procedures (WHO – World Health Organization, 1995). Height was measured to nearest 0.1cm using a portable stadiometer (Seca model 214, Germany). Weight was recorded to the nearest 0.1kg using a portable digital scale (Seca model robusta 813). Waist circumference was assessed in the anatomical landmark midpoint between the lowest rib and the iliac crest at the end of expiration by using a flexible band (Seca). This measurement was taken three times, recorded to nearest 0.1cm and calculated the average of measures to improve precision (Klein et al., 2007; H David McCarthy & Ashwell, 2006). To ensure measurement reliability, the equipment was calibrated prior each day of assessments. All the anthropometrical measurements were obtained by one examiner, nutritionist and author of the research, and assisted by a teacher of the Health Promoter Office for recording the collected data.

Body Mass Index (BMI) values for normal weight, thinness, overweight and obesity were defined using cut-off points according to Cole and collaborators (2000; 2007) to have a complete picture of the prevalence of overweight and obesity in the studied population. Waist circumference (WC) was classified by using UK reference percentiles to gather an overview related to adiposity due to its correlation with intra-abdominal fat mass (H. D. McCarthy, Jarrett, & Crawley, 2001). Waist-to-height ratio (WHtR) was calculated by dividing WC by height, both in centimetres (H David McCarthy & Ashwell, 2006).

Raw BMI is considered a suitable method to assess adiposity change in children at risk of obesity (Tim J Cole, Faith, Pietrobelli, & Heo, 2005), nevertheless height, weight and BMI for age and sex-specific z-scores were obtained using the LMS method (Pan & Cole, 2008) in case of comparative analysis with international studies. BMI used alone to assess improvements on nutritional status is not reliable due to its low sensitivity for the percentage

of body fat, whereas the WC and WHtR can identify fat tissue change over time with more accuracy (Brambilla, Bedogni, Heo, & Pietrobelli, 2013).

The anthropometric measures were used to demonstrate the effectiveness of the PHS-pro and served as evaluators of children’s nutritional status changes, before and after the PHS-pro implementation, as well as for comparisons with the control group.

### ***- Lifestyle assessment***

A self-reporting questionnaire was used to collect the eating habits, physical activity and sedentary behaviours. Food knowledge score and socio-demographic variables were also obtained through this questionnaire, which were structured in five main parts: (i) socio-demographics variables included age, calculated on birth date related to each date of assessment; education level and occupation of parents; household conditions; (ii) food knowledge was assessed with one open question about “Portuguese food wheel” and seven closed-ended multiple choice questions about recommended food portions (Rodrigues, Franchini, Graça, & De Almeida, 2006). A score of 1 and 0 was assigned for each correct and incorrect answer respectively, with a possible total score of 7; (iii) physical activity included four-item related to participation in organized sport activities out of school and number of hours per week. Response options ranged from “never” to “7 or more hours” in a total of six categories; (iv) sedentary behaviours were assessed with two-item asking the number of hours spent per day watching TV and playing videogames. Questions of physical activity and sedentary behaviours were adapted from the Youth Risk Behaviour Survey (YRBS) of 2009 (Eaton et al., 2010); (v) eating habits were collected using a 58-item food frequency questionnaire (FFQ), detailed below.

The questionnaire was previously pilot tested to an eligible sample of thirty children from the same region, grade and age, but not involved in the study.

Children were informed about the procedures for filling in the questionnaire, individually, completing it in 30 minutes at Natural Science class under researcher supervision.

**Table 2.1.** Stages and processes of change applied to the eight learning modules, adapted from Prochaska et al. (2008) and Prochaska et al. (2013)

Stage of readiness	Description of the TTM core constructs	Key strategies for learning modules	Process of change
<b>Stage 1 Precontemplation</b>	No intention to change behaviour in the near future (next six months) Unawareness of their problems No interest in change behaviours No plans to change	<b>Learning module 1</b> - Assessing children's stage of change (baseline stage) - Increasing information and awareness about general changes on eating and physical activity behaviours - Providing general behavioural targets - Allowing children to express their readiness to change behaviours	No commitment to any change process
<b>Stage 2 Contemplation</b>	Intention to change within the next six months Aware of their problems Interest in change behaviours but not ready to make changes yet Plans to change without commitment	<b>Learning module 2</b> - Increasing information and awareness about a specific behaviour related to the learning module's topic - Encouraging children to discuss and solve barriers for healthy changes and express their own problems - Helping children to make clear benefits of changing - Motivating children to set a specific behaviour goal	<b>Consciousness-raising:</b> increasing information about the topic that supports a healthy change. <b>Dramatic relief:</b> expressing feeling about unhealthy behaviours related problems and solutions. <b>Decisional balance:</b> pros and cons of changing.
<b>Stage 3 Preparation</b>	Intention to change soon (next month) Makes small changes Has a plan to change	<b>Learning module 3</b> - Increasing information and awareness about a specific behaviour related to the learning module's topic - Encouraging children to discuss and solve barriers for healthy changes and express their own problems - Helping children to make clear benefits of changing - Reinforcing small changes if already achieved by children - Encouraging children to set a specific behaviour related to the topic's module	<b>Consciousness-raising:</b> increasing information about the topic that supports an healthy change. <b>Dramatic relief:</b> expressing feeling about unhealthy behaviours related problems and solutions. <b>Decisional balance:</b> pros and cons of changing. <b>Environmental reevaluation:</b> combination of cognitive and affective assessment to realize the impact of the unhealthy behaviour on one's family environment.

Stage of readiness	Description of the TTM core constructs	Key strategies for learning modules	Process of change
<p><b>Stage 4 Action</b></p>	<p>Makes specific behaviour changes for less than six months Visible behaviour changes</p>	<p><b>Learning module 4, 5, 6, 7</b></p> <ul style="list-style-type: none"> <li>- Increasing information and awareness about a specific behaviour related to the learning module’s topic</li> <li>- Encouraging children to discuss and solve barriers for healthy changes and express their own problems</li> <li>- Helping children to make clear benefits and costs of changing</li> <li>- Developing competencies for decision-making on healthy food and active life habits</li> <li>- Reinforcing small changes reported by children</li> <li>- Supporting confidence</li> <li>- Encouraging children to set a specific behaviour related to the topic’s module</li> </ul>	<p><b>Consciousness-raising:</b> increasing information about the topic that supports an healthy change. <b>Dramatic relief:</b> expressing feeling about unhealthy behaviours related problems and solutions. <b>Decisional balance:</b> pros and cons of changing. <b>Self-liberation:</b> making a solid commitment to change and decision-making abilities. <b>Counterconditioning:</b> Learning healthier behaviours for substituting unhealthy ones. <b>Self-efficacy:</b> Confidence that people follows healthy. behaviours across a challenging situation without relapsing to old habits.</p>
<p><b>Stage 5 Maintenance</b></p>	<p>Makes specific behaviour changes for six months or longer Intention of preventing unhealthy behaviours Increasingly confident of continuing changes</p>	<p><b>Learning module 8</b></p> <ul style="list-style-type: none"> <li>- Providing a recall of the overall modules</li> <li>- Reinforcing small changes reported by children</li> <li>- Encouraging children continuing to follow the healthy behaviours achieved</li> <li>- Supporting confidence</li> </ul>	<p><b>Self-liberation:</b> making a solid commitment to change and decision-making abilities. <b>Self-efficacy:</b> Confidence that people follows healthy behaviours across a challenging situation without relapsing to old habits.</p>

Prochaska, J. O., Norcross, J. C., & DiClemente, C. C. (2013). Applying the stages of change. *Psychotherapy in Australia, 19*(2), 10.

Prochaska, J. O., Redding, C. A., & Evers, K. E. (2008). The Transtheoretical Model and Stages Change In B. K. R. Karen Glanz, K. Viswanath (Ed.), *Health behavior and health education: theory, research, and practice* (pp. 97-121). San Francisco, CA: John Wiley & Sons.

**Table 2.2.** Process evaluation and data collection

Process evaluation/ Method	Participants	Timeline	Measurements
<b>Schools setting scan</b>	School principals and teachers coordinators of the four schools	Phase 1	<ul style="list-style-type: none"> <li>- School conditions (semi-structured interview):</li> <li>- School curriculum</li> <li>- Textbooks</li> <li>- Physical education classes</li> <li>- School food services</li> </ul>
<b>Anthropometric assessment</b>	Intervention group and control group	Phase 1 Baseline and Follow-up	<ul style="list-style-type: none"> <li>- Anthropometric measures: height, weight, waist circumference (WC)</li> <li>- Calculation of: BMI, Waist-to-height ratio (WHtR) and height, weight and BMI for age and sex-specific z-scores</li> </ul>
<b>Self- reporting questionnaire</b>	Intervention group and control group	Phase 1 Baseline and Follow-up	<ul style="list-style-type: none"> <li>- Socio-demographic and lifestyle behaviours</li> <li>- Age</li> <li>- Education level and parents' occupation</li> <li>- Food knowledge score</li> <li>- Physical activity, including sport participation</li> <li>- Sedentary behaviours: watching TV, Play computer &amp; videogames</li> <li>- Food frequency questionnaire (FFQ)</li> </ul>
<b>List of topics for the learning modules</b>	Intervention group	Phase 2 Baseline	<ul style="list-style-type: none"> <li>- List of 16-topics; eight of them will be selected by children</li> </ul>
<b>Food Records</b>	Intervention group	Phase 2 Over the PHS-pro (between baseline and follow-up)	<ul style="list-style-type: none"> <li>- Measuring dietary change according to the multiple target behaviours of the PHS-pro:               <ul style="list-style-type: none"> <li>- Consumption of F&amp;V</li> <li>- Consumption of F&amp;V by gender</li> <li>- Beverages contributing mostly to children's daily diet (water, milk, yogurt, soft drinks)</li> <li>- High fat and energy dense food consumption, high sugar food</li> </ul> </li> </ul>
<b>Feedback of participants Children's questionnaire</b>	Intervention group	Phase 2 After PHS-pro	<ul style="list-style-type: none"> <li>- Children's perceptions about:               <ul style="list-style-type: none"> <li>- PHS-pro components</li> <li>- Eating behaviour changes</li> </ul> </li> </ul>
<b>Feedback of participants Teachers' questionnaire and SWOT analysis</b>	Teacher staff of the Intervention School	Phase 2 After PHS-pro	<ul style="list-style-type: none"> <li>- Teachers' perceptions about:               <ul style="list-style-type: none"> <li>- PHS-pro components (questionnaire)</li> <li>- Teachers' proposes for a better programme (SWOT analysis)</li> </ul> </li> </ul>
<b>Field notes</b>	All participants	Phase 1 Phase 2	<ul style="list-style-type: none"> <li>- Documenting and registration of activities, meetings, interviews, information, documents and time spent to conduct the research.</li> </ul>

***- Assessing eating habits of children***

There is no single best method for assessing human’s food consumption as all have limitations (Thompson, Subar, Coulston, & Boushey, 2008) because humans usually do not pay attention to the foods and beverages they eat and drink (Thompson, Subar, Loria, Reedy, & Baranowski, 2010). However, there are three commonly used tools in such evaluations: the food frequency questionnaire (FFQ) (Thompson & Byers, 1994), the 24-hour dietary recall (24HR) (Beaton et al., 1979) and the food record (Fisberg, Slater, Marchioni, & Martini, 2005). The FFQ is suitable to assess the long-term eating behaviours over time, up to one year, providing general information about food intake (Thompson et al., 2010). The 24HR is often used to estimate usual food intake for 24 hours, and as a single evaluation gives reduced dietary habits (Dodd et al., 2006). The FR is similar to 24HR, yet give more registration days (3 to 7 days) allowing to record the actual intake of all foods and beverages with detailed information (Fisberg et al., 2005). Also the FR is the preferred method and is considerate the “gold standard” between all, especially when the main focus is raising awareness in eating behaviours to generate changes, as in intervention studies (Thompson & Byers, 1994).

To lead this study two methods were selected for different research proposes: the FFQ and the FR. The FFQ was used to collect the eating patterns of the two studied groups at baseline (September 2011). This diagnostic assessment was important for two main methodological aspects: first, to check whether the intervention and control groups were identical for the eating habits at the starting point, without which the research would lose its internal validity; second, to establish the progress occurred in both groups, with (intervention group) and without (control group) the implementation of the programme, as well as to compare to the second assessment (follow-up: June 2012) in order to determine the effectiveness of PHS-pro. The FR was applied to check the usual food consumption and choices in the intervention group, which allowed to measure dietary change over the intervention and according to the multiple target behaviours of the PHS-pro. The obtained information should answer to the following research questions: did intervention children improve the consumption of F&V? What were the beverages that contribute mostly to children’s daily diet? Did energy dense food consumption (high fat and high sugar food) and soft drinks intake decrease over the intervention?

- **The 58-item FFQ**

Participants of the two groups were asked to report their usual frequency of consumption of foods on a weekly basis with a 58-item FFQ (Appendix 2.2). The food list selected was based on a validated instrument for Portuguese population developed by Lopes (2000) and adapted to suit to PHS-pro goals. The guidelines of Cade and colleagues (2002) were followed to organize the FFQ. Answers were displayed on a 5-point ordinal scale, ranging from never (0) to everyday (4). In addition to the FFQ 58 items, nine single questions were included to assess specific daily food consumptions: milk, bread, number of servings fruits, water and salt. Food frequency consumption data allowed evaluating children's health-risk eating habits.

Five food clusters were created according to PHS-pro goals and a score system was introduced to allow an estimation of servings per day from the times-per-week system, as proposed by Wakimoto and colleagues (2006). The five category options for answering in FFQ were recoded into outcome variables: (i) never = 0; (ii) once a week = 0.142; (iii) two to four times a week = 0.357; (iv) four to six times a week = 0.714; (v) everyday = 1. Thus, for each answer a score was assigned to give the estimation of servings per day.

Food items were grouped in terms of providing central nutrients (vitamins, minerals and dietary fibres), fats or free sugars. Accordingly, five food clusters were created: (1) F&V including six-items: fruits, vegetable soup at lunch, vegetable soup at dinner, salad or greenery at lunch, salad or greenery at dinner, fresh fruit juices; (2) High energy dense food, including two-items: pastry (croissants, panikes, donuts, cakes, pastries, among others) cookies or biscuits; (3) Soft drinks, including two-items: soda and added sugar squash juices; (4) High sugar food, including six-items: chocolate, candies, ice-creams, sugar jelly, marmalade and jams and sugar; (5) High fat food, including three-items: homemade French fries, chips, rissoles, pasties and croquettes.

In short, daily servings of F&V were estimated by summing their specific items and the other clusters. Each cluster is the sum of the included food items resulting in a score that represents the servings per day.

- **The Food Record**

For monitoring eating habits among children of the intervention group and evaluating the dietary evolution after each module and over the intervention, a 3-day food record was selected to collect the daily food intake. The application of this tool allowed children to report

all the food and beverages they consumed for three days subsequent to each learning module (two consecutive weekdays and one weekend day) in high detail: time and place, cooking method, quantity, the brand, and a space to comment anything else. The effectiveness of each module was determined by each food record in short and long term.

The 3-day food record form was built according two models presented by Thompson and colleagues and Fisberg and colleagues (Fisberg et al., 2005; Thompson & Byers, 1994) to be adapted to the research features. The food record form was composed by an initial space for demographic data and general instructions to fill in and help the recording properly. Instructions included representative pictures of household measures to make easier children identify weight, volumes, units of foods and standard portions and for helping them to describe as much detail as possible the consumed amounts of foods and beverages. Also in instructions, a single day food record pre-filled served as an example. Finally, the 3-day food record contained three separate sheets, one for each food day recording (Appendix 2.3). Children were encouraged to record at the time of eating events.

#### ***- Assessing PHS-pro participants’ views***

To capture the PHS-pro participants’ views about the programme in its several components and dimensions, two open-ended questionnaires were designed, one for children and the other for teaching staff. In addition, at the end of the PHS-pro, a SWOT analysis was also conducted with teachers who were directly involved in the programme implementation. These feedbacks allowed to understand the participants’ views and to identify key facilitators, constraints and limitations to the PHS-pro implementation.

- **Children’s questionnaire**

The children’s questionnaire intended to collect their views about the PHS-pro implementation. It was applied shortly after the end of the last learning module of the PHS-pro intervention (June 2012). First, children were asked to give their opinion concerning several components of the programme focusing in what they liked less, the reasons and suggestions for improvements in the programme. Second, children were specifically asked whether they recognized any changes in their own eating habits over the intervention by a yes-no question, followed by an open space to report which changes happened (Appendix 2.4).



- **Teachers' questionnaire and SWOT analysis**

This activity allowed to document data on how teachers perceived the PHS-pro intervention at school. In this regard, teachers were asked to give feedback about the different programme components giving particular attention to four dimensions: organization of the PHS-pro, learning modules, food records and literary contest. In addition, teachers were asked to suggest improvements to the programme. The questionnaire was applied to all teachers of grade-6 involved in the PHS-pro (Appendix 2.5).

A SWOT analysis was also used to provide an effective overview of the teachers' participants upon components, dimensions and strategies adopted during the implementation, regarding their involvement in the PHS-pro activities as well as the delivering of the programme to children. Data collected during the focus group discussion were structured according to the four SWOT categories: strengths, weakness, opportunities, and threats. The diagnostic power of SWOT would enable to identify gaps, best practices, give information from the point of view of teachers, and provide useful inputs to improve the planning process of the PHS-pro for future interventions (Dyson, 2004; Helms & Nixon, 2010).

#### **2.4.4 Preparation of School Setting**

For carrying out the research, the preparation process of the school setting involved several procedures and stakeholders: recruitment of schools, ethical issues, school setting conditions, sessions with parents and teachers.

##### ***- Recruitment of schools***

Elementary schools existing in an urban municipality, integrated in the second largest metropolitan region of Portugal, Porto (Trofa), were invited to participate in the research. Four educational institutions were under these circumstances (Napoleão Sousa Marques, Alvarelos, São Romão de Coronado, Colégio da Trofa) and the first aim was to cover all children attending grade-6 at the mentioned municipality.

In order to organize two balanced samples of subjects, an estimation of the number of children normally registered was calculated for the following school year (2011/2012) to implement the PHS-pro and arrange a reasonable sample with homogeneous two groups: intervention and control group. One of the four schools, *Napoleão Sousa Marques*, had registered more children and, consequently, more classes to implement the programme, for

this reason it was selected to be the ‘intervention school’. The three remaining schools were selected as ‘control schools’ (*Alvarelhos, São Romão de Coronado* and *Colégio da Trofa*). Accordingly, the two group samples were set: the intervention group (IG) composed of children of grade-6 classes of the ‘intervention school’ while the other three schools served as the control group (CG) gathering all classes of grade-6. Being a quasi-experimental study, the PHS-pro was applied to subjects of IG in the intervention school; the CG did not participate in the PHS-pro, it was only subjected to the two assessments (baseline and follow-up).

### ***- Ethical issues of the research***

To initiate the research, several arrangements were carried out to obtain distinct authorizations. The Scientific Council of the Institute of Education of the University of Minho approved the present research and ethical permission was obtained from each school Pedagogical Board. School principals and class coordinator teachers of each school accepted to collaborate in this research project.

A partnership was established with the Health Promoter Office (HPO) of the intervention school, enabling the inclusion of the PHS-pro in the Yearly Activity Plan of the school, which facilitated synergies to develop other activities over the school year, not initially planned. In addition, the HPO coordinator conducted all the arrangements required for implementing the intervention in the school setting, connecting the PHS-pro with several stakeholders: class coordinator teachers, grade-6 teachers, school principal, school parents’ association and the school library.

The PHS-pro schedule was delivered to each of the four schools covering all assessments and activities required to conduct the research and allow integration between the coordinator teachers and class teachers, for the regular running of the school schedule. The advance planning has allowed the researcher to be present in all crucial moments for granting authorizations and providing full information concerning the research.

Parents were invited to participate at the school meeting and were fully informed about the study procedures, participants’ risks and benefits, access to information on child’s nutritional status at the end of the programme (Appendix 2.6), data confidentiality and, finally, they signed an informed consent (Appendix 2.7). Similar procedure was delivered to children, in the classroom on the first day of school. Detailed information was made first orally, then through an individual distribution of a paper package that included a participant information sheet to explain the research purpose and the child’s informed consent (Appendix 2.8) to enable free and active participation, beyond the formal request previously addressed to

parents. In addition, children were informed about the respect for privacy and confidentiality of collected data over the research process. In brief, a range of ethical precautions were taken into account and fulfilled in accordance with the ethical principles of children participatory methodology (Fernandes, 2009).

**- *School setting conditions***

Several factors that might affect the research outcomes were controlled in the four schools: school grade (grade-6); nutrition and health-related school curriculum; textbooks; physical education classes; and school food services. This ensured homogenous conditions between children from different schools. Therefore, an analysis was conducted to food infrastructures of schools in respecting to the bar/buffet, vending machines, cafeteria and the food offering menus. All the four schools exhibited identical conditions: children had access to the buffet during breaks with a similar food offering; cafeterias presented lunchtime menus, which followed the guidelines of Portuguese Government for education (Ministério da Educação, 2007a, 2007b). However, there was a difference between the management of the cafeterias: the three schools gathering the CG were running by catering businesses while the intervention school had internal management, which allowed the support of the school direction to guarantee the availability of F&V in the school canteen at lunch with an extra salad buffet.

Curriculum programmes were assessed, specifically the Natural Sciences grade-6 curriculum and its textbooks to understand whether children would be subjected to identical conditions over the school year. Textbooks, didactic content and time structure were followed identically under the guidelines published by the Curricular Organization and Programs of the Ministry of Education (Ministério da Educação, n.d.). In addition, subjects concerning the digestive system, nutrition and related activities sheets, were taught by the four schools, at the same timeline, during the first school period, which avoided any methodological biases between the IG and CG.

**- *Briefing session with parents and teachers***

The parents' meeting organized by the coordinator teacher at the beginning of the school year was also the PHS-pro kick-off. After ethical procedures, parental involvement was requested addressing exclusively the raising awareness to the importance of healthy eating habits at home. Educational messages delivered to parents were based on: (i) eating fruits and vegetables everyday; (ii) eating vegetables soup to start lunch and dinner; (iii) increasing fish intake and decreasing meat; (iv) healthy food choices available between meals; (v) drinking

primarily water; (vi) having everyday breakfast; (vii) being active at least one hour a day. Parents were challenged to adopt these healthy behaviours, leading the example and contributing to a healthy growth of their children. In addition, this session intended to promote equal attitudes on family’s environment over the intervention period. Parental attendance reached to a rate of 100% at this session. Parents and children were unaware about the existence of intervention and control schools and consequently of two studied groups of participants.

The parents briefing session in the IG had an additional goal: to encourage parents increasing F&V availability at home and supporting children for behaviours changes during the implementation of the PHS-pro. Specifically, the key message strongly advised to have at home available: fresh fruit; vegetable soup at meals, mainly at dinnertime; and salads or vegetables as side dishes.

Teaching staff of the intervention school was invited to several meetings of the PHS-pro to request active participation, listen teachers’ point of views, and invite teachers to participate in the PHS-pro’s challenge. The challenge was based on the opportunity that the PHS-pro would run over the academic year and could organise, in partnership, school activities related with eating and lifestyle habits. Teachers responsible of Natural Science, Portuguese Language and Physical Education worked more closely with the PHS-pro implementation and were informed of their participation and different tasks required.

Although a teachers’ and school auxiliaries’ staff training session had been planned in the initial conceptual design of PHS-pro, it was not held for logistical reasons of the school year start. However, one meeting was provided to the kitchen staff of the school canteen (a cook and two auxiliary staff), where the purpose of the PHS-pro was explained and requested collaboration to ensure the availability of fruit and vegetable salads washed and ready to eat at school lunch.

#### **2.4.5 Studied population and sample selection**

There were two main reasons for selecting children attending grade-6 for the development of the educational programme and not others. The first, is partly due to the fact that grade-6 Natural Science curriculum and school textbooks address issues related to nutrition and nutrients, healthy diet principles, the digestive system, digestion and the process of obtaining nutrients as well as healthcare of digestive system, among other. Thus, both IG and CG were ranked on the same knowledge level of formal learning at school, and were also

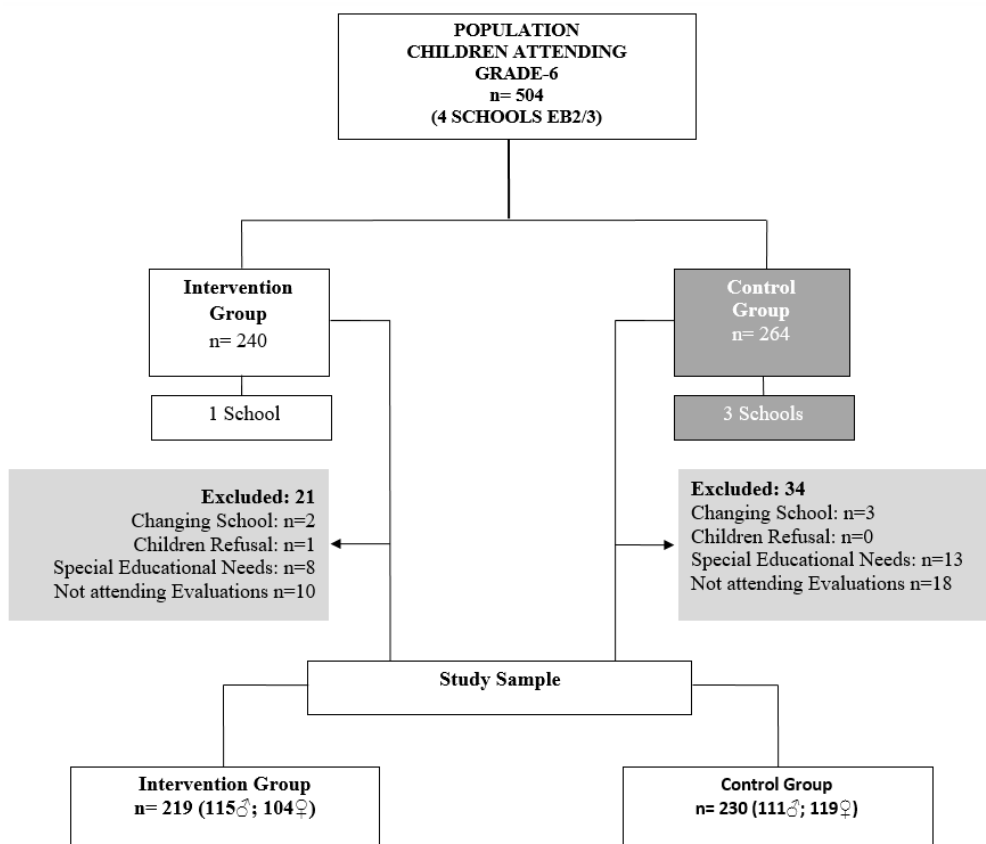
provided the appropriate environment to expand several of these issues, encouraging children to be aware of eating matters and simultaneously increasing children's ability to choose healthy food and to know more about what they really eat (Marks & Marks, 2008). Secondly, this age group (mainly 10 to 12 years old) acquires greater autonomy, mostly financial, when compared with the younger ones who attend the earlier school years of elementary school. At grade-6, children are immersed in an environment without parents' supervision on snacks and have access to a school buffet, in a new reality, which increases the risk of unhealthy food choices in the school buffet and outside the school.

As previously stated, this research purposed to recruit all children attended grade-6 in the elementary schools of a Portuguese urban municipality (Trofa). Children were included in the study according to the following inclusion criteria: (i) aged between 10 to 14 years inclusive; (ii) parental permission assigned to enter the study. Children were excluded in case of: (i) not wanting to participate in PHS-pro (only in the intervention school) (ii) not attending the two evaluations, baseline and follow-up; (iii) receiving monitoring or any nutritional intervention; (iv) being indicated with pathological conditions which required to take medication that might interfere with the body metabolism or associated with weight change; (v) being identified as special educational needs.

A total of 504 boys and girls (aged 10-14 years) were found to be registered in the grade-6 at the four schools of the Trofa municipality and were enrolled in the study. All parents signed the informed written and all children agreed to participate freely, except one boy of the intervention group school, who refused participating in the research.

Of these 504 children, 55 (10.9%) were excluded: one refused to participate, five moved to another school, 21 had special education needs and 28 did not attend both assessments (baseline and follow-up). Children with special educations needs participated in all tasks and activities carried out by both groups (IG and CG), though data were not included for the analysis. Therefore, the final sample comprised 449 children, 89.1% of the available population, with 219 children (48.8%) in the IG and 230 (51.2%) in the CG, as shown in Figure 2.2.

The CG was limited to the regular teaching of Natural Sciences curriculum, by studying nutrition and related issues at the classroom and was submitted to both assessments for data collection, whereas the IG participated in the PHS-pro intervention at the school over the school year and was also submitted to both assessments.



**Figure 2.2.** Flow chart of recruitment and sample selection

## 2.5 PHASE 2: THE PHS-pro IMPLEMENTATION

The PHS-pro intervention started in September of 2011 and went on until June of 2012, at the intervention school (intervention group), in nine classes. It included three learning activities: (i) Learning modules; (ii) Workshop “Cooking is Science”; (iii) Challenge: literary contest. The PHS-pro intervention was initiated with a briefing session and monitored by seven food records, as shown in Figure 2.3.

Activities Panel	2011				2012					
<i>Planning Health In School</i>	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
<i>Challenge</i>	<i>Short Stories</i>		<i>Contest</i>				<i>Delivery</i>	<i>Jury Selection</i>		<i>LC</i>
<i>Educational Programme</i>	<i>BS</i>	<i>LM1</i>	<i>LM2</i>	<i>LM3</i>	<i>LM4</i>	<i>LM5</i>	<i>LM6</i>	<i>LM7</i>	<i>LM8</i>	
<i>Monitoring</i>	<i>Food Records 3 days</i>	FR0	FR1	FR2	Xmas	FR4	FR5	FR6	FR7	G
<i>Workshop Cooking is Science</i>							WS			

BS – Briefing Session; LM – Learning Module; FR- Food Record  
LC- Literary Contest; WS- Workshop; G- Final Game

**Figure 2.3.** Implementation timeline of PHS-pro

### 2.5.1 Briefing session for children

The starting point of the PHS-pro implementation was a briefing session (BS) in each class. The different components of the programme, schedules and rules for an effective functioning were introduced to children.

Since PHS-pro wanted to create a time and a space for learning healthy behaviours in a practical approach, it was emphasised that the intervention would be subjected to children's acceptance and opinions, according to the procedures of participatory methodology. Therefore, the approach for the learning modules implementation was explained and children were told that they would have time for sharing their thoughts and doubts and exploring expectations.

During the baseline assessments and after the application of the self-reported questionnaire, children chose the eight topics they wanted to have in the learning modules, and this briefing session also served to inform children about the elected eight-topic list.

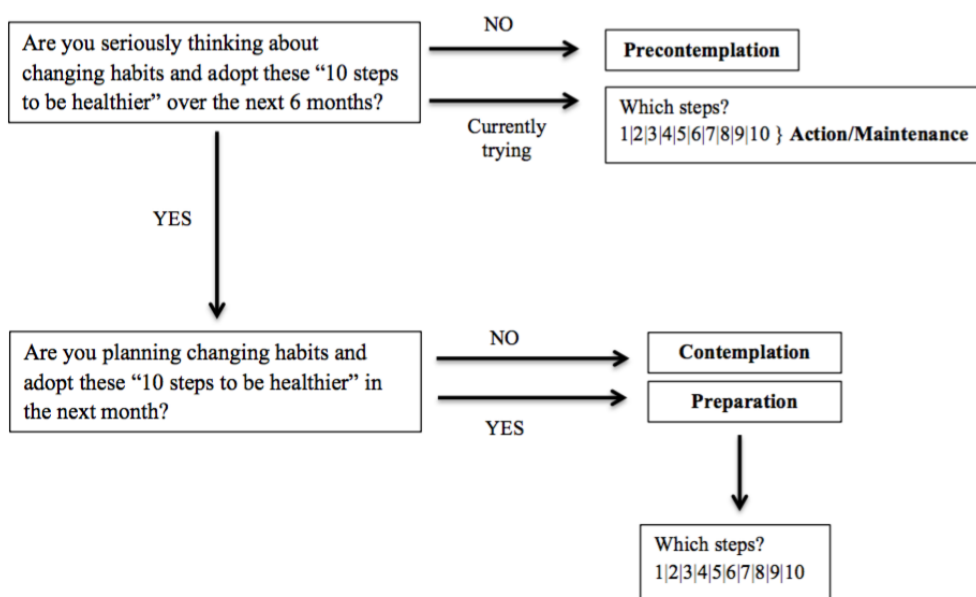
In addition, the structure of the 3-day food record was shown to children, they were explained how to fill it correctly and delivery rules were defined. The first food record was delivered and applied in the following days, before the learning sessions. So, this first food record was designated by food record zero (FR0) and allowed to identify foods and beverages consumed, and monitor the usual eating pattern of children before intervention. The FR0 constituted the basis to compare with the subsequent food records. Indeed, after each learning module, a food record was distributed to children for filling it within the subsequent three days (Figure 2.3) and to be delivered to the class teacher at the next lesson. This procedure was repeated till the end of the intervention except in last module, where a game (G) closed the activity instead.

### 2.5.2 Baseline Stage of Change

Children’s stage of readiness to change behaviours was assessed in order to evaluate their cognitive and behaviour engagement, prior to initiate the first learning module of the PHS-pro. For it, general healthy habits were structured in a list entitled the “10 steps to be healthier”: (i) daily breakfast intake, (ii) eating vegetable soup to start lunch and dinner, (iii) eating a colourful diet, (iv) eating more fruit: three different fruits each day, (v) balancing meals between meat and fish, (vi) eating two snacks midmorning and afternoon, (vii) avoiding high rich fat food, (viii) reducing salt, (ix) drinking water, and (x) playing regular physical activity and watching their weight.

Grounded on the questions and algorithm derived from Kristal et al. (1999) stages of change, the baseline stage of children for the “10 steps to be healthier” was categorized and assigned according to the five stages of TTM: (i) precontemplation (not seriously thinking in changing habits), (ii) contemplation (seriously thinking in changing habits, still being not sure when), (iii) preparation (planning to change soon, in the next month), (iv/v) action/maintenance (currently trying to change).

The “10 steps to be healthier” were introduced at each class of the IG and children were first asked their intention of change for adopting those healthful habits, as Figure 2.4 shows.



**Figure 2.4.** Questions used to assign stages of change for the “10 steps to be healthier”



### 2.5.3 Learning modules

As mentioned above (section 2.5.1) children selected the topics they wished to learn about. The eight topics were the following: (i) 10 steps to be healthier; (ii) water & milk help you to grow up; (iii) Training every day to be healthier; (iv) 3 fruits a day, how much good it does?; (v) F&V are essential to life; (vi) Start on moving! ; (vii) The best snacks; (viii) Final game: who has learned about everything?. The contents of the learning modules were defined according to children's selection, although the eight modules were organized into this suitable sequence to ensure an appropriate action and allowing the support of the TTM model assumptions.

Learning modules were designed to improve children's food knowledge, food choices, eating behaviours and other healthy habits by developing skills, which can help them to think on their real problems and learning how to deal with these problems.

The contents of the eight learning modules, the activities undertaken and the outcomes to be achieved are briefly described below.

**Learning module-one (LM1)** – In the first learning module general behaviours changes were presented and structured in “**10 steps to be healthier**” (as mentioned before, in section 2.5.2) which were: (i) daily breakfast intake, (ii) eating vegetable soup to start lunch and dinner, (iii) eating a colourful diet, (iv) eating more fruit: three different fruits each day, (v) balancing meals between meat and fish, (vi) eating two snacks midmorning and afternoon, (vii) avoiding high rich fat food, (viii) reducing salt, (ix) drinking water, and (x) playing regular physical activity and watching their weight. This module addressed the most important basic principles of healthy eating, adapted from the main preventive strategies presented by WHO (2003, pp. 67-68) into a simple 10 step-wise format.

The main objective was to reinforce basic rules for a healthy lifestyle and recognize short-term benefits and long-term effects. It was identified the aspects to improve for motivating possible future changes in short time towards meeting the goal steps. Solutions and options were discussed in class large group and at least one practical decision was taken to solve the unhealthy behaviour detected by children.

According with children expressed individually to be as the main obstacle for a healthy eating, values and individual skills were strengthened and encouraged to take daily attitudes that could reflect positive changes.

*Activity-one (A1)* – This activity consisted into a set of actions:

- Election of the most difficult step to meet between the 10 wise-steps – choosing the step, changing for better;
- Brief discussion about consequences of not to follow the difficult step identified;
- To settle a simple and clear goal for overtaking the detected difficulty of the step with a practical measure on daily behaviour;
- Joint commitment of children to adopt the elected solution until the next module;
- Each child received a card with ‘10 wise-steps for a healthier life’ to take home and discuss about it with the family (Appendix 2.9).

*Expected outcomes in Food Record 1 (FR1)*: according to the identified step, to find out changes in the related behaviours.

**Learning module-two (LM2) – Water & milk help you to grow up**, was the topic to call for consumption of healthy choices: water, milk and yogurt, which contribute to a proper growth and development during adolescence. Benefits and adequate portions were explained. Decreasing or moderate consumption of sugar-sweetened soft drinks was recommended, allowing a discussion about the pros and cons of beverages that children said they usually consumed, such as: nutrients, prices, benefits and quantities. Comparative nutritional contents were presented.

*Activity-two (A2)* – The goal of this activity was very clear to children. They had to set a solution and a goal to achieve until the next module: adopting water instead of soft drinks was the joint commitment, being the water elected the favourite beverage of that month.

*Expected outcomes in Food Record 2 (FR2)*: increasing water consumption, milk and simultaneously a decrease of sugar-sweetened soft drinks, compared with the collected data of FR0, the food record applied before the PHS-pro began.

**Learning module-three (LM3) – Training every day to be healthier.** What does it means to be healthy? What are the benefits of it? How to train everyday healthy habits and which basic strategies can be adopted to put into practice healthy food choices at healthy eating level? A basic discussion was promoted around these concepts of health. It was proposed to think about these topics to find out which practical measures can be implemented in order to children to become more aware, emphasising the importance of being able to give priority to healthy choices and behaviours.

*Activity-three (A3)* – A card was delivered to each child and it was requested to give attention to his/her family's lifestyle behaviours during Christmas holidays. Individually, children were invited to design what would they consider to be relevant to change in their families' behaviours to be closer to a healthier life.

After the LM3, it was not applied any food record, because it overlapped with Christmas time (Xmas). In this period, there are always changes on eating habits with Christmas typical consumptions that varies greatly compared with the usual pattern.

#### **Learning module-four (LM4) – 3 fruits a day, how much good it does?**

The fourth topic explored the benefits of a balanced fruit rich diet and the importance of a daily intake, and recommended consumption of three portions of fruit per day. The key point focused on the great variety of fruits existing, respecting each one's preferences and tastes. Thus, on the basis of the positive features of different fruits, children in each class elected the fruits' top list. Obstacles to fruit consumption were identified and opportunities to increase the daily intake of fruit were found.

*Activity-four (A4)* – Identifying and recording the fruit portion intakes of the day before and of the present day. Subsequently, children were guided to think about which fruits they would like eating on the next day or even taste a new fruit. The intentions were to raise awareness for daily fruit recommendations, compare with the usual consumptions that each child did, and increase children perception on its consumption.

*Expected outcomes in Food Record 4 (FR4):* increasing the fruit consumption in general, including on snacks and meals, comparatively with FR0.

**Learning module-five (LM5) – Fruits & vegetables are essential to life.** This module was designed to call great attention for the important role of F&V in the daily diet: nutrients benefits, their nutritional value and richness, especially in dietary fiber. Promoting F&V by helping children to recognize the existing plethora of vegetables, such as legumes, roots and tubers, pulses; presenting different ways of eating these vegetables (soups, salads, ways of preparation); encouraging to choose the favourite ones and start by eating one or two of them at the school canteen.

*Activity-five (A5)-* Recording the favourite vegetables and elect the popular soup, salad or side dishes. The intention was to make children understand that they have options between the big vegetables family and they are able to increase the consumption with their favourite choices to reach to a healthy goal.

*Expected outcomes in Food Record 5 (FR5):* increasing intake of vegetable soup, legumes or salads during lunch and dinnertime, compared with the verified consumptions in FR0.

**Learning module-six (LM6) – Start on moving!** Motivation for a regular practice of physical activity was the focus of this module, enhancing the health benefits and self-esteem. Raising awareness and helping children to try new sports as well as to appreciate and take advantage of physical activity classes and the available extracurricular programs at school. Also, to identify obstacles that can block the daily habit of practicing physical activity.

*Activity-six (A6)-* To record children’s usual sport or playful activities and discuss about activities they would like to have the chance of trying.

*Expected outcomes after the Activity 6 (A6):* To find in the A6 card annotations related to a decision of starting the practice of a sport or other forms of physical activity. To access inclusion of more children participating in sports and activities at the end of PHS-pro.

*Expected outcomes in the Food Record 6 (FR6):* The FR6 was applied with the aim of being used as a follow-up evaluation.

**Learning module-seven (LM7) – The best snacks.** This module was about foods that should be included on a healthy snack. Whether there is a meal that depends exclusively on children’s choice in these age groups, a snack is a good example. Snacks are frequent small meals, which depend mainly on children’s food choices. The approach to this daily behaviour was encouraged by a discussion to identify eating patterns and foods more consumed at snacks. For that, it was undertaken comparisons between different options and then children were guided to choose in various aspects: nutrients, preferences, prices and new options. The intention was to reinforce skills that could help them of being more aware of their autonomy on food choices and eating behaviours, since individual decision is exclusively an option of each child. Snacks are frequent small meals but with a big impact in the overall nutrition.

*Activity-seven (A7)–* Before initiated the LM7 for the corresponding activity, children were asked to record in a card (Appendix 2.10), individually, what they would think it could be a best choice for a healthy snack. After discussion and argumentations about the composition of snacks to be healthy, children had to distinguish the snacks rich in essential nutrients by repeating the recording in another card (Appendix 2.10).

*Expected outcomes after the Activity (A7) and Food Record 7 (FR7):* progress in the nutritional quality of food choices for snacks between A7-card-one and A7-card-two. Analysing differences between snacks recorded on FR0 and FR7.

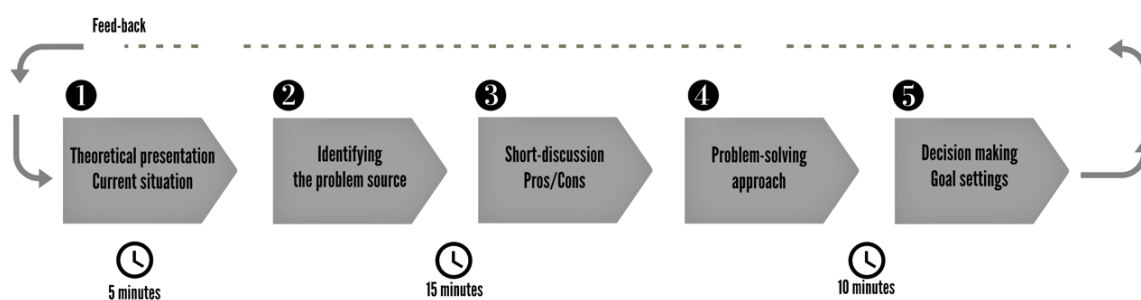
### Learning module-eight (LM8) – The final game: who has learned about everything?

This module was the last one and closed the intervention. Hosted by a simple game (G) called “let’s play on: who has learned about everything?”, this activity served to recall and re-examine what had been developed over the PHS-pro intervention. This last activity, which happened in the last days of school year, did not had any monitoring, as with all other. Instead, the application of a small questionnaire was carried out, to ask children whether they could identify any changes that have occurred on their eating and lifestyle behaviours over the programme.

#### - Implementation process of the learning modules

Each module was designed to last approximately 30 to 45 minutes and to be implemented monthly in the Natural Science classes without interfering with school activities. The eight modules previously scheduled for the first hour of a two hours class, were established with each teacher.

The general structure of the learning modules included a short presentation of the key issue and the behavioural goal, time for discussing and sharing children’s experiences, feelings and opinions, an activity related to the key issue, ending with a behaviour goal setting proposed by children to be applied for the coming module. The implementation process of a learning module is illustrated in Figure 2.5. After the first module, every learning module was initiated with a feedback of the previous module regarding children’s improvements and commitment goals.



**Figure 2.5.** Implementation process of a learning module

Educational materials included PowerPoint presentations, worksheets and paper cards to draw during the activities developed of the learning modules. The modules were conducted by the researcher (nutritionist) and supported by the teacher. In addition of being an observer

and had a moderating influence, the teacher also coordinated the time management at the classroom so that the researcher adopted the facilitator role to conduct the short discussion needed. For every learning module implemented in each class, data was collected and gathered in a fieldwork notebook, allowing to collect children’s perceptions and comments in real time in every class.

As said before (sections 2.4.3 and 2.5.1) the monitoring of the learning modules was conducted regularly by food records application (see Figure 2.3). This procedure was repeated over the intervention with 3-day food records, enabling to monitor the outcomes of the corresponding module. This articulation was very effective except in Easter season, which had a longer holiday period.

#### **2.5.4 Workshop “Cooking is Science”**

This Workshop “Cooking is Science” arose from the partnership established with the intervention school HPO, which created synergies among teachers of grade-6.

Teachers were invited to organize activities related to healthy eating and lifestyle behaviours during the PHS-pro intervention period. Following this challenge the teaching staff organized a set of 2-day workshop to be put in place, in the second scholar period for all school grades. Under the title ‘Cooking is Science’, eating habits were linked to different science areas, in an interdisciplinary approach in six topics: ‘everything in proper measure’; ‘fruits are health’; ‘how is bread produced?’; ‘there are delicacies that are bacteria’s work’; ‘fresh cheeses’; ‘how did our grannies preserve food... without fridge?’

The PHS-pro selected the topic of ‘fruits are health’ and was responsible for the development of this workshop to be implemented in children grade-6. Since this activity occurred in April, strawberries were recruited as the fruit of the season for the culinary activity.

The activity started with a few recommendations: introducing this fruit at breakfast and explaining the need of a generous amount of fresh strawberries to benefit of its great nutritional value. And it was cooked a simple strawberries recipe to be consumed as a snack. Under the supervision of the organization staff, the children prepared the strawberries, followed the recipe and tasted it. This activity involved groups of eight children each, whose goals were especially to provide contact with the strawberries preparation and develop the ability needed for washing and cutting this fruit. This activity also allowed to create

opportunities to understand children perceptions about strawberries: preferences, potential uses, nutritional quality, and food safety.

### **2.5.5 Challenge: the literary contest**

Children were challenged to participate in a literary contest to continuously following-up the main focus of the programme over the year: adopting healthy habits. This activity intended to encourage self-expression and creativity for writing and/or drawing, providing opportunities for children to express their ideas, opinions, day-to-day experiences and emotions, about healthy eating and active living issues, without forget to give voice and action to participants (Baraldi, 2008).

To achieve this, a children's story reading session about eating and lifestyle habits was performed during the Portuguese language class by the story's author. Children were then invited to participate in the literary contest on a voluntary basis, to write a short story, a comic strip, with illustrations or other artistic nature, where they should develop, individually or as a group, a story related to healthy habits.

This activity was sought with the collaboration of the Portuguese language teachers and coordinated by them over nine months (see Figure 2.3), and Visual and Technological Education teachers were also involved.

Rules of the literary contest for participating were presented, having children six months (between Out 2011 and March 2012) to build the storyline and submit the creative writing to the jury committee. Short stories that meet the requirements were selected and evaluated by a jury composed of eight elements (two fiction writers, a children's literature lecturer of the University of Minho, a school teacher and four school students of grades 5, 7, 8 and 9).

The literary contest culminated with the closing event to announce the winner group, held at the end of the school year (June 2012), where all the works were exhibited.

### **2.5.6 Data analysis**

Data collected over the research study derived from different sources: anthropometric measures, questionnaires, food records, semi-structured individual interviews, teachers focus group, field notes, documents about the school contexts.

All data were organized around four central research questions to evaluate the PHS-pro, as defined above (section 2.2):

- i) What were the effects of the PHS-pro on the nutritional status of children?
- ii) Which were the behaviours improvements (eating, physical activity habits) reached by children over the intervention?
- iii) What are the costs and benefits of implementing the PHS-pro?
- iv) How participants evaluated the implementation and perceived their participation? And what improvements should be done for future implementations?

Data collected for questions i), ii) and iii) are analysed in detail in specific studies presented in Chapters 3, 4 and 6, respectively. In Chapter 3 children’s anthropometric assessments and self-reporting questionnaires were applied in two assessment moments (at baseline and follow-up) of the IG and CG. Chapter 4 is dedicated to the children’s food record analysis along the PHS-pro implementation. Finally, Chapter 6 provides an analysis of the costs and benefits of the PHS-pro implementation.

In this Chapter 2, the analysis focuses on the qualitative data gathered among participants, which were organized and entered in a database by using version Excel (Microsoft 2007). Answers to the open-ended questions were examined according the components of the programme and categorized by using content analysis (Pope, Ziebland, & Mays, 2000). Field notes, information and documents gathered over the research served as the basis of the analysis and were organized according the Phases 1 and 2 of this study.

## **2.6 RESULTS**

### **2.6.1 General characteristics of the participants**

The sample was composed of 229 children, 119 boys (52%) and 110 girls (48%) and the mean age was 11.0 (SD = 0.7). Children were distributed by nine classes of grade-6 with a minimum of 20 and a maximum of 28 per class.

Sixteen teachers were permanently involved during the PHS-pro school intervention. The teaching staff was composed of three males and 13 females: five teachers of Natural Sciences, four of Physical Education, six of Portuguese language and the coordinator teacher which also represented the HPO.



### 2.6.2 Findings

#### - The eight selected topics

As referred above (section 2.4.1) children selected eight topics out of a list of sixteen. Of the 229 children, 100 (43.7%) also chose a free-topic, providing an additional suggestion. These free-topics were gathered in three categories: (i) healthy eating and specific food questions was the most selected topic, by 59 children (59%), (ii) sports and physical activity by 32 children (32%), and (iii) dieting and weight loss, by 9 children (9%).

The eight topics to be used for learning modules most voted are shown in Figure 2.6. The less voted topics were those related to sugar and sweets, suggesting that children were more interested in developing healthy competences and learning how to make healthy choices than topics already identified as unhealthy.

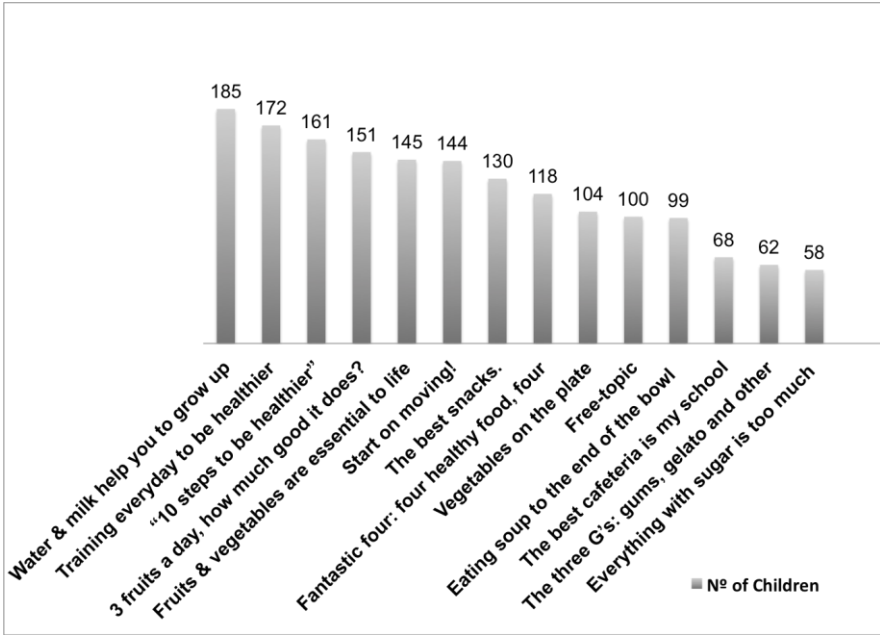


Figure 2.6. The eight topics selected by children

#### - The food records application

Of the seven 3-day food records applied to 229 children, a total of 1089 food records were collected, corresponding to 3267 days of food reports. The summary of the collected data is the following:

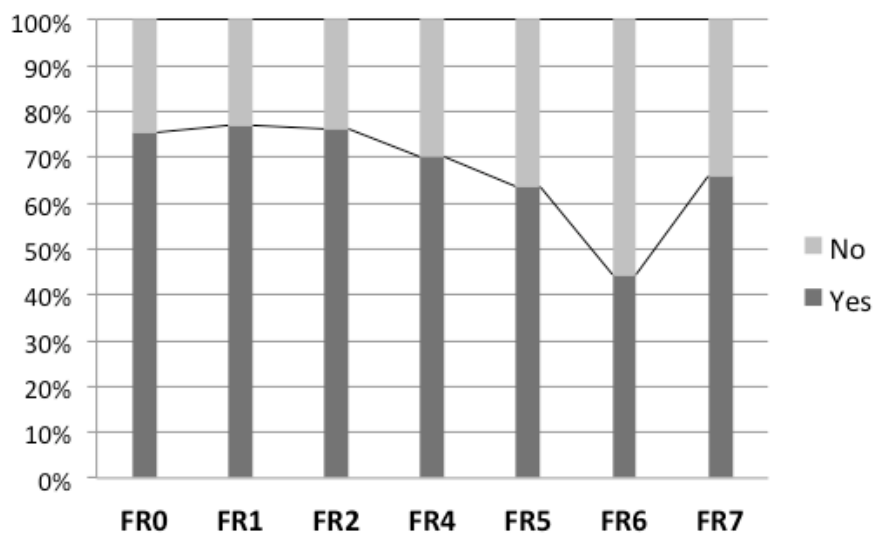
- 70 children (30.6%) returned all their seven 3-day food records completely filled in, with greater involvement of girls (42 = 60.0%) as compared to boys (28 = 40.0%). Only 12 children (5.2%) did not deliver any food record.

- Most of children (72.1%) delivered four or more food records and 27.9% delivered less than four food records. Again, girls had higher rates of the food record delivering (54.0%) than boys (46.0%) as shown in Table 2.3.

**Table 2.3.** Frequencies of the returned food records

Food Records Collected	Boys (n=119)	Girls (n=110)	Total (n=229)	Total %	
0	11	1	12	5.2	} 28%
1	8	7	15	6.6	
2	15	7	22	9.6	
3	10	5	15	6.6	
4	15	7	22	9.6	} 72%
5	15	16	31	13.5	
6	17	25	42	18.3	
7	28	42	70	30.6	

Figure 2.7 shows the return of the successive seven 3-day food records after each learning module. The food records delivery was always above 60%, except the FR6 return (44%) that occurred just before the Easter school holidays.



**Figure 2.7.** Food record return frequencies

**- Children's views on the PHS-pro implementation**

Children's participating rate in the PHS-pro implementation was 99.1%, i.e. of the 229 children, 227 completed the questionnaire.

Table 2.4 shows that the food records application was the PHS-pro component that children liked less. Of the 227 children, 116 (51.1%) said the food record was "too much work to do", "too many days to record", "whenever I eat I have to record" or "I do not like to write"; on the other hand there were 3 children (1.3%) reporting that the food record helped them "to pay attention to what they were eating." By contrast, among the 227 children, 82 (36.1%) did not pick any of the boxes available, stating they liked everything.

Although children considered the food record a tedious task, the recovery reached high rates along the relatively long period of intervention as referred above (see Figure 2.7). Girls, as a group, proved to be more engaged than boys in the recording process, delivering more information about food and beverage consumption (Table 2.3).

Children's perceptions respecting their behaviours change (Table 2.4) showed that the great majority of children (84.6%) recognized changes on eating habits. They mentioned that they have started eating more fruit (40.6%), followed by the vegetable soup (27.6%). In fact, these most frequent declared behaviour changes match the main focus of the learning modules developed over the PHS-pro intervention: improve fruit and vegetables consumption.

Table 2.4 also shows that children were pleased for participating in the PHS-pro, as most of them (98.2%) agreed that this kind of programme could help other children adopting healthy habits, with nearly a half of the children (45.0%) indicating that the PHS-pro is appropriated to help young people eating right.

These findings suggest that children's participation must be highly considered to increase their motivation, and children's inputs can lead to a better acceptance of the intervention and better outcomes. To support the importance of children motivation on the implementation process, an informal conversation documented in the researcher field notes is reproduced below. The conversation took place at school's entrance in the mid-term of the PHS-pro implementation (see Figure 2.3) between the researcher and three children participants:

**- Location of conversation/talk: school's entrance - 23/01/2012 11:00 AM**

Three children participating in the programme have come to researcher and said:

Children 1: *Is it today you'll come to our class?*

Researcher: *No, it is on next Wednesday.*

Children 1: *oh, it ought to be today!*

Researcher: *So, it’s now only a couple of days away.*

Children 1: *But it should be today.*

Children 2: *Don’t you see that is in the two-hour class? It is better. Yeah!*

Children 1: *For more than a month now that I don’t eat French-fries!*

Children 3: *So do I.*

Children 2: *Me too, almost for a while. At least I eat less.*

Researcher: *Fine. So your class are already having healthier changes.*

### ***- Teachers’ evaluation on the PHS-pro implementation***

Teachers participating in the implementation were asked to contribute with their perspectives and opinions about the components of the programme for which they had collaborated directly. Of the 16 teachers, 12 (75%) answered to the questionnaire and participated in the focus group to a SWOT analysis. Table 2.5 shows the 12 teachers’ remarks on the PHS-pro components. Teachers mentioned more often the literary contest (with 9 inputs) as a good and successful experience in involving the children. In contrast, the seven 3-day food records were considered a challenging activity but becoming tedious, opinion similar to children’s view (see Table 2.4). The learning modules and their organization were in general well accepted (Table 2.5).

The teachers’ questionnaire answers were very useful for initiating the discussion in the teachers’ focus group for the SWOT analysis. Table 2.6 summarizes the strengths, weaknesses, opportunities and threats identified in the overall PHS-pro implementation.

Generally, teachers reported the implementation as a positive experience. All teachers mentioned to be crucial to have this kind of interventions based on learning and changing for healthy habits. They suggested additional components (more interaction with parents, more activities, more collaboration of school staff, more coordination) which demand increased coordination and agreed that the programme should be continued, extending to other grades. However commitment and motivation to collaborate over the intervention varied among teachers’ participants.

**Table 2.4.** Children's views of their participation in the PHS-pro and perceptions on their eating habits changing (n= 227)

<b>Opinions</b>	n= 227 n (%)
<b>1. What were the two components you liked less during your participation in the PHS-pro? You can pick two boxes.</b>	
a. 58-item FFQ	13 (5.7%)
b. Anthropometric assessment	15 (6.6%)
c. Short story reading session	7 (3.1%)
d. Literary contest	11 (4.8%)
e. Learning modules	3 (1.3%)
f. Learning modules topics	6 (2.6%)
<b>g. Food record</b>	<b>124 (54.6%)</b>
h. Anthropometric assessment information card	2 (0.9%)
<b>Perceptions</b>	
<b>2. Do you think your eating habits changed during the programme?</b>	
<b>Yes</b>	<b>192 (84.6%)</b>
No	35 (15.4%)
<b>3. If your answer is affirmative, would you like to explain how?</b>	
<b>Eating more fruit</b>	<b>78 (40.6%)</b>
Eating more vegetables or salads	41 (21.4%)
<b>Eating more vegetable soup</b>	<b>53 (27.6%)</b>
Eating more fish	13 (6.8%)
Drinking more milk	11 (5.7%)
Drinking more water	26 (13.5%)
Drinking less soft drinks	12 (6.3%)
Eating less sweets	38 (19.8%)
Eating less fried foods	33 (17.2%)
Eating breakfast	3 (1.6%)
<b>4. Do you think this kind of programmes can help young people having more careful with food?</b>	
<b>Yes</b>	<b>223 (98.2%)</b>
No	4 (1.8%)
<b>5. If your answer is affirmative, would you like to explain why?</b>	
To know more about nutrition	8 (3.6%)
For preventing obesity	36 (16.1%)
<b>To help eating right</b>	<b>100 (45.0%)</b>
Eating for better health	16 (7.1%)
Greater awareness with food and nutrition	24 (11.0%)
Helps for better lifestyle habits	12 (5.4%)
For weight control	20 (9.0%)

**Table 2.5.** Teachers’ evaluation questionnaire regarding the implementation (n=12)

Components	Teachers (n= 12)
1. Organization	6 inputs <ul style="list-style-type: none"> <li>• <i>Extra-class organization successful</i></li> <li>• <i>Extra-class organization went very well. No negative aspects.</i></li> <li>• <i>Extra-classes organization worked and was very helpful for general results</i></li> <li>• <i>Teachers as key stakeholders need more coordination with more meetings to make a progress report. A wider dissemination of the programme, more effective to the school community.</i></li> <li>• <i>Creation of a support group for coordinating participation and work of other stakeholders. More meetings for evaluation and for having a progress report.</i></li> </ul>
2. Literary Contest	9 inputs <ul style="list-style-type: none"> <li>• <i>Contest criteria should be with more anticipation and clarification.</i></li> <li>• <i>Portuguese language teachers should have greater involvement as well as the library, which should have more participation.</i></li> <li>• <i>Good adhesion of students to the competition, from which emerged interesting works and could serve as suggestions for future initiatives.</i></li> <li>• <i>An enriching experience. It crossed the creative writing with the acquisition of new expressions and perceptions about eating habits. I was also able to observe that there was commitment of the Portuguese language teachers, a determining factor for the quality of the tales. Having children, as members of the jury seemed to me an interesting idea, giving greater visibility to the issues. The prize-giving ceremony involving parents was also a very positive factor.</i></li> <li>• <i>Children shown enthusiasm in the elaboration of the stories.</i></li> <li>• <i>I could see that most of children were enthusiastic and cooperated immediately.</i></li> <li>• <i>I think that prize-giving ceremony should not happen on the last day of school but in the penultimate week. The jury and contest criteria were well chosen.</i></li> <li>• <i>The literary competition did not arise in the best way due to the unwillingness of some of the Portuguese teachers.</i></li> <li>• <i>The literary competition went well, children were very motivated.</i></li> <li>• <i>It was an important phase of the project, in which children were involved enthusiastically.</i></li> </ul>
3. Learning modules	7 inputs <ul style="list-style-type: none"> <li>• <i>Interesting topics, linked together, and providing continuity. Reasonable period of time. Most of children liked.</i></li> <li>• <i>Relevant topics, clear and adequate. The possibility of choosing the topics by the children was a very positive approach.</i></li> </ul>

Components	Teachers (n= 12)
	<ul style="list-style-type: none"> <li>• <i>Interesting topics, good running time and good acceptance.</i></li> <li>• <i>Topics are quite important for food education, and were well accepted by the children. They were always asking when the nutritionist returned to the class. Good learning of the 10 steps with a positive perception of behaviours. Modules had enough time.</i></li> <li>• <i>Modules were appropriate to the age group (language and graphic).</i></li> <li>• <i>Modules were appropriate to the age group.</i></li> <li>• <i>Modules have gone well.</i></li> <li>• <i>PowerPoint presentations can be improved.</i></li> </ul>
4. Seven food records	<p>6 inputs</p> <ul style="list-style-type: none"> <li>• <i>Children complained of being repetitive. A large number had failed to do.</i></li> <li>• <i>Interesting dynamics, putting in evidence the reality of practices and behaviours, often "disguised". Some resistance on the deliveries perhaps because they were many.</i></li> <li>• <i>Interest and commitment in carrying out the registration daily, however some children gave up the task.</i></li> <li>• <i>At the beginning, the food record had a good participation, however, by the end some children get tired with the task, were reluctant and failed to deliver.</i></li> <li>• <i>The food record was well accepted by children and their parents.</i></li> <li>• <i>The food record was well accepted by the children but then there were withdrawals.</i></li> </ul>

**Table 2.6.** Results of teachers’ SWOT analysis about the components of the implementation

<b>SWOT analysis</b>	
<b>Programme overall organization</b>	
<b>Strengthens</b>	<b>Weaknesses</b>
<ul style="list-style-type: none"> <li>• Possibility of choosing topics by the children.</li> <li>• Participatory methodology approach in different components (learning modules, literary contest jury) stimulating responsibility and meeting deadlines.</li> <li>• Triggers creativity writing and teamwork linking with health and food topics.</li> <li>• Organization on time gave the possibility of the programme be included in the school curricular project.</li> </ul>	<ul style="list-style-type: none"> <li>• The lack of a global communication to all teachers to involve the school community.</li> <li>• Difficult to reach to some teachers and motivate them to participating.</li> <li>• Limited communication with parents.</li> <li>• Lack in providing training to the school community (teachers, kitchen staff, parents and those who want to improve their lifestyle habits).</li> </ul>
<b>School Environment</b>	
<b>Opportunities</b>	<b>Threats</b>
<ul style="list-style-type: none"> <li>• Provides knowledge of the children’s nutritional status and creates the possibility of changing the situation: obesity rising.</li> <li>• Motivates children to adopt healthy habits.</li> <li>• Supports the healthy choices and a healthy environment in school.</li> <li>• Possibility of creating extra-class dynamics with physical activity classes.</li> <li>• Chance for stimulating school canteen and buffet and motivate healthy food choices.</li> <li>• Possibility to bring healthy messages to parents.</li> <li>• May stimulate collaboration between stakeholders and the school community.</li> <li>• May spread the programme format to other grades.</li> </ul>	<ul style="list-style-type: none"> <li>• Resistance of children to delivering the food record form for behaviours change monitoring.</li> <li>• The food record registration was seen as a one more homework.</li> <li>• Lack of a continuum communication with parents over the intervention.</li> </ul>



### **- Baseline stage of change**

Intention to change behaviours of children was assessed at baseline for each of the nine classes. According to the “10 steps to be healthier” none of the classes indicated to be in the pre-contemplation stage as shown in Table 2.7. All classes, at baseline, reported trying to change three (1; 6; 9) of the 10 steps, and were considered to be in the action/maintenance stage for these behaviours. All classes were in the contemplation stage, thinking in changing habits for steps 7 and 8. Also, all classes, except one (class F) were on the preparation stage for steps 2 and 10, which meant they were ready to change soon. For the other steps (3, 4 and 5) children were ranging between the two stages: contemplation and preparation (Table 2.7).

These findings showed that children were thinking about changing or ready for change some of the eating behaviours among the ten steps introduced, which was promising for the involvement needed to the PHS-pro.

**Table 2.7.** Children’s stage of readiness to change behaviours based on the “10 steps to be healthier” list

<b>Stages of Change</b>	<b>Class A (n=19)</b>	<b>Class B (n=27)</b>	<b>Class C (n=28)</b>	<b>Class D (n=27)</b>	<b>Class E (n=22)</b>	<b>Class F (n=26)</b>	<b>Class G (n=27)</b>	<b>Class H (n=27)</b>	<b>Class I (n=26)</b>
<i>Pre Contemplation</i>	-	-	-	-	-	-	-	-	-
<i>Contemplation</i>	3	4	4	3	5	2	5	7	4
	4	5	5	5	7	5	7	8	7
	7	7	7	7	8	7	8		8
	8	8	8	8	8	8			
<i>Preparation</i>	2	2	2	2	2	3	2	2	2
	5	3	3	4	3	4	3	3	3
	10	10	10	10	4	10	4	4	5
<i>Action Maintenance</i>					10		10	5	10
	1	1	1	1	1	1	1	1	1
	6	6	6	6	6	6	6	6	6
	9	9	9	9	9	9	9	9	9

<b>10 steps to be healthier</b>	
1. Daily breakfast intake	6. Two snacks midmorning and afternoon
2. Eating vegetables soup to start lunch and dinner	7. Avoiding high rich fat food
3. Eating a colourful diet	8. Reducing salt
4. More fruit: three different fruits each day	9. Drinking water
5. Switches meals: balance between meat and fish	10. Regular physical activity and watching the weight

### **- The literary contest**

Of the 227 children, 165 (72.7%) enrolled voluntary to participate in the literary contest, as a group or individually for developing short stories. Sixteen stories met the rules of the contest and were accepted for the jury evaluation. This activity involved 41 children from the nine classes (Table 2.8). The winner story was from class H and was written by four boys.

**Table 2.8.** Short stories accepted for the literary contest by class

Short stories	Class A	Class B	Class C	Class D	Class E	Class F	Class G	Class H	Class I
Number of stories	1	2	2	6	1	1	0	3	0
Number of children	1	5	5	16	3	3	0	8	0

## 2.7 DISCUSSION

This study describes the PHS-pro design and implementation with its educational components and the process evaluation. The PHS-pro intended to improve the eating behaviours and physical activity of grade-6 children for a healthy nutritional status.

Since the worldwide well recognised inadequacy of young people’s eating behaviours is the low income of F&V, one of the main priorities of the PHS-pro was to encourage the consumption of these foods among Portuguese children. Educational components and related assessments tools were designed and selected to achieve these goals: improving F&V consumption, by making children aware of the importance of an adequate intake of such foods, and guiding them to other healthy choices over each day.

The theoretical approach to support the development of the ideas to build the educational components and implement the programme was based on the TTM of Prochaska and colleagues (2008).

Several strategies were combined to collect different data, both quantitative and qualitative, which helped to evaluate the programme as a whole. Details of these analyses are presented in Chapters 3, 4 and 6 of this thesis. Here the implementation of the PHS-pro is analysed by the participants’ views on the several components of the PHS-pro intervention. Children and teachers gave their inputs concerning the educational components and procedures implemented over the programme.

Understanding children needs and interests as well as seeking for an active participation for healthy solutions were a permanent concern of the programme, so that they could build and developed skills for adopting adequate eating behaviours and other related lifestyle habits. In this way, the participatory method approach was used (Fernandes, 2009; Simovska, 2012; Soares et al., 2004), and children were asked to take part in several activities: the selection of topics, participating actively in the learning modules by expressing

attitudes, opinions, and spontaneous doubts. Moreover, the challenge of creating short stories in a literary contest and the workshop “Cook is Science” were included and conceived to be pedagogical helpers, providing participation, promoting cohesion and increasing self-determination (Fernandes, 2009; Griebler, Rojatz, Simovska, & Forster, 2014; Sinclair, 2004).

Regarding children participation, the outcome findings showed a good acceptance and compliance. The selection of topics and the workshop participation were generally agreed by the entire sample. Similarly, the learning modules were very successful among children, because topics were adapted to children’s profile and needs, which also simplified the process of motivation for behaviours change, as acknowledged in the assessment of the baseline stage change. The literary contest was accepted by 73% of children, despite only 18% (N=41) were submitted to the contest. By contrast, the seven 3-day food records were the less approved activity, but of the seven deliveries, the returning was steadily above the 60% over the PHS-pro intervention.

Additionally, perceptions of children and teachers about how the programme components were conducted and reached to them during the intervention were examined. Of all the components, the food record application was considered tedious receiving the worst opinion from a large part of children, and confirmed by teacher’s inputs. This reaction could be justified because the food record was applied several times, becoming a repetitive task over the intervention. Teachers identified the repetitive application of the food record as one important threat for the successful implementation of PHS-pro. Although, the food record monitoring was crucial to evaluate the effectiveness of the programme, it was recognized as a specific barrier to a sustainable implementation in a long-term. As an assessment tool, the food record allowed the access of relevant information, highly useful for conducting interventions with young people: children’s food choices and eating habits patterns, identifying trends, drawing conclusions and providing information for future interventions (details of food record application can be seen in Chapter 4). The main reason of the repeated food record use was justified because it was of most importance to collect information continuously for monitoring behaviours change, allowing assessing the effectiveness of the different educational modules as well as the PHS-pro intervention as a whole. However, such finding can help to improve this process, pointing that other potential strategies must be investigated and should be integrated in future interventions to adapt the food record application.

Children’s perceptions about their own eating behaviours during the implementation programme showed that they were able to identify their own positive changes, indicating

improvements in daily servings of fruit and vegetable soup. This can explain why the majority of children supported the idea that the PHS-pro can help young people eating healthier.

Teachers highlighted several strengths and opportunities of the programme, confirming the successful strategies implemented, and reinforced by the suggestion of extending the programme to other school grades. Also, threats and weakness were identified, in particular the need of reaching closer to parents by increasing the contacts during the PHS-pro, and highlighted the influence of the teachers’ motivation on the PHS-pro, which may, subsequently, strengthen the intervention or might become into a great barrier not easily perceived. Therefore, difficulties in reaching to some teachers or in motivating them to participate in the programme should be given special attention.

Moreover, these findings are very useful in the development of improvements to be incorporated on future applications of the PHS-pro in order to increase acceptance of participants and be sustainable in long-term intervention. Besides, these participants’ practical suggestions must be considered in the designing of future interventions.

An important strength of this study was the theoretical support of the programme grounded on TTM, the stages of change and the processes of change, which were applied for the designing and the overall planning of the PHS-pro components, for the assessment of children’s baseline stage of change, allowing to measure the readiness to change. Additionally, the application of the participatory methodology enabled to engage children and meet their needs, assuming them as active participants for their own change process. Since children were motivated, and to a certain point, they were ready for taking specific steps to healthier habits, the participatory approach facilitated the implementation and met children’s expectations.

Other strength was the early planning of the programme, conciliating all participants and stakeholders schedules, which allowed that all activities and components of the PHS-pro were carried out in accordance with the conceptual planning and embedded in the school year activities. Another strength is related to the research design, being able to gather two similar groups of children for comparison, allowing to evaluate the effectiveness of the PHS-pro between the IG in a school and the CG in the other 3 schools.

It is also important to mention some limitations of this study. Firstly, self-reported data from children questionnaires can lead to bias, and methodologies for analysing qualitative data also can generate a wide range of dimensions and categories, leaving a large room for subjective interpretation. However, to minimize these influencing factors, the inclusive process of collecting data was chosen, and categories were added to reflect

children's inputs of each component-evaluated (Pope et al., 2000) with additional triangulation with teachers' views (Mays & Pope, 2000). Secondly, the use of questionnaires not previously validated, since the programme was implemented for the first time and these tools were specifically tailored to analyse the implementation. Participants who were more committed, might have selected positive answers, yet these questionnaires sought for inputs of what went wrong during the implementation, searching for barriers and limitations with the aim of improving the programme, rather than appointing what work well. Therefore, it was possible to decrease the risk of the confirmation bias by seeking disapproval observations of participants (Nickerson, 1998). Thirdly, although parental involvement was included, it was restricted to two moments, at the onset of the PHS-pro and at the end of it. This strategy was intentional, because PHS-pro was a pilot version and it was of highest importance to investigate the impact of the components and strategies designed to improve children's skills for healthy choices. In this research, the PHS-pro sought children to develop their own responsibility in a real world setting, with the access of healthy environments at home and at school, rather than increasing parental supervision. Children should learn how to deal with the current scenario of food choices in order to take wise and healthful decisions. This can be more powerful for a behaviour change process than actions focused in making restrictions or creating environmental adaptations using parents' involvement to improve the living conditions of children. In future interventions, PHS-pro should wisely include strategies of communication and educational tools to improve parental skills, which can help them to support their children. Also, teachers and school community can have a wide participation, although there will always be some who will not be receptive.

In sum, these findings suggest that children's participation must be highly considered to increase their motivation in order to foster positive behavioural change, and children's inputs can lead to a better acceptance of the intervention and better outcomes.

PHS-pro intended to change daily behaviours by engaging children in healthy choices and behaviours to improve children's nutritional status. However, to achieve all of these goals, the programme has to be implemented in a long-term continuous process; this is indeed a necessary condition for reducing effectively the overweight and obesity prevalence.

To the best of our knowledge, the PHS-pro is the first formal Portuguese programme model to apply the stages of change and the core constructs of the Transtheoretical Model (TTM), for developing skills towards healthy behaviours among Portuguese children over a full school year. This research is important from the health promotion perspective because it examined dynamically new approaches and has opened new pathways to take action in the

prevention of overweight and obesity among children.

## Chapter 3

### *Study 2: Effectiveness of the “Planning Health in School” programme (PHS-pro): guiding children to adopt healthy habits, improving nutritional status*

#### ABSTRACT

**Background:** Effective interventions for guiding children to change habits are needed to tackle overweight and obesity. This study evaluates the effectiveness of “Planning Health in School” programme (PHS-pro) on children's nutritional status, a non-randomized control group pretest-posttest trial conducted at elementary schools of a Portuguese Municipality.

**Methods:** A total of 504 children of grade-6, aged 10-14 years old were assigned in two groups: children of one school as the intervention group (IG); three schools as the control group (CG). Anthropometric measures (height, weight, waist circumference, BMI and waist-to-height ratio (WHtR)) and lifestyle behaviours (eating, physical/sedentary habit questionnaire) were assessed at baseline and repeated after PHS-pro. Priorities of PHS-pro focused on adequate intake of fruit and vegetables; decreasing high sugar food and beverages, high fat and energy dense food consumption; increasing physical activity and decreasing TV watching.

**Results:** Children of IG grew significantly taller more than the CG ones ( $p < 0.001$ ). Waist circumference had reduced significantly in IG (-0.4 cm) whereas in the CG had increased (+0.3 cm;  $p = 0.015$ ) and the WHtR of IG showed a significant reduction ( $p = 0.002$ ) compared with CG. After PHS-pro, IG children consumed significantly fewer soft drinks ( $p = 0.043$ ), ate more fruit and vegetables daily compared with CG. Physical activity time increased significantly in IG from a median of 23.58 to 27.88 min/day ( $p = 0.022$ ), while CG children maintained the same level of physical activity, except 5% of them that increased physical activity time (baseline P95: 62.18 and follow-up P95: 79.28 min/day;  $p = 0.019$ ).

**Conclusion:** The PHS-pro did improve anthropometric outcomes effectively leading to better children nutritional status and healthier lifestyle. These findings are promising, suggesting that PHS-pro intervention can contribute to prevent children's overweight and obesity.

**Keywords:** obesity prevention, school-based Intervention, nutritional status, eating behaviours, physical activity

### 3.1 BACKGROUND

Overweight and obesity have spread worldwide very fast in the last thirty years with children being the mostly affected (Lobstein et al., 2015). The prevalence of this serious problem in children has already exceeded the 20% in all Europe (Branca et al., 2007).

According to the last update of the World Obesity Federation (2014) more than 30% of Portuguese children are overweight or obese, with girls and boys occupying, respectively, the second and fourth positions in all the European countries. Two previous studies have found these results in Portuguese children and adolescents (Gouveia, Pereira-da-Silva, Virella, Silva, & Amaral, 2007; Padez et al., 2005).

Obesity is no longer seen as the simple result of a daily and chronic imbalance between consumed and expended calories but rather recognized as a complex problem with multiple etiological overlapping factors. Biological factors, where genetics contributes to one third of obesity cases (Bradford, 2009), do not seem to play the major role. Indeed, environmental factors, such as unhealthy eating and inactivity, inappropriate food system and transportation resources are seen as the major drivers to explain the dimension of obesity (De Bourdeaudhuij et al., 2009; C. B. Ebbeling, Pawlak, & Ludwig, 2002; Swinburn et al., 2011). Children live with excessive availability of high energy dense foods complemented by a lack of energy expenditure (Ambrosini et al., 2012; Martens et al., 2005; Sebastian, Cleveland, & Goldman, 2008).

The consequences of being overweight and obese during growth are well documented, showing a general risk in physical and psychological health. Obese children are more likely to experience mental health problems such as depression or anxiety, low self-esteem, bullying and behaviour problems than non-obese, and also exhibit a higher frequency of cardiovascular risk factors like high blood pressure, dyslipidaemia, hypertension, insulin resistance plus other clinical consequences as asthma, type I diabetes and abnormalities of foot structure (Alberga et al., 2012; Reilly et al., 2003). Furthermore, a large body of evidence indicates that obesity in youth imposes an even larger burden in adulthood with significant increase risk of premature mortality with substantial and adverse long-term consequences as cancer, cardiovascular diseases and diabetes (Reilly & Kelly, 2011).

Considering the current knowledge and the delay for tackling the epidemic, it is urgent to act. The focus must be on the development of effective interventions carrying away new perspectives and solutions, conducting children to change behaviours and making them understand what is important for them now and will be crucial in their future. Recent evidence



indicates school-based intervention programmes as the most appropriate approach to educate young people and promote healthy habits to reduce rates of overweight and obesity (Foster et al., 2008; Katz, 2009).

Bearing this in mind, an educational intervention called “Planning Health in School” programme (PHS-pro) was designed and implemented based on the Transtheoretical Model (TTM) of behaviour change so children could progress through the five stages developed by Prochaska and colleagues (2008).

We hypothesized that the implementation of PHS-pro, an educational intervention about healthy eating and active living issues in grade-6 children, over an academic year, would lead to positive changes in their anthropometric measures and nutritional status. The primary aim was to determine anthropometric changes on children following the PHS-pro as compared with the control group; the secondary aim was to assess their eating and other lifestyle behaviours changes.

## **3.2 METHODS**

### **3.2.1 Participants**

A non-randomized control group pretest-posttest trial was conducted between September 2011 and June 2012 at the four existing elementary schools of a municipality integrated in the second largest metropolitan region of Portugal – Porto, Trofa.

Schools and participants were assessed on several environmental factors to ensure equivalence and organize two balanced samples: school grade, nutrition and health-related school curriculum, textbooks, physical education classes and school food services.

A total of 504 children were registered in grade-6: 47.6% of children attended one school and was selected for the intervention group (IG) while the other three schools served as the control group (CG). No chance of contamination between groups was possible. Random assignment of children among different classes and schools to be the CG or IG was not possible due to practical reasons of working and it would generate bias in outcome results. Indeed, synergies should be created over daily contacts between subjects of IG for a successful implementation of the programme in a school environment (Leedy, 1996).

Ethical permission for this study was obtained from each Pedagogical School Board.

Parents were invited for a school meeting and were fully informed about the study procedures, risks and benefits of participation, confidentiality and signed an informed consent. Similar procedure was delivered to children on the first day of school.

Of the 504 children recruited, 26 (5.2%) were excluded: one refused to participate, four moved to another school and 21 had special education needs.

Inclusion criteria for participants were the following: complete data of baseline and follow-up assessments, not receiving any nutritional intervention outside the school, taking no medication that might interfere with body metabolism or associated with weight change. The final sample was composed of 449 children: 219 in IG and 230 in CG.

### **3.2.2 Intervention**

An educational intervention to promote healthy eating and active living in children was implemented over an academic year in the IG school only. For it, several priorities were set based on international guidelines (WHO – World Health Organization, 2003): *(i)* adequate consumption of fruit and vegetables (F&V) - five servings/day; *(ii)* decreasing high sugar food and beverage intake *(iii)* decreasing high fat and energy dense food consumption; *(iv)* one hour of physical activity daily and TV watching below two hours/day.

The PHS-pro was designed to produce a strong cognitive, attitudinal and behavioural impact rather than just build up on limited advices like “eat less, move more” (Sharma & Padwal, 2010). For this reason, the intervention was based upon the TTM, supporting behaviours change as a process, in which children progress through five-stages moving from inaction to maintenance of healthy behaviours. In addition, the core constructs of TTM (processes of change, decision balance, self-efficacy) were also applied for supporting their progress across stages (James O Prochaska et al., 2008).

The educational components of the intervention consisted of a set of eight learning modules, which followed the five-stages of TTM. According to the participatory methodologies, (Soares et al., 2004) children selected eight topics from a list of 16 about nutrition and physical activity. The modules were implemented monthly for 30 to 45 minutes in the Natural Science classes. The core constructs of TTM were used to engage children to participate actively for increasing knowledge, developing competencies for decision-making on healthy choices. The intervention was delivered by a nutritionist and supported by the teacher. The process of behaviour change was monitored through food records (M. Vieira & G. S. Carvalho, 2013) as described in Chapter 2.

For PHS-pro efficient implementation, several activities were carried out with teachers’ support: a literary contest under the healthy lifestyle’s issue and a workshop called “Cooking is science”, also detailed in Chapter 2.

Parental involvement was required in two meetings for encouraging parents to increase F&V availability at home and support children’s behaviours changes. In addition, the availability of F&V in the school canteen was assessed periodically over the intervention.

**3.2.3 Measurements**

Two evaluations were carried out: baseline (September 2011; first two school weeks) and follow-up (May/June 2012; last two school weeks). Each evaluation included: anthropometric measures for nutritional status; eating, physical, sedentary behaviours and food knowledge assessed by a self-reporting questionnaire (Table 3.1).

**Table 3.1.** Data collection for evaluation

Process evaluation	Measurements
Anthropometric measures	Height, Weight, Waist Circumference (WC) Calculation of BMI (Body Mass Index) and Waist to Height Ratio (WHtR)
Self- reporting questionnaire	Age, parents’ level of education, occupation and household Food frequency questionnaire 58- item Food knowledge based on “Portuguese food wheel” Physical activity, including sport participation Sedentary behaviours: watching TV, play computer & videogames

**- Anthropometric measures**

Height, weight and waist circumference measures were collected during physical education classes (shorts, t-shirt without footwear), using standard procedures (WHO – World Health Organization, 1995). Height was measured to nearest 0.1cm using a portable stadiometer (Seca model 214, Germany). Weight was recorded to the nearest 0.1kg using a portable digital scale (Seca model robusta 813). Waist circumference (WC) was assessed in the

anatomical landmark midpoint between the lowest rib and the iliac crest at the end of expiration, and was taken three times to improve precision (Klein et al., 2007).

BMI values for normal weight, thinness, overweight and obesity were defined using cut-off points of Cole and collaborators (2000; 2007). WC was classified according UK reference percentiles to gather an overview of adiposity due to its correlation with intra-abdominal fat mass (H. D. McCarthy et al., 2001), and waist-to-height ratio (WHtR) calculated, dividing WC by height (H David McCarthy & Ashwell, 2006). Indeed, BMI used alone to assess improvements on nutritional status is not reliable due to its low sensitivity for body fat percentage, whereas WC and WHtR can identify accurately fat tissue changes (Brambilla et al., 2013). Height, weight and BMI for age and sex-specific z-scores were also obtained to give reliability for comparative analysis with international studies (Pan & Cole, 2008).

#### **- Lifestyle behaviours and food knowledge**

A self-reporting questionnaire was used to collect eating habits, physical activity, sedentary behaviours and food knowledge. Participants were asked to report their usual food consumption on a weekly basis with a 58-item food frequency questionnaire (FFQ). The guidelines by Cade and colleagues (2002) were followed to organize the FFQ and the food list adapted from an instrument developed by Lopes (2000) to suit to PHS-pro priorities. Answers were displayed on a 5-point ordinal scale, ranging from never (0) to everyday (4), as used by Block (Thompson & Byers, 1994).

Food frequency consumption data allowed evaluating children’s health-risk eating habits. Five food clusters were created according to PHS-pro priorities and a score system was introduced to allow an estimation of servings per day from the times-per-week system as proposed by Wakimoto and colleagues (2006). The five category options for answering in FFQ were recoded into outcome variables: (i) never = 0; (ii) once a week = 0.142; (iii) two to four times a week = 0.357; (iv) four to six times a week = 0.714; (v) everyday = 1. Thus, for each response a score was assigned to give the estimation of servings per day.

Food items were grouped in terms of providing central nutrients (vitamins, minerals and dietary fibers), fats or free sugars. Accordingly, five food clusters were created: (i) F&V including six-items: fruits, vegetable soup at lunch, vegetable soup at dinner, salad or greenery at lunch, salad or greenery at dinner, fresh fruit juices; (ii) High energy dense food, including two-items: pastry (croissants, panikes, donuts, cakes, pastries), cookies/biscuits; (iii) Soft drinks, including two-items: soda, added sugar squash juices; (iv) High sugar food,

including six-items: chocolate, candies, gums, ice-creams, marmalade (jelly, jams), sugar; (v) High fat food, including three-items: homemade French fries, chips, rissoles (pasties, croquettes).

Physical activity was assessed using four-items of participation in organised sport activities out of school and number of hours per week. Response options ranged from “never” to “7 or more hours” in a total of six categories. School curriculum included two physical education classes with a total of 135 minutes/week, which gives a mean of 19.28 minutes daily.

Sedentary behaviours were assessed with two-items asking the number of hours spent watching TV and playing videogames daily. To compare time spent in physical activity recommendations with sedentary behaviours, children answers were calculated in minutes/day.

Questions regarding physical activity and sedentary behaviours were adapted from the Youth Risk Behaviour Survey of 2009 (Eaton et al., 2010).

Food knowledge was assessed with one open question regarding the “Portuguese food wheel” knowledge and seven closed-ended multiple choice questions about recommended food portions (Rodrigues et al., 2006). A score of 1 and 0 was assigned for each correct and incorrect answer respectively, with a possible total score of 7.

The questionnaire was pilot tested to an eligible sample of thirty children from same region, grade and age, but not involved in the study.

### **- Statistical analysis**

The normality of the data was verified with Q-Q plots. Unpaired or paired two-sided t-test was used for comparison normally distributed data and were characterised by means and standard deviations (SD). In cases of non-normally distributed variables, Mann-Whitney or Wilcoxon test were applied and data were characterised by medians (Q2; 50th percentile) and interquartile ranges (IQR: [Q1-Q3]; 25th-75th percentile) or 5<sup>th</sup> and 95<sup>th</sup> percentiles (P5;P95) when differences were not visible with IQR. Chi-square test, Fisher's test, were used to compare categorical variables, which were characterised by absolute (n) and relative (%) frequencies.

Changes in anthropometric variables were computed as the difference between measures at baseline and follow-up. The intervention effect identified as Delta ( $\Delta$ ) is the change difference of anthropometric variables between groups. A multiple linear regression analysis was applied to make the adjustment of significantly different variables. Values of

$p < 0.05$  were considered significant. SPSS statistical software package version 22.0 was used for data analysis.

### 3.3 RESULTS

Demographical and socio-economical characteristics of IG and CG children (Table 3.2) showed no significant differences at baseline regarding age, gender and maternal education level. However, significant differences between groups were found regarding paternal education level ( $p=0.017$ ), maternal and paternal occupation ( $p=0.020$  and  $p=0.013$ , respectively).

Statistical analysis of IG and CG children anthropometric data at baseline (Table 3.3) showed no significant differences, except for weight: the CG was significantly heavier ( $p=0.012$ ) and consequently the BMI was higher ( $p=0.017$ ). Also CG overweight (33.0%) and obese (15.2%) children were in significantly higher percentage ( $p=0.038$ ) as compared with IG children, 27.4% and 10.5%, respectively. Also, a clear majority of the studied sample was found to be above the 90<sup>th</sup> percentile of WC by age and sex (61.9%).

#### *- Changes in anthropometric measures*

As expected, both groups grew in height and weight over the study period (10 months). However significant differences between groups were found. Table 3.4<sup>1</sup> presents the changes in anthropometric measures by group and gender following the intervention. Regarding the height, significant differences between groups were found ( $p < 0.001$ ). The IG grew significantly taller than the CG among girls (+0.4cm;  $p=0.011$ ) and boys (+0.5cm;  $p=0.003$ ). Although the CG was heavier at baseline, both groups gained almost the same weight (IG: 2.5kg; CG: 2.4kg). Naturally the BMI increased between baseline and follow-up in both groups, but the increase of CG ( $0.2\text{kg}/\text{m}^2$ ) almost doubled compared with IG ( $0.1\text{kg}/\text{m}^2$ ).

Significant differences were also found in WC ( $p=0.015$ ): IG children showed a decrease while CG had an increase. Gender effects in WC values were also found among girls (IG: -0.5cm and CG: +0.4cm;  $p=0.023$ ). Considering that, girls of CG increased more than boys (+0.4 v. +0.2cm, respectively) whereas girls of IG reduced more than boys (-0.5 v. -0.3cm). WHtR and z-scores variables exhibited the same statistical behaviour as their

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<sup>1</sup> Table 3.4 is presented with more than two decimal places in order to allow looking at the differences found.

matching variables.

**Table 3.2.** Demographical and socio-economical characteristics of intervention group (IG) and control group (CG)

	Total n= 449		IG n=219		CG n=230		p-value
Age (years), <i>mean (SD)</i>	11.2	0.6	11.2	0.6	11.2	0.64	0.736 <sup>a</sup>
Gender, <i>n (%)</i>							0.368 <sup>b</sup>
Boys	226	50.3	115	52.5	111	48.3	
Girls	223	49.7	104	47.5	119	51.7	
<b>Maternal Education, <i>n (%)</i></b>							0.058 <sup>a</sup>
Do not know	27	6	16	7.3	11	4.8	
Primary school (grade 4)	91	20.3	40	18.3	51	22.2	
Secondary school (grade 6)	114	25.4	46	21	68	29.6	
(grade 9)	108	24.1	52	23.7	56	24.3	
(grade 12)	82	18.3	50	22.8	32	13.9	
University degree	27	6	15	6.8	12	5.2	
<b>Paternal Education, <i>n (%)</i></b>							0.017 <sup>a,*</sup>
Do not know	45	10	28	12.8	18	7.8	
Primary school (grade 4)	86	19.2	37	16.9	49	21.3	
Secondary school (grade 6)	157	35	66	30.1	91	39.6	
(grade 9)	78	17.4	47	21.5	31	13.5	
(grade 12)	52	11.6	30	13.7	22	9.6	
University degree	30	6.7	11	5	19	8.3	
<b>Maternal Occupation, <i>n (%)</i></b>							0.020 <sup>b,*</sup>
No answer	11	2.4	10	4.6	1	0.4	
Unemployed	80	17.8	39	17.8	41	17.8	
Worker	355	79.1	168	76.7	187	81.3	
Retired	3	0.7	2	0.9	1	0.4	
<b>Paternal Occupation, <i>n (%)</i></b>							0.013 <sup>b,*</sup>
No answer	18	4	13	5.9	5	2.2	
Unemployed	35	7.8	22	10	13	5.7	
Worker	393	87.5	184	84	209	90.9	
Retired	3	0.7	0	0	3	1.3	

<sup>a</sup>,  $\chi^2$  test; <sup>b</sup>, Fisher's exact test.

\*  $p < 0.05$ .

Given these results, and considering IG and CG children showed a significant difference for weight at baseline, we carried out a multiple linear regression analysis in order to adjust the weight variable and find out whether the significant differences found in height, WC and WHtR have remained. After adjustment, the significant differences found in height, WC and WHtR between the two groups persist. The results are presented in Appendix 3.1.

**Table 3.3.** Anthropometric measures of intervention group (IG) and control group (CG) at baseline

	<b>Total n=449</b>	<b>IG n=219</b>	<b>CG n=230</b>	<b><i>p-value</i></b>
<b>Anthropometric data, Mean (SD)</b>				
Weight (kg)	46.1 (1.1)	44.7 (11.1)	47.4 (11.5)	0.012*
Weight z-score	1.0 (1.1)	0.9 (1.1)	1.2 (1.1)	0.005*
Height (cm)	148.8 (7.1)	148.3 (7.0)	149.3 (7.2)	0.11
Height z-score	0.6 (1.0)	0.5 (1.0)	0.7 (1.0)	0.066
Waist Circumference	74.8 (1.1)	73.8 (10.8)	75.7 (10.9)	0.065
BMI (kg/m <sup>2</sup> )	20.6 (4.0)	20.2 (4.0)	21.1 (4.1)	0.017*
BMI z-score	1.0 (1.2)	0.8 (1.3)	1.1 (1.2)	0.008*
WHtR (waist-to-height ratio)	0.5 (0.1)	0.5 (0.1)	0.5 (0.1)	0.135
<b>IOTF Classification, n (%)</b>				0.038 <sup>b,*</sup>
Underweight	16 (3.6)	12 (5.5)	4 (1.7)	
Normal	239 (53.2)	124 (56.6)	115 (50.0)	
Overweight	136 (30.3)	60 (27.4)	76 (33.0)	
Obesity	58 (12.9)	23 (10.5)	35 (15.2)	
<b>WC Percentiles, n (%)</b>				0.106 <sup>b</sup>
P5	0 (0.0)	0 (0.0)	0 (0.0)	
P10	3 (0.7)	3 (1.4)	0 (0.0)	
P25	12 (2.7)	9 (4.1)	3 (1.3)	
P50	44 (9.8)	23 (10.5)	21 (9.1)	
P75	64 (14.3)	31 (14.2)	33 (14.3)	
P90	48 (10.7)	27 (12.3)	21 (9.1)	
P95	278 (61.9)	126 (57.5)	152 (66.1)	

<sup>a</sup> student's t-test; <sup>b</sup>  $\chi^2$  test.

\*  $p < 0.05$ .



**Table 3.4.** Changes in anthropometric measures for intervention (n=219) and control group (n=230)

	IG $\Delta$		CG $\Delta$		<i>p</i> -value
	Mean	SD	Mean	SD	
<b>Height (cm)</b>	3.5944	1.3127	3.0914	1.3055	<0.001 <sup>a,*</sup>
Girls	3.4018	1.2548	2.9634	1.2789	0.011 <sup>a,*</sup>
Boys	3.7685	1.3447	3.2286	1.3255	0.003 <sup>a,*</sup>
<b>Height z-score</b>	0.0449	0.2382	-0.0212	0.2445	0.004 <sup>a,*</sup>
<b>Weight (kg)</b>	2.4493	2.1711	2.4078	2.3756	0.847 <sup>a</sup>
Girls	2.6058	2.1822	2.5966	2.3211	0.976 <sup>a</sup>
Boys	2.3078	2.1608	2.2054	2.4269	0.738 <sup>a</sup>
<b>Weight z-score</b>	-0.0189	0.2441	-0.0316	0.2521	0.588 <sup>a</sup>
<b>BMI (kg/m<sup>2</sup>)</b>	0.1216	0.9395	0.2078	1.0113	0.351 <sup>a</sup>
Girls	0.2445	0.9379	0.3374	0.9398	0.462 <sup>a</sup>
Boys	0.0105	0.9310	0.0689	1.0695	0.662 <sup>a</sup>
<b>BMI z-score</b>	-0.0762	0.2971	-0.0632	0.3264	0.659 <sup>a</sup>
<b>Waist Circumference (cm)</b>	-0.3745	2.8105	0.2970	2.9844	0.015 <sup>a,*</sup>
Girls	-0.4708	3.0458	0.4297	2.8240	0.023 <sup>a,*</sup>
Boys	-0.2875	2.5898	0.1546	3.1539	0.250 <sup>a</sup>
<b>WHtR (waist-to-height ratio)</b>	-0.0142	0.0195	-0.0082	0.0204	0.002 <sup>a,*</sup>

IG, intervention group; CG, control group.

( $\Delta$ ) indicates the change observed for the specific variable over the intervention period.

<sup>a</sup>: t-test.

\*:  $p \leq 0.05$ .

### **- Changes on eating habits and physical activity**

Differences between groups on eating habits changes, physical activity and sedentary habits over the intervention are shown in Table 3.5. Regarding eating habits, the five food clusters represent the consumptions of F&V, high-energy dense food, soft drinks, high sugar food and high fat food. Daily consumption of F&V showed a negative change in CG children between baseline and follow-up, decreasing significantly the median value from 3.2 to 3.0 serving/day ( $p=0.002$ ); in contrast, no statistical change was found in IG, but a tendency to increase fruit intake with an improvement of 2.8 to 3.2 servings/day. Regarding soft drinks consumption, IG children reported consuming significantly less, as the median decreased from 0.7 to 0.5 servings/day ( $p=0.043$ ) while CG kept the median 0.5 ( $p=0.097$ ). No evidence was found of the PHS-pro effect on consumption of high sugar, high fat and high dense energy snacks.

Regarding physical activity, baseline data showed half of children of both groups with a physical activity far from the recommended 60-minutes/day (IG: 23.58 and CG: 19.28 min/day). After intervention, the IG significantly increased daily minutes (more 4.30 min/day) spent on physical activities ( $p=0.022$ ), while CG children maintained the same level of physical activity, except 5% of them that increased the time of physical activity (Baseline

P95: 62.18 and Follow-up P95: 79.28 min/day;  $p=0.019$ ). For the time spent watching TV plus playing videogames no significant differences between groups were found either at baseline and follow-up. However, 5% of the IG children reported significantly more time spent with these activities ( $p=0.006$ ).

**Table 3.5.** Changes on eating habits, physical activity and sedentary habits for intervention (n=219) and control group (n=230)

	Baseline			Follow-up			<i>p</i> -value of change
	IG Median [IQR] or (P5;P95)	CG Median [IQR] or (P5;P95)	<i>p</i> -value	IG Median [IQR] or (P5;P95)	CG Median [IQR] or (P5;P95)	<i>p</i> -value	
<b>Eating habits, servings/day</b>							
F&V	N=206 2.83 [1.71-4.37]	N=217 3.19 [2.26-4.35]	0.167 <sup>b</sup>	N=207 3.19 [2.05-4.42]	N=219 3.00 [1.77-4.12]	0.158 <sup>b</sup>	IG:0.068 <sup>a</sup> CG:0.002 <sup>a,*</sup>
Soft drinks	N=214 0.70 [0.28-1.14]	N=226 0.49 [0.28-1.06]	0.072 <sup>b</sup>	N=213 0.49 [0.28-1.06]	N=220 0.49 [0.28-1.06]	0.132 <sup>b</sup>	IG: 0.043 <sup>a,*</sup> CG:0.097 <sup>a</sup>
High sugar food	N=214 0.84 [0.42-1.55]	N=226 0.91 [0.42-1.49]	0.944 <sup>b</sup>	N=212 0.91 [0.44-1.41]	N=225 0.91 [0.42-1.47]	0.636 <sup>b</sup>	IG: 0.591 <sup>a</sup> CG: 0.401 <sup>a</sup>
High fat food	N=216 0.49 [0.28-0.99]	N=221 0.49 [0.28-0.84]	0.573 <sup>b</sup>	N=212 0.49 [0.28-0.84]	N=224 0.49 [0.28-0.84]	0.541 <sup>b</sup>	IG: 0.643 <sup>a</sup> CG: 0.615 <sup>a</sup>
High energy dense food	N=212 0.70 [0.35-1.06]	N=226 0.49 [0.35-1.00]	0.777 <sup>b</sup>	N=219 0.70 [0.35-1.06]	N=225 0.49 [0.28-1.00]	0.090 <sup>b</sup>	IG: 0.253 <sup>a</sup> CG: 0.478 <sup>a</sup>
<b>Physical activities, (min/day)</b>							
	N=207 23.58 (19.28;72.44)	N=221 19.28 (19.28;62.18)	0.171 <sup>b</sup>	N=217 27.88 (19.28;62.18)	N=222 19.28 (19.28;79.28)	0.104 <sup>b</sup>	IG:0.022 <sup>a,*</sup> CG:0.019 <sup>a,*</sup>
<b>Watching TV plus videogames, (min/day)</b>							
	N=211 90.0 (45.0;390.0)	N=223 90.0 (45.0;450.0)	0.335 <sup>b</sup>	N=218 90.0 (45.0;450.0)	N=223 90.0 (45.0;450.0)	0.877 <sup>b</sup>	IG:0.006 <sup>a,*</sup> CG: 0.235 <sup>a</sup>

IG, intervention group; CG, control group; IQR, interquartile range; P5, percentile 5; P95, percentile 95.

<sup>a</sup>: Wilcoxon test.

<sup>b</sup>: Mann-Whitney test.

\*:  $p \leq 0.05$ .

**- Changes on Food Knowledge**

A significant improvement in food knowledge was found in both groups compared to the baseline ( $P<0.001$ ; Table 3.6). Given that the total score could reach 7 points out of 7 questions, after the school-year, in the total sample ( $N=449$ ), only 16 children (7.1%) had the maximum score, being 9 from IG and 7 from CG, showing a modest improvement of the overall score. Careful analysis of questions on both groups showed, CG children had a significant score on Question 2 ( $p=0.002$ ), which means they theoretically identified the most important food group in daily consumption; IG children had a significant improvement on Question 4 ( $p<0.001$ ), meaning more children knew the adequate amount of fruits they needed eating daily, how to do it and when. This was one of the issues developed by the PHS-pro.

**3.4 DISCUSSION**

In this study, near one third (30.3%) of children had a BMI above the  $25 \text{ kg/m}^2$  and about one-eighth (12.9%) above  $30 \text{ kg/m}^2$  being classified as overweight and obese. Additionally, a clear majority of children were above the 90<sup>th</sup> WC percentile, a cut-off value linked to high abdominal fat mass and cardiometabolic risk (Klein et al., 2007). Furthermore, the high prevalence of overweight and obesity was even surpassed by a highly prevalence of children above the 90<sup>th</sup> WC, supporting the urgent need for intervention. These results are in line with other previous Portuguese studies (Gouveia et al., 2007; Leitao et al., 2011; Padez et al., 2005).

Several studies have identified healthy eating and physical activity as the best solution to revert obesity (Swinburn et al., 2011; WHO – World Health Organization, 2009b). Also some school-based interventions have given clear evidence of being successful in obesity control (Katz, 2009; WHO – World Health Organization, 2009b).

The results of this study have showed favorable changes on children's nutritional status participating in the PHS-pro. Boys and girls of IG had a significant height increase and WC reduction; in contrast CG grew less in height and increased the WC. In childhood, a healthy development is characterized by a gradual increase of height and weight, which influences consistently other anthropometric measures, such as the WC. However, the WC can be a marker of adiposity-related morbidity and the increase of WC in these ages may not be considered a healthy outcome (Brambilla et al., 2013; Sardinha et al., 2012).

**Table 3.6.** Food knowledge scores for intervention (IG) and control (CG) groups at baseline and follow-up

	Baseline					Follow-up					p-value of change
	IG N=219		CG N=230		p-value	IG N=219		CG N=230		p-value	
	n	%	n	%		n	%	n	%		
<b>Food Knowledge</b>											
Q1. How many groups have the food wheel?	115	52.5	105	45.7	0.146 <sup>b</sup>	137	62.6	145	63.0	0.915 <sup>b</sup>	IG: 0.032 <sup>a,*</sup> CG: <0.001 <sup>a,*</sup>
Q2. In a daily base, which food group should you consume in greater quantities?	81	37.0	90	39.1	0.640 <sup>b</sup>	103	47.0	142	61.7	0.002 <sup>b,*</sup>	IG: 0.014 <sup>a,*</sup> CG: <0.001 <sup>a,*</sup>
Q3. Which food group is high in fiber foods?	46	21.0	46	20.0	0.792 <sup>b</sup>	60	27.4	66	28.7	0.760 <sup>b</sup>	IG: 0.141 <sup>a</sup> CG: 0.042 <sup>a,*</sup>
Q4. How many portions of fruit should you eat daily?	63	28.8	67	29.1	0.932 <sup>b</sup>	120	54.8	75	32.6	<0.001 <sup>b,*</sup>	IG: <0.001 <sup>a,*</sup> CG: 0.456 <sup>a</sup>
Q5. How many milk glasses should you drink daily?	129	58.9	118	51.3	0.106 <sup>b</sup>	164	74.8	153	66.5	0.052 <sup>b</sup>	IG: <0.001 <sup>a,*</sup> CG: <0.001 <sup>a,*</sup>
Q6. How much sugar should you consume daily?	135	61.6	133	57.8	0.410 <sup>b</sup>	145	66.2	160	69.6	0.446 <sup>b</sup>	IG: 0.320 <sup>a</sup> CG: 0.005 <sup>a,*</sup>
Q7. Which is the healthy dish?	181	82.6	177	77.0	0.134 <sup>b</sup>	184	84.0	181	78.7	0.148 <sup>b</sup>	IG: 0.775 <sup>a</sup> CG: 0.704 <sup>a</sup>
<b>Overall Knowledge Score<sup>†</sup></b>	3.4	1.5	3.2	1.5	0.773 <sup>b</sup>	4.2	1.4	4.0	1.38	0.464 <sup>b</sup>	IG: <0.001 <sup>c,*</sup> CG: <0.001 <sup>c,*</sup>
<b>Knowledge Score</b>											
0	4	1.8	8	3.5		0	0.0	0	0.0		
1	22	10.0	24	10.4		7	3.2	7	3.0		
2	34	15.5	44	19.1		17	7.8	26	11.3		
3	54	24.7	60	26.1		52	23.7	49	21.3		
4	47	21.5	45	19.6		46	21.0	64	27.8		
5	42	19.2	33	14.3		59	26.9	51	22.2		
6	12	5.5	13	5.7		29	13.2	26	11.3		
7	4	1.8	3	1.3		9	4.1	7	3.0		

IG, intervention group; CG, control group; Q1, question 1; Q2, question 2; Q3, question 3; Q4, question 4; Q5, question 5; Q6, question 6; Q7, question 7.

<sup>a</sup>: McNemar-Bowker test. <sup>b</sup>:  $\chi^2$  test. <sup>c</sup>: Wilcoxon test.

<sup>†</sup> Mean and SD. \*  $p < 0.05$ .

There has been little research investigating WC changes in children, the majority of school interventions use BMI as the principal obesity indicator. However, our WC results are consistent with small amount of data that does exist (Sanigorski, Bell, Kremer, Cuttler, & Swinburn, 2008; Taylor et al., 2007).

Additionally, the PHS-pro showed to be effective in improving daily F&V intake, in reducing soft drink consumption, and encouraging the dedication of more time to physical activities. Conversely, CG children did not show any improvements regarding these habits; actually, worse behavioural measures were found: lower daily F&V consumption, less time spent in physical activity and more time in front of screens. Comparable findings to this study were found in a two-year school programme focused on increasing F&V, reducing sweetened drink intake and improving WC (Taylor et al., 2007) and with another programme about soft drink consumption (James, Thomas, Cavan, & Kerr, 2004).

Baseline consumptions of F&V were below the recommendation of 5 servings/day with half of IG children consuming 2.8 and CG 3.2 servings. Favourable changes were observed on daily consumption of F&V in IG children at the end of the intervention, but not in CG. A study held in 33 countries, examining F&V consumption among children, showed that most children do not consume F&V on a daily basis and a significant decrease in fruit consumption has occurred in five countries where Portugal was included (Vereecken et al., 2015) An analysis of seven school-based nutrition programme seeking to increase F&V consumption, has shown weaker results (Howerton et al., 2007) than those of this study.

In the case of high sugar, high fat and high dense energy snacks, no evidence was found of the PHS-pro effect on self-reported consumption. A possible explanation could be that the FFQ is not sensitive enough to detect changes, although it was previously validated for the target population. In future interventions, brief-screening tools to assess specific eating behaviours (F&V or high sugar foods) ought be used for detecting changes, instead of FFQ. This issue was considered during the research design of PHS-pro, but since it was a pilot intervention, a wider questionnaire should give larger perspectives to perceive children's eating behaviours background. On the other hand, eating behaviours of IG over the intervention period were tracked with food records.

Positive changes were found on physical activity of IG children as compared with the CG. At baseline, time spent with physical activities was much below the 60 minutes/day, in both groups. In Portugal, school physical education ensure 135 minutes/week, which gives 19.30 minutes/day, far shorter than 60 minutes/day recommended for children (WHO – World Health Organization, 2003). Half of the children did not practice any sport or other

extra-school physical activity. Time spent with sedentary tasks (watching TV and playing computer games) was found to be very high, with half of the children reporting 90 minutes daily on these activities.

The PHS-pro dedicated only one learning module to active living, and a significant increase of 4.30 minutes/day was obtained. A recent systematic review involving 14326 children to assess the effectiveness of interventions on physical activity showed an increase of 4.00 minutes/day (Metcalf, Henley, & Wilkin, 2012), which is similar to our results. Achieving the balance between time dedicated to sedentary activities and the active ones, rather than limiting time in front of screens was one goal of PHS-pro.

The “Portuguese food wheel” knowledge is part of the grade-6 school curriculum content of Natural Science classes. Both studied groups were equally exposed to this knowledge. Despite the improvements achieved in the overall score by both groups, they were far from the maximum possible score of 7 points. Food knowledge and health matters taught in school are part of the curriculum and can help promote children’s healthier attitudes and choices. However, knowledge is not enough to result in changes to a healthier lifestyle (Hesketh, Waters, Green, Salmon, & Williams, 2005; Worsley, 2002) as children have to transfer knowledge to daily practice.

Educational interventions in the school context can have success in improving health status through daily changes habits as this study showed. Nevertheless, the motivation process for healthy behaviours must be delivered regularly and continuously, allowing the progress over the stages of change as TTM prescribes (James O Prochaska et al., 2008). The promotion of healthy behaviours during childhood has to combine methodologies to encourage children’s participation and monitor their needs, as implemented in the PHS-pro. In contrast, sporadic actions, to fulfil public policy schedules, have shown to be ineffective (Katz, 2009; Stewart-Brown, 2006; Swinburn et al., 2011).

The major strength of this study is the applicability of the programme to the real world in a school context over an academic year. The PHS-pro implementation conciliated school schedules, curriculum contents and infrastructures, school staff and family efforts.

This study has some limitations. The study design was not randomized and there is always a risk of selection bias, however both groups were homogeneous regarding age and gender, had high participation rates and low dropouts. The eating behaviours data were self-reported by children who may not recall data correctly (Livingstone, Robson, & Wallace, 2004). Finally, the study was conducted in a small municipality and results must not be generalized to other populations. However these results are useful to conduct larger studies.

To summarize, the PHS-pro did improve anthropometric outcomes effectively leading to a better nutritional status. The PHS-pro has the potential to guide children for healthy behaviours and contribute to reduce childhood obesity.





## Chapter 4

### *Study 3: Children learn, children do! Results of the “Planning Health in School”, a behavioural-change programme.*

#### **ABSTRACT**

**Background:** “Planning Health in School” programme (PHS-pro) is an educational health programme developed for school grade-6 children. It was designed to improve eating behaviours, in particular the intake of fruits and vegetables, and to guide children for healthy choices. The overall programme with its educational components was designed based on the Transtheoretical Model of stages of change to integrate nutritional knowledge and healthy behaviours, using children’s participatory activities to develop problem-solving and decision-making skills. Therefore, the aim of the present study was to assess the impact of one-school year behavioural-change programme on nine eating behaviours among children.

**Methods:** All grade-6 children of the largest school of Trofa (a suburban city included in the second largest metropolitan area of Portugal, Porto) participated in the PHS-pro and were evaluated throughout the programme implementation in a repeated time-series design. Children’s outcome evaluation was conducted through seven 3-day food records for eating behaviours recorded after each learning module, and through participatory activities to analyse their attitudes, preferences and expectations.

**Results:** Substantial changes were found in several eating behaviours over the programme, supported by children’s motivation for change observed in their attitudes and expectations. Significant changes were observed on vegetable soup ( $p=0.003$ ), milk products ( $p=0.024$ ), and fruit to higher consumption ( $p=0.008$ ), while high-energy dense food ( $p=0.048$ ), and soft drink consumption ( $p=0.042$ ), significantly decreased. No positive effects on fried food, water, vegetables and bread were found.

**Conclusions:** The PHS-pro intervention planned according to the Transtheoretical Model and participation techniques can be effective in developing healthy eating behaviours for guiding young people to a healthy growth.

**Keywords:** health promotion, health educational programme, transtheoretical model, eating behaviours, fruit and vegetables

## 4.1 BACKGROUND

A healthy diet is one of the key-elements to ensure a proper growth during childhood (Gidding et al., 2006; WHO – World Health Organization, 2005). However, at the present time, it is abundantly evident that most children have unhealthy dietary habits, mainly because they do not eat fruit and vegetables (F&V) in sufficient quantities while consume excessively high-fat snacks and high-sugar food and beverages (Ambrosini et al., 2012; Diethelm et al., 2012; Cara B Ebbeling et al., 2012; WHO – World Health Organization, 2009a).

The scientific literature has been warning about the negative impact of such eating pattern, particularly the low F&V intakes, which are associated to obesity and serious chronic diseases, such as diabetes, cardiovascular disease and cancer (Alberga et al., 2012; Reilly & Kelly, 2011).

A primary consideration is to encourage children to eat healthily in order to ensure the adequate dietary intake of central nutrients and micronutrients, based on a wide diversity of food sources, wherein F&V have a large share (Slavin & Lloyd, 2012). A healthy diet can provide all conditions for the optimum growth during childhood and adolescence and prevent all forms of poor nutrition, to move away the main risk factors of obesity epidemic and related chronic diseases (Lobstein et al., 2015). Therefore, helping children in the changing process for better eating behaviours is now a much-needed measure, and school-based health promotion programmes are clearly identified as the most effective strategy to promote healthy habits among young people (Khambalia, Dickinson, Hardy, Gill, & Baur, 2012; Kropski et al., 2008).

A recent systematic review (Waters et al., 2011), assessing 55 international studies reporting health promotion interventions for preventing obesity in children, has found strong evidence to support beneficial effects on children’s health, particularly programmes targeted to children aged 6 to 12 years. Of the 55 examined studies, positive changes were found on children’s eating behaviours in 20 studies regarding nutrition knowledge, eating practices, F&V consumption, energy dense snack foods, sweetened/carbonated drinks, sweet foods and other indicators of better diets (Waters et al., 2011).

For this research work an educational health programme was designed, implemented and evaluated. This “Planning Health in School” programme (PHS-pro) is a school-based intervention aimed at improving children’s eating behaviours for a healthy lifestyle by

implementing a nutritional education programme with a configuration of eight learning modules and delivered monthly over a full school-year. The PHS-pro provided easy-to-use food and nutrition knowledge for healthy choices, increasing skills for better decision-making, as presented in detail in Chapter 2 of this thesis.

The intervention was shown to be effective in improving children's nutritional status, which was the primary outcome of the research (see Chapter 3).

The purpose of this Chapter 4 study is to determine the impact of the eight learning modules on children's eating behaviours and lifestyle along the one school year intervention. Additionally, this work provides detailed information about the circumstances and how children's behaviours and attitudes improved. The effectiveness of the programme was evaluated according to the selected key-behaviour goals of the learning modules and children's eating behaviours changes were assessed using a 3-day food record following each learning module.

## **4.2 METHODS**

### **4.2.1 Study design**

In order to achieve the objectives of this longitudinal study, the research design was based on a repeated time-series design. The time-series strategy consists of taking a series of initial observations and introducing a variable or a new dynamic into the research field, after which another series of observations is made and in which only one group is available (Biglan, Ary, & Wagenaar, 2000; Leedy, 1996). Therefore, a baseline data collection was conducted prior to intervention, followed by a series of repeated measures to determine the influence of the independent variable (the PHS-pro) to provide evidence about the effects of it on children's eating behaviours (see Figure 4.1).

The study period extended from September 2011 up to May 2012 and the data of the present study come from the Phase II of the PHS-pro research corresponding to the implementation of the programme content over one school year; Phase I concerned the designing and development of the educational components, process evaluation of the programme and preparation of the school setting. Both *Phases I* and *II* are described in detail in Chapter 2, section 2.4 and 2.5, respectively.

Baseline Data Collection	PHS-pro intervention														
	<u>Intervention</u>	Data Collection	<u>Intervention</u>	Data Collection	<u>Intervention</u>	Data Collection	<u>Intervention</u>	Data Collection	<u>Intervention</u>	Data Collection	<u>Intervention</u>	Data Collection	<u>Intervention</u>	Data Collection	<u>Intervention</u>
FR0	LM1	FR1	LM2	FR2	LM3	No FR	LM4	FR4	LM5	FR5	LM6	FR6	LM7	FR7	LM8
O1	X	O2	X	O3	X	–	X	O4	X	O5	X	O6	X	O7	X
Sep 2011	Oct 2011	Oct 2011	Nov 2011	Nov 2011	Dec 2011	Dec 2011	Jan 2012	Jan 2012	Feb 2012	Feb 2012	Mar 2012	Mar 2012	Apr 2012	Apr 2012	May 2012

LM (learning module); FR (3-day food record)

**Figure 4.1.** Research design

The PHS-pro learning modules were implemented three weeks after the baseline data collection and evaluations were conducted at monthly intervals except in two distinct periods: in December, the Christmas month to avoid this festive season effects that causing changes in the usual diet; and in May, after the last learning module since the evaluation period overlapped with the last days of school, making not possible to control the return of the usual data collection.

The Pedagogical School Board approved all intervention procedures. Teachers' class coordinators and the Health Promoter Office (HPO) placed themselves available to offer assistance in the developing of the research activities.

#### **4.2.2 Participants**

All 240 grade-6 children in *Napoleão Sousa Marques* School of the municipality of Trofa were recruited to participate in this study. Of these, 11 (4.6%) were excluded of the study: one refused to participate, two moved to another school and eight were special educational needs cases. Consequently, the sample size at the onset of this study was 229 children, but at the end of the study the sample was reduced to 157 children (aged 10 to 14; with 87 girls and 70 boys) due to failing to meet the following criteria: (i) having complete baseline data evaluation (corresponding to the food record zero) (ii) having returned two or more complete food records over the intervention; (iii) having parents' informed consent and their own informed consent for participation.

#### **4.2.3 The intervention**

The implementation of the programme was designed upon the Transtheoretical Model (TTM) to encourage eating behaviour changes and engage children to participate actively in their own process of change (James O Prochaska et al., 2008).

The intervention consisted of eight learning modules focused on the four main goals of the programme, which were based on the international guidelines of WHO (2003): adequate consumption of F&V five-serving/day; decreasing high sugar food and beverage intake (to 10% of free sugar of total daily energy); decreasing high fat and energy dense food consumption; one hour of physical activity and daily TV watching time below two hours.

The eight learning modules’ topics were chosen out of 16 by the children (see Chapter 2, section 2.4.1). Each learning module (LM) emphasized a different topic and a specific behaviour change. The learning modules sequence was as follows: LM1 (“10 steps to be healthier”); LM2 (“Water & milk help you to grow up”); LM3 (“Training everyday to be healthier”); LM4 (“ 3 fruits a day, how much good it does?”); LM5 (“ F&V are essential to life”); LM6 (“Start on moving!”); LM7 (“ The best snacks”); LM8 (“Final game: who has learned about everything?” - a summary of the programme).

A LM session was designed to last 30 to 45 minutes and was scheduled as part of the school Natural Science classes, one per month over the school year. The learning modules goals were to provide nutritional education, identify obstacles and training problem-solving skills, support children to find solutions and strategies, and motivate them to set a personal behaviour change goal and implement it on daily life. All the modules were conducted to follow the TTM stages of change and the processes of change, as presented on Chapter 2, section 2.4.2 and Table 2.1.

Furthermore, in each LM was included a participative activity for supporting children to enhance skills and taking decisions to change their behaviours to healthier ones. This kind of activity enabled children participation as well as their feedback about specific behaviour change goals. Table 4.1 shows the eight modules, describing the scope and the sequence of activities (column 1) the goals (column 2), the behaviours changes goals and the expected outcomes in the food records (column 3).

Additionally, two supportive school activities complemented the learning modules, the workshop “Cooking is Science” and the challenging literary contest as described in Chapter 2, section 2.5.4 and 2.5.5, respectively. These activities were included to generate synergy and social cohesion between children (Griebler et al., 2014; Sinclair, 2004). Also, these activities had the important goal of calling other teachers to participate, and creating relationships between school subjects, especially in the Portuguese language subject.

**Table 4.1.** Learning modules of the intervention and related educational and behaviour change goals

Learning Modules	Educational goals	Behaviour change goals and <i>Expected outcomes in the Food Record</i>
<p><i>Learning module-one (LM1)</i>  <b>“10 steps to be healthier”</b>            (i) Basic principles of healthy eating presentation into a simple 10 step-wise format            (ii) In-group discussion to explore obstacles, solutions/options to meet the goal steps  <i>Activity-one (A1)</i>  <b>Choosing the step, changing for better</b>            Election of the most difficult step between the 10 wise-steps and one step to improve as a behaviour change goal.</p>	<ul style="list-style-type: none"> <li>- Reinforce healthy eating and active living</li> <li>- Recognize short and long-term benefits</li> <li>- Enhance motivation for changing behaviour</li> <li>- Identify main obstacles for a healthy eating</li> <li>- Encourage daily attitudes for positive changes</li> </ul>	<p>Choosing a personal behaviour change goal            Setting one practical measure to implement on daily behaviour            Children commitment to accomplish the goal before the next learning module  <b><i>Expected outcomes in Food Record 1 (FR1)</i></b>            To find behaviour changes regarding to children’s selection steps: step 2 (starting lunch and dinner by eating vegetable soup), and step 7 (avoiding fried foods).</p>
<p><i>Learning module-two (LM2)</i>  <b>Water &amp; milk help you to grow up</b>            (i) Food items were identified and described (water, milk and yogurt) for a healthy consumption            (ii) Discussion about the pros and cons of beverages usually consumed by children: nutrients, prices, benefits and quantities, comparative nutritional contents  <i>Activity-two (A2)</i>  <b>Favourite beverage of the month</b>            Setting a solution to be achieved in group.</p>	<ul style="list-style-type: none"> <li>- Calling for consumption of healthy choices: water, milk and yogurt, which contribute to a proper growth</li> <li>- Identification of benefits and adequate portions</li> <li>- Recommendations to decrease/moderate consumption of sugar-sweetened soft drinks</li> </ul>	<p>Children resolution: adopting water or milk instead of soft drinks  <b><i>Expected outcomes in Food Record 2 (FR2):</i></b>            - Increasing water consumption and milk, and decreasing of sugar-sweetened soft drinks.</p>

Learning Modules	Educational goals	Behaviour change goals and <i>Expected outcomes in the Food Record</i>
<p><i>Learning module-three (LM3)</i></p> <p><b>Training every day to be healthier</b></p> <p>(i) Introduce the concept of health, what is to be healthy and its relationship with several benefits of health promotion in which nutrition and food choices have influence</p> <p>(ii) Basic discussion around concepts of health</p> <p><i>Activity-three (A3)</i></p> <p><b>Planning for a healthier family</b></p> <p>Designing the best strategy for changes at home to a healthier life.</p> <p>A card was delivered to each child and was requested to give attention to his family’s lifestyle during Christmas holidays.</p>	<ul style="list-style-type: none"> <li>- Raising awareness to be healthy and of giving priority to health choices and behaviours</li> <li>- Identifying unhealthy behaviours on the family’s lifestyle</li> <li>- Finding practical measures to implement a healthy environment at home</li> </ul>	<p>Individually children were invited to design what would they consider to change on their families’ behaviours to be closer to a healthier life.</p> <p><b>No Food Record</b>, Christmas season (Xmas).</p>
<p><i>Learning module-four (LM4)</i></p> <p><b>3 fruits a day, how much good it does?</b></p> <p>(i) The importance of a daily fruit intake</p> <p>(ii) The recommended consumption of three portions of fruit per day</p> <p>(iii) Demonstration of ways of eating fruit</p> <p>(iv) Ranking the fruits’ top list</p> <p><i>Activity-four (A4)- My Fruit planning: take a step forward into the future</i></p> <p>Identifying and recording the fruit portion intakes of the day before, the present day and which fruits would children like eating on the day after or taste a new one.</p>	<ul style="list-style-type: none"> <li>- Focusing on two key-points: the great variety of fruits existing, respect each one’s preferences and likes</li> <li>- Understanding for different fruits, several differences and characteristics</li> <li>- Identifying obstacles to fruit consumption, opportunities to increase the daily intake of fruit: ways to add fruit</li> <li>- To raise awareness for daily fruit recommendations: compare the usual consumptions to increase children perception on their consumption</li> </ul>	<p>Setting a specific daily fruit servings goal to be accomplished before the next module.</p> <p><b><i>Expected outcomes in Food Record 4 (FR4):</i></b> Increasing fruit consumption.</p>



Learning Modules	Educational goals	Behaviour change goals and <i>Expected outcomes in the Food Record</i>
<p><i>Learning module-five (LM5)</i></p> <p><b>Fruits &amp; vegetables are essential to life</b></p> <p>(i) The important role of fruits and vegetables in the daily diet presentation: benefits of nutrients, nutritional value, richness in fibers</p> <p><b>Activity-five (A5)- The most popular ones: soup, salad and side dishes</b></p> <p>Identifying to record the favourite vegetables and rank the most popular soup, salad and side dishes. The intention was to make children understand that they have favourite options between the big vegetables family and they could increase the consumption with their favourite choices to reach to a healthy goal.</p>	<ul style="list-style-type: none"> <li>- Calling for the consumption of fruits and vegetables in the daily diet</li> <li>- Recognizing the existing plethora of vegetables (legumes, roots and tubers, pulses)</li> <li>- Presenting different ways of eating vegetables (soups, salads, ways of preparation)</li> <li>- Encouraging for choosing the favourite ones and just start by eating one or two of them at the school canteen</li> <li>- Making children understand that they have favourite options between the big vegetables family and they could increase the consumption with their favourite choices to reach to a healthy goal</li> </ul>	<p>Choosing a personal behaviour change goal</p> <p>Setting one practical measure to implement on daily behaviour</p> <p>Children commitment to accomplish the goal before the next learning module</p> <p><b><i>Expected outcomes in Food Record 5 (FR5):</i></b></p> <p>Increasing intake of vegetable soup, vegetables as legumes or salads at meals, and increasing fruit consumption.</p>
<p><i>Learning module-six (LM6)</i></p> <p><b>Start on moving!</b></p> <p>(i) The importance of regular practice of physical activity (PA)</p> <p>(ii) In-group discussion to explore obstacles, that blocked the daily habit of practicing PA</p> <p>(iii) Explore solutions/options to try new sports</p> <p><b>Activity-six (A6) - What sort of sports do you play on?</b></p> <p>Identifying to record sports or playful activities usually played and activities they would like to have the chance of trying.</p>	<ul style="list-style-type: none"> <li>- Enhancing the health benefits of PA and for self-image</li> <li>- Raising awareness to try new sports</li> <li>- Reinforcing physical activity classes of extracurricular programs at school</li> </ul>	<p>Choosing a personal behaviour change goal to begin the practice of a sport or other forms of PA.</p> <p><b><i>No Food Record evaluation.</i></b></p>

Learning Modules	- Educational goals	Behaviour change goals and <i>Expected outcomes in the Food Record</i>
<p><i>Learning module-seven (LM7)</i></p> <p><b>The best snacks</b></p> <p>(i) Food items that should be included on a healthy snack</p> <p>(ii) Demonstration of ways to change snacks quality, and how to confirm it using label readings</p> <p>(iii) In-group discussion to identify foods more consumed at snack-breaks and argumentations of what must have a snack to be healthy, which must be rich in essential nutrients.</p> <p><i>Activity-seven (A7) - Small meals big impact</i></p> <p>Identifying to record what is a best snack (A7-card-one) firstly and then what must have a snack to be healthy (A7-card-two).</p> <p>Understand the difference of which is considered the best snack and the best choice for a healthy snack.</p>	<ul style="list-style-type: none"> <li>- Calling for consumption of healthy choices on snack-breaks</li> <li>- Reinforcing skills that could help them of being more aware of their autonomy on food choices and eating behaviours (individual decision is exclusively an option of each child)</li> <li>- Guiding how to choose a healthy snack in various aspects: nutrients, preferences, prices and new options</li> <li>- Encouraging to change one specific eating habit on breaks and improve nutritionally snacks: an opportunity to add fruit</li> </ul>	<p>Choosing a personal behaviour change goal to healthy choices on snack-breaks</p> <p>Implementing a snack rich in essential nutrients</p> <p>Children commitment to accomplish the goal before the next module</p> <p><b><i>Expected outcomes in Food Record 7 (FR7):</i></b></p> <p>Evolution in the nutritional quality of food choices of snacks: increasing fruit, bread, yogurt and milk consumptions. Decreasing soft drinks, high-energy dense food (croissants, panikes, donuts, cakes, pastries, cookies and biscuits).</p>
<p><i>Learning module-eight (LM8)</i></p> <p><b>The final game: who has learned about everything?</b></p> <p>(i) Closure of the intervention</p> <p>(ii) Children were invited to play a little game. This activity allowed children’s self-evaluation toward change behaviour occurred on their eating habits over the programme.</p> <p><b><i>Activity-eight (A8): The final game: who has learned about everything?</i></b> Game ‘lets play on: who has learned about everything?’</p>	<ul style="list-style-type: none"> <li>- Recalling, re-examining concepts and self-assessment regarding changes over the intervention.</li> <li>- Reinforcing skills for healthy eating and active living</li> <li>- Enhance motivation for changing behaviour</li> <li>- Encourage daily attitudes for positive changes</li> </ul>	<p>No application of a food record.</p> <p>Application of a small questionnaire to ask children whether they could identify any changes that have occurred on their eating and lifestyle habits over the programme.</p>

#### 4.2.4 Outcome Measures

For measuring the eating behaviours over the implementation of the educational components and evaluating behaviour changes after each LM and over the intervention, a 3-day food record was selected to assess all the food and beverages that children consumed for three days. The 3-day food record is considered the most accurate method, both in qualitative and quantitative terms, to describe food eaten (Crawford, Obarzanek, Morrison, & Sabry, 1994; Thompson & Byers, 1994). Nevertheless, measuring food intake among free-living individuals continuing to be a challenging task (Kirkpatrick et al., 2014).

Seven 3-day food records were applied to determine the intervention efficacy. The first one collected the baseline data prior to the intervention and was designated food record zero (FR0), followed by six more 3-day food records applied subsequently to each learning module (FR1, FR2, FR4, FR5, FR6 and FR7). That is, for each LM children had to record the respective 3-day food record. The exceptions of returning the food record were for the LM3 and the LM8, corresponding to Christmas season (there are always changes on eating habits with Christmas typical consumptions that varies greatly compared to the usual pattern) and to the end of the academic year (instead a questionnaire was applied, see Chapter 2, section 2.5.3). As well the LM6 was concerning active living and sports practice and was not a food topic, accordingly the FR6 was applied for potentially being used as a follow-up evaluation.

##### ***- The Food Record Form***

At the briefing session for children, they received a 3-day food record form and were instructed how to fill in, according standardized procedures, as described in detail in Chapter 2, section 2.5.1.

The food record form includes instructions for helping children to complete it: representative pictures of household measures (cups, spoons or standard packaging) are shown to make easier the definition of portions sizes; an example of a completed day records is also shown (see Appendix 2.3). After these instructions, the food record form has three blank forms to be completed in each of the three subsequent days to the LM. Each blank form had at the top a space for weekday, day, month and year. There were 33 lines for recording all food events over each day. The first column was to describe the hour of the meal at which each food was consumed. The second column was for recording the place where food items were consumed. The third column provided the space to describe as much detail as possible each item of food and beverage consumed, by reporting number of servings or amounts or

quantity, cooking method, brands, and a space to comment anything else. Children were encouraged to record at the time of eating events and use their best judgment in the reports.

In the current study, only children who returned the FRO (baseline data) completed plus at least two or more completed food records, were reviewed and validated by the nutritionist and considered for analysis.

### ***- Measuring eating behaviour changes***

Children’s 3-day food records were coded following the behavioural coding protocol (Cullen, Baranowski, Baranowski, & Hebert, 1999). Given that people consume foods, not nutrients, the PHS-pro had a behavioural focus instead of a knowledge-based focus. In order to guide children for desirable nutrition-oriented behaviour changes and to healthy food choices, rather than nutrients (Hoelscher et al., 2002), the first step was to categorize all food items reported by children into a behavioural perspective for assessing the eating behaviour changes outcomes.

All food items reported in the seven 3-day food records were coded by meal and place of consumption, food category, cooking method, and number of servings (one serving was the default serving and the usual amount of food recorded by children).

Each food item was categorized in terms of providing central nutrients (proteins, vitamins, minerals, dietary fiber, complex carbohydrates, fats, free sugars) based on the six food categories of the New Portuguese Food Guide (Rodrigues et al., 2006): (i) fruits; (ii) vegetables; (iii) potato, cereal, and cereal products; (iv) pulses, milk and dairy products; (v) meat, fish, seafood, and eggs; (vi) fats and oils. Subcategories were created within each of these groups, except for vegetables and fruits, in a total of 21 items. Within each subcategory, food items can further be identified as low, medium and high-fat options or low, medium and high-sugar options. Two examples of these are: French fries and potato chips were credited as high-fat options compared to boiled potatoes that were credited as low fat; donuts or cakes were credited as high sugar versions compared to fresh bread. Also, typical Portuguese mixed dishes had to provide at least one-cup of cooked vegetables or legumes to be credited one serving of vegetables as the example of ‘chicken and vegetable stew’.

After these procedures, to assess the servings consumed of specific foods and beverages and to measure behaviour changes, smaller eating sub-behaviours were created according to the learning modules goals, and nine study variables were organized for analysis:

(1) *Vegetable soup servings*: it included all traditional Portuguese preparations of vegetable soups. In LM1 (“10 steps to be healthier”, see Table 4.1), all children chose to take action

and go up to the step 2, which corresponded to increase their vegetable soup consumption at meals. The LM5 (“Fruits & vegetables are essential to life”, see Table 4.1) was also dedicated to the vegetables topic, in which vegetable soup was considered an important preparation for increasing vegetables intake. Consequently, this variable was assessed comparing FR0 (baseline data) with FR1 and FR5.

- (2) *Fried food/High fat food servings*: it included all fried foods and products as French-fries, chips, rissoles, pasties, croquettes, fish fingers, nuggets. In LM1 all children chose to take action and go up to the step 7, which corresponded to avoid eating fried foods. This variable was assessed comparing FR0 with FR1.
- (3) *Water servings*: it included tap water and bottled water. Consumption of water was developed in LM2 (“Water & milk help you to grow up”, see Table 4.1) as a regular beverage. This variable was assessed comparing FR0 with FR2.
- (4) *Milk products servings*: it included plain milk, milk mixed with coffee or barley, and yogurt, except chocolate milk. LM2 was dedicated to a healthy and adequate consumption of milk products. Also LM7 (“The best snacks”, see Table 4.1) focused on milk products as healthy choices for snacks. This variable was assessed comparing FR0 with FR2 and FR7.
- (5) *Soft drinks servings*: it included soda, cola, ice-tea, added sugar squash juices. In LM2 the soft drinks’ topic was developed to promote children’s consumption decrease. Again, the LM7 strengthened the same idea of avoiding these beverages on snacks. This variable was assessed comparing FR0 with FR2 and FR7.
- (6) *Fruit servings*: it included all fruit and fresh fruit juices, except fruit in syrup. LM4 was exclusively dedicated to the fruits topic (see Table 4.1). Then it was further strengthened in LM5 together with vegetables, and in LM7 as one of the best choices for children’s snacks. Therefore, fruit variable was assessed comparing FR0 with FR4, FR5 and FR7.
- (7) *Vegetables servings*: it included all vegetables, legumes, salads, greenery, and mixed dishes rich in legumes or vegetables, except potatoes. LM5 was entirely dedicated to the vegetables topic. This variable was assessed comparing FR0 with FR5.
- (8) *Bread servings*: it included all varieties of fresh and toasted bread. LM7 explored the best nutritional options for children’s snacks, in which bread has a healthy place. This variable was assessed comparing FR0 with FR7.
- (9) *High-energy dense food servings*: it included croissants, panikes, donuts, cakes, pastries, cookies and biscuits. LM7 explored the best nutritional options for children’s snacks

comparing with other food choices that are loaded of fat and sugar. This variable was assessed comparing FR0 with FR7.

The variables were limited to these nine food behaviours of particular relevance to the learning modules goals (see Table 4.1) and to the overall objectives of the PHS-pro. Figure 4.2 provides a summary of the analysed variables according to the learning modules goals.

#### ***- Measuring attitudes, preferences and expectations***

Children’s participative activities were implemented over the programme to support peer-led activities and children’s decision-making over the learning modules. Such activities were also used to collect data related to children’s attitudes, preferences and expectations. Different activities were developed for each of the eight learning modules to support children for changing their attitudes and behaviour towards the learning modules goals (Table 4.1).

Children’s returned feedback gathered in the classroom was then subject to content analyses.

The learning modules activities are briefly described below.

#### ***Activity-one (A1): Choosing the step, changing for better***

Children were asked which of the 10 wise-steps presented in LM1 was the most difficult one. As mentioned above, two steps were equally chosen: step 2, increasing vegetable soup servings on meals; and step 7, related to avoid fried products. They were also asked to elect the step that they found they were prepared for immediate behaviour change. Children’s commitments were based on the improvements of their daily behaviour on the same two steps, 2 and 7. Attitude toward change behaviour was assessed through this activity and feedback evaluated in connection with the FR1.

#### ***Activity-two (A2): Favourite beverage of the month***

From the discussion about the pros and cons of beverages usually consumed by children, it was proposed children choose their favourite beverage of the month and the resolution was: adopting water or milk instead of soft drinks. Attitude towards change behaviour was assessed throughout this activity and feedback was evaluated in connection with the FR2.

Baseline data collection: (3-day FR)															
Intervention		3-day FR		Intervention		3-day FR		Intervention		3-day FR		Intervention		3-day FR	
Sep 2011		Oct 2011		Nov 2011		Dec 2011		Jan 2012		Feb 2012		Mar 2012		Apr 2012	
FR0	LM1	FR1	LM2	FR2	LM3	No FR	FR4	LM5	FR5	LM6	FR6	LM7	FR7	LM8	
<b>Outcome variables</b>	"10 steps to be healthier"	Selected Variables: Steps 2 and 7	"Water & milk help you to grow up"	Selected Variables	"Training everyday to be healthier"	Christmas Season	"3 fruits a day, how much good it does?"	Selected Variables	"Fruit & vegetables are essential to life"	Selected Variables	"Start on moving!"	Selected Variables	"The best snacks"	Selected Variables	"The final game"
Vegetable soup		Vegetable soup								Vegetable soup					
Fried foods/High fat foods		Fried foods/High fat foods													
Water				Water											
Milk products				Milk products										Milk products	
Soft drinks				Soft drinks										Soft drinks	
Fruit							Fruit		Fruit					Fruit	
Vegetables									Vegetables						
Bread															
High-energy dense food														Bread	High-energy dense food

LM (Learning Module); FR (Food Record)

**Figure 4.2.** Analysed variables according the learning modules goals

***Activity-three (A3): Planning for a healthier family***

Children were invited to analyse their families’ lifestyle and design what they considered to be of the highest importance for changing in their family environment and being a healthier family. A card was individually delivered and it was asked to return it after Christmas holidays. This activity allowed analysing whether children were able to identify the risky behaviours of their own families and develop problem-solving skills.

***Activity-four (A4): My Fruit planning: take a step forward into the future***

Children were asked to identify and record the fruit servings consumed on the day before, on the present day and which fruits would they like eating on the day after or even taste a new one. This activity allowed analysing fruit servings consumed as well assessing children’s expectations to fruit serving consumption for the next day.

***Activity-five (A5): The most popular ones: soup, salad and side dishes***

Children were asked to report their food preferences by selecting a vegetable soup, a salad or vegetable side dishes they would eat when they had the choice. Preferences of vegetable options were assessed.

***Activity-six (A6): What sort of sports do you play?***

Children were asked which sports or playful activities they usually play outside school, in which environments and if in family, and what activities they would like to have the chance of trying. Attitude toward sports participation and playful activities were assessed as well as expectations of trying.

***Activity-seven (A7): Small meals big impact***

Snack choices that children considered to be part of a healthy snack were assessed prior to implementing the LM7 (“The best snacks”, see Table 4.1) and immediately after it. Two cards were applied for the two moments. Attitude toward change behaviours was assessed through this activity.

***Activity-eight (A8): The final game: who has learned about everything?***

Children were invited to play a little game called ‘let’s play on: who has learned about everything?’ This activity allowed children’s self-evaluation about their attitude and behaviour changes occurred on their eating habits over the PHS-pro.



### 4.2.5 Statistical analysis

In the current study, only children who delivered baseline data (FR0) and at least two post-intervention food records (FR1, FR2, FR4, FR5, and/or FR7) were considered for analysis.

Descriptive statistics were calculated to describe participants' characteristics at baseline using the mean and standard deviation for continuous variables and frequencies for categorical variables.

To assess the effects of the intervention for the outcome variables representing different food behaviours, analysis of Wilcoxon rank-signal test was performed, to examine differences between pre-intervention (baseline: FR0) and post-interventions (FR1, FR2, FR4, FR or FR7). Results are expressed as the median and interquartile range (IQR).

Initial analyses were performed for symmetrical distribution of the outcome variables by analysing the histogram.

For all analyses, a  $p$ -value $<0.05$  was accepted as statistically significant, and the statistical software SPSS (package version 21) was used for statistical analysis.

Children's feedback of the activities developed during the learning modules was treated as categorical variables that were analysed in a descriptive way and no statistical testing strategy was used. Content analysis was applied to qualitative responses of children to the open-ended questions (Pope et al., 2000).

## 4.3 RESULTS

Of the 229 grade-6 children, 157 (68.6%) completed the baseline 3-day food record (FR0) and two or more subsequent food records. Only data for these 157 children were used in the analysis to minimize unreliability in the dietary outcome measures. The participation rate in data collection of the other six 3-day food records applied during the intervention was 91.1% in FR1, 92.4% in FR2, 87.9% in FR4, 82.2% in FR5, 59.2% in FR6 and 80.9% in FR7. Considering that the LM6 was dedicated to active living and sports topic, and the FR6 had a rather low returning with the worst children's participation rate, data of the FR6 was withdrawn from the analysis.

### ***- Baseline characteristics of participants***

Mean age was 10.9 (SD = 0.6) with 55.4% female and no statistical differences were detected between genders ( $\chi^2=1.84$ ;  $p=0.175$ ).

The most common, significant dietary concern was the F&V consumptions. Children reported an intake of F&V well below the recommended levels over a 3-day period. At baseline (Table 4.2), more than one-third of the children reported not eating **fruit** (31.2%), not eating **vegetable soup** (36.9%) and more than half did not eat any sort of **vegetables** (51.0%) over a 3-day period.

**Milk** products had a regular intake, except for 1.9% of children who reported no consumption and 3.2% with one portion for three days (Table 4.2). **Bread** intake was also regular for snacks but not for 4.5% of children that reported not eating it (Table 4.2). **High-energy dense food** intake was not reported by only 17.8 % of children, however there were more children eating at least one or two servings of these foods over the three days (Table 4.2). About 39.5% of the sample reported eating **fried foods**, once in three days (Table 4.2).

Daily **water** consumption was not a regular behaviour for 14.6% of children that reported not drinking water over three days (Table 4.2). **Soft drinks** consumption is already established as a current habit among young people as one can see in more than half of children (51.0% i.e., counting the frequencies of children who reported daily servings), reporting the intake of one or more servings over the 3-day period analysed.

### ***- Changes in food behaviours***

Table 4.3 shows the changes of the nine food behaviours by comparing children’s food intakes between baseline (one month prior to the intervention) and the corresponding 3-day FR.

Regarding the two goals of LM1: increasing vegetable soup and decreasing fried food servings, children reported in their FR1 a significant change in **vegetable soup** servings by doubling the median value from 1 to 2 servings/3-day period ( $p= 0.003$ ) between baseline and the FR1. For **fried food** variable there was no significant change.

**Table 4.2.** Baseline eating behaviours of children in a 3-day period (n= 157)

Reported servings	0	1	2	3	4	5 or more
	% of children					
Fruit	31.2	17.2	17.8	12.7	7.0	14.7
Vegetable soup	36.9	26.8	12.7	10.8	5.1	7.7
Vegetables (in salad or cooked)	51.0	28.0	10.8	6.4	2.5	1.3
Milk products	1.9	1.3	6.4	13.4	15.9	61.0
Bread	4.5	12.7	14.0	24.8	19.7	24.2
High-energy dense food	17.8	25.5	27.4	19.1	4.5	5.5
Fried food	38.2	39.5	14.6	5.7	1.9	0.0
Water	14.6	21.0	18.5	14.6	12.7	18.4
Soft drinks	49.0	22.3	11.5	7.0	3.8	6.2

### - Changes in food behaviours

Table 4.3 shows the changes of the nine food behaviours by comparing children's food intakes between baseline (one month prior to the intervention) and the corresponding 3-day food record. Regarding the two goals of LM1: increasing vegetable soup and decreasing fried food servings, children reported in their FR1 a significant change in **vegetable soup** servings by doubling the median value from 1 to 2 servings/3-day period ( $p= 0.003$ ) between baseline and the FR1. For **fried food** variable there was no significant change.

Following the LM2, although it was expected the increasing of water and milk consumption and decreasing of sugar-sweetened soft drinks in the FR2, only **milk** consumption had a statistically significant change ( $p=0.024$ ), though the median value is equal at baseline and FR2; higher milk consumption was reported in 75 (51.7%) out of the 145 children analysed in the FR2 compared to baseline, and in 25 children (17.2%), milk quantities were equally consumed (data not shown). **Soft drinks** did not show significant changes ( $p=0.340$ ), between the two moments although there was a reduction in the first quartile (Q1) from 1 to zero servings over three days, indicating that 25% of children decreased the soft drinks intake.

Significant increase in **fruit** consumption was observed (0.008), following LM4. More children ate fruit, indicated by a median value of 2 fruit servings and showing an increase in the third quartile. In fact, of the 138 children cases analysed, 67 (48.6%), reported a higher number of fruit servings at FR4 compared to baseline, and 35 children (25.4%) reported equal fruit servings.

**Table 4.3.** Comparison of outcomes between baseline and post-intervention 3-day food records

<b>Food behaviours' evaluation between baseline and FR1</b>				
Outcome	Sample size	Baseline	3-day FR1	
Consumption (servings)		Med (IQR)	Med (IQR)	<i>p-value</i>
Vegetable Soup	n=143	1 (0-2)	2 (0-3)	0.003*
Fried food		1 (0-1)	1 (0-2)	0.673
<b>Food behaviours' evaluation between baseline and FR2</b>				
Outcome	Sample size	Baseline	3-day FR2	
Consumption (servings)		Med (IQR)	Med (IQR)	<i>p-value</i>
Milk products		5 (4-7)	5 (4-7)	0.024*
Water	n=145	2 (1-4)	2 (0-4)	0.435
Soft drinks		1 (0-2)	0 (0-2)	0.340
<b>Food behaviours' evaluation between baseline and FR4</b>				
Outcome	Sample size	Baseline	3-day FR4	
Consumption (servings)		Med (IQR)	Med (IQR)	<i>p-value</i>
Fruit	n=138	2 (0-3)	2 (0-4)	0.008*
<b>Food behaviours' evaluation between baseline and FR5</b>				
Outcome	Sample size	Baseline	3-day FR5	
Consumption (servings)		Med (IQR)	Med (IQR)	<i>p-value</i>
Vegetables (in salad or cooked)		0 (0-1)	0 (0-1)	0.400
Vegetable Soup	n=129	1 (0-3)	1 (0-3)	0.093
Fruit		2 (0-3)	2 (0-4)	0.903
<b>Food behaviours' evaluation between baseline and FR7</b>				
Outcome	Sample size	Baseline	3-day FR7	
Consumption (servings)		Med (IQR)	Med (IQR)	<i>p-value</i>
Bread		3 (2-5)	3 (2-4)	0.455
High-energy dense food		2 (1-3)	1 (0-2)	0.048*
Milk products	n=127	5 (4-7)	5 (3-6)	0.078
Soft drinks		1 (0-2)	0 (0-1)	0.042*
Fruit		2 (0-3)	1 (0-3)	0.176

Med (IQR): median (interquartile range).

Wilcoxon Rank Test\*:  $p < 0.05$

Vegetable soup, fruit and vegetables servings were examined between baseline and FR5, as increasing consumption of these foods were the main goals of the LM5. There were no significant changes on these consumptions. However **vegetable soup** preserved the positive tendency as of the 129 cases analysed, 51 children (39.5%) reported eating more vegetable soup in the FR4 than in the baseline, and 38 (29.5%) retained an equal consumption. Likewise, children did not reported changes on **fruit** consumption; nevertheless the third quartile has kept the number of fruit servings observed in the previous evaluation at

FR4. No positive changes were found in **vegetables** servings, although vegetables' topic has been the primary focus and the increasing of consumption the most important goal of LM5. Vegetables (in a salad or cooked as side dish) have recorded consumptions rather low, where half of children did not eat any kind of vegetables over a 3-day period at both baseline and FR5 evaluations, with the exception of vegetable soup.

Regarding the five food variables evaluated following the LM7 (bread, high-energy dense food, milk products, soft drinks and fruit), consumption changes were found significantly different between baseline and FR7 for high-energy dense food and soft drinks. After intervention with LM7, children significantly decreased **high-energy dense food** from a median of 2 to 1 servings/3-day period ( $p=0.048$ ). For **soft drinks**, children reduced servings of this kind of beverages, with half of children lowering to zero servings in a 3-day period. **Bread** and **milk** products had no changes and kept the usual consumptions. Similarly, fruit consumption had no significant change, yet the consumption of fruit lowered among 58 children (45.7%) of the 127 children cases observed (data not shown).

In short, regarding the nine studied variables, children improved their nutritional practices in five variables (vegetable soup, milk products, fruit, high energy dense food and soft drinks) by following the PHS-pro.

#### ***- Changes in attitudes, preferences and intentions toward healthy food choices***

The participating activities were introduced during the learning modules implementation as an approach to promote both children's in-group discussion and active participation.

The first two activities (A1 and A2) allowed children showing their attitudes toward behaviour change. In **A1**, children decided to improve two steps (instead of one as initially proposed) that were equally chosen: step 2, advocating the increasing of vegetable soup intake; and step 7, advocating the avoiding of fried foods. This attitude was followed by a significant change in vegetable soup servings found in FR1, already referred above. However, regarding step 7 there was no change, although children had initially indicated their positive attitude for changing.

In **A2**, children's resolution was increasing water consumption and milk, and decreasing of sugar-sweetened soft drinks. This attitude was followed by a significant change in milk products servings observed in FR2, but not in water or soft drinks consumption.

In the third activity (**A3**) children were asked which key-strategy would be a good planning for having a healthy family. Of the 157 children participating, 118 (75.2%) returned the card, in which each child, individually, identified the risk behaviour that his own family

should avoid. Four children (3.4%) reported quitting smoking as the primary strategy to have a healthier family, 97 children reported healthy eating (82.2%) and 12 (10.2%) expressed physical activity as the most important for a healthy family. Five children (4.2%) have not clearly specified a strategy, and merely stating, “My family needs to change habits”. Clearly, children were able to determine the key change for a healthier family environment and most of them expressed the need to take measures for changing eating habits.

In the fourth activity (A4), 142 children (90.4%) returned the feedback card of fruit servings consumed and their fruit eating intentions. Table 4.4 shows the results of a detailed analysis. In the day before this assessment, more than 35.9% of participants reported the intake of two fruits, and almost one-quarter (23.9%) the intake of three fruits, still 11 children (7.7%) did not eat fruit. For the assessment day, more than one-quarter (25.4%) of children recorded one serving fruit intake, nevertheless the time of assessments ranged over the school day, between morning and afternoon, which means that it cannot be confirmed whether the same fruit intake would follow the profile of the previous day. Children intentions to eat fruit for the day after showed highly positive, as nearly half of the children (49.3%) stated that intend eating three fruit servings daily. According to this, a great number of children (25.4%) showed to have the intention of improving fruit intake, and all children had a positive attitude to improve fruit consumption.

**Table 4.4.** Fruit servings consumed in two moments (previous day and assessment day), and fruit eating intentions (Activity-four)

Fruit servings	0	1	2	3	4
	% of children				
Previous day	7.7	23.9	35.9	23.9	5.6
Assessment day	67.6	25.4	6.3	0.7	0
Next day intentions	0	10.6	24.6	49.3	11.3

Children reported preferences of vegetables (Table 4.5) in the fifth activity (A5) with the feedback of 156 children (99.4%) of the total sample of 157. A proportion of 78.2% of children reported having two favourite vegetable soups, being green cabbage soup (*caldo verde*) and carrot soup the two most indicated by children. For fresh salads, the majority (66.7%) had at least two preferences (lettuce and tomato salads, either separated or mixed), however five children (3.2%) did not appreciate any kind of salad. Vegetables served as a side dish received a similar acceptance with a large percentage of children (68.6%) reporting having two preferences: broccolis and peas. In addition, more children indicated having three,

four or five preferences of this kind of vegetable preparation compared with vegetable soups or salads.

**Table 4.5.** Vegetables preferences on the basis of vegetable soup, salad and vegetable side dishes (Activity-five)

Number of preferences	0	1	2	3	4
	% of children				
Vegetable soups	0	17.3	78.2	3.2	0.6
Fresh salads	3.2	23.1	66.7	5.1	1.9
Vegetable side dishes	1.9	14.1	68.6	8.3	3.8

Activity-six (**A6**), according to the LM6, had the focus on active living such as physical and leisure activities. Table 4.6 presents a summary of the 152 children's reports (96.8%) from the total of 157 participants. The great majority of children were not engaged in sports practice (56.6%). When they were asked which activities they usually dedicated their time in the playground, playing games was the most referred (51.3%). After school, 18 children (11.8%) indicated not doing any kind of physical activity, but the rest of them used the time after school for playing different leisure activities. For weekends in family, more than one-quarter of children (25.7%) reported not doing any kind of leisure activity or sports, while 44.1% indicated, "going for a walk", most frequently in family activity. Finally, when children were asked about activities they would like to have the chance of trying, the majority was interested in doing some sports (65.8%) or playful activities (31.6%); between 34 activities mentioned by children, surf was the most referred (with 16 occurrences), followed by tennis (12) house riding (11) and skating (11). This shows that the majority of children were motivated to engage with sports and other activities compared with the reality of a great percentage of children (56.6%) that reported not practicing any kind of physical activity.

In the **A7**, children were assessed regarding foods that can be part of a healthy snack. Table 4.7 below shows the differences between the two assessment moments of A7. In this activity of 157 children, 155 delivered the two cards applied (98.7%). Among these, a great number of children identified correctly healthy foods for snacks, with 127 (81.9%) doing snack choices such as bread, milk products, instead of high-energy dense foods and soft drinks. In contrast, 28 children (18.1%) selected unhealthy choices for their snacks (high-energy dense foods, soft drinks, fried foods). Nevertheless, of the 127 children that have made healthy choices, 55 (35.5%) did not included fruit as a healthy snack on the first card

assessment (A7-card 1). After the LM7, a change in children’s attitude were found with 148 children (95.5%) reporting all the healthy foods including a fruit serving, against 7 children (4.5%) that continuing with the previous snacks choices and not including fruit. Thus, reported snack healthy choices improved at post-activity.

**Table 4.6.** Frequency distribution of children practicing sports or playful activities (Activity-six)

<b>Practice daily physical activities</b>	<b>% of children</b>
Nothing	56.6
Sports	43.4
<b><i>Physically active at school (playground)</i></b>	
Playing games	51.3
Walking	25.0
Football	21.1
Dancing	2.6
<b><i>Physically active after school</i></b>	
Cycling	23.7
Football	21.1
Walking	14.5
Other sports	13.2
Playing games	11.8
Nothing	11.8
Dancing	3.9
<b><i>Physically active at weekend (in family)</i></b>	
Going for a walk	44.1
Cycling	28.9
Nothing	25.7
Swimming	1.3
<b><i>Expectations of trying sports or playful activities</i></b>	
Sports	65.8
Playful activities	31.6
Nothing	2.6

**Table 4.7.** Frequency distribution of children healthy food choices for snacks (Activity-seven)

<b>Food choices for snacks</b>	A7-card-one	A7-card-two
	<b>% of children</b>	
Healthy foods	81.9	95.5
Unhealthy foods	18.1	4.5

The last activity (A8) gathered children’s feedback of the basic concepts focused regarding each topic developed in the seven learning modules over the PHS-pro. Of the 157



children distributed by nine classes, four classes had difficulties in recalling the concepts of the topic developed during the third learning module (LM3): training every day to be healthier. However, all the concepts of the other learning modules were 100% recorded, suggesting that there was an increase in the healthy-eating concepts with the implementation of the PHS-pro with the step-by-step learning modules approach.

#### **4.4 DISCUSSION**

The purpose of this study was to determine the impact of eight learning modules on children's nine eating behaviours (fruit, vegetable soup, vegetables in salad or cooked, milk products, bread, high-energy dense food, fried food, water and soft drinks) and of one learning module dedicated to active living over the PHS-pro intervention.

Results showed substantial changes in serving consumptions with statistically significant increase of vegetable soup, milk products and fruit, while high-energy dense food and soft drinks significantly decreased between the two time periods of evaluation (from baseline to post-intervention). In contrast, other variables had no significant change: fried food, vegetables, water and bread consumption. These findings indicate that the one academic year PHS-pro intervention was successful in meeting some of the PHS-pro goals. However, it can be expected that whether continued over time, the programme could also influence positively the other children's eating behaviours, which might be useful in preventing and reducing the development of obesity.

The most disappointing results were the lack of significant changes in fried food and vegetables servings (in salads or cooked) after the intervention. This can be explained by the fact that these foods are usually served at meals not prepared by children and such factors either facilitate or impeded such behaviours, consequently children did not have absolute control in such circumstances (Reinaerts, de Nooijer, Candel, & de Vries, 2007). In contrast, fruit serving consumption significantly increased after the PHS-pro intervention. Reinaerts (2007) also explained that fruit consumption is more under children's control and in the case the child chooses to eat fruit, availability is the only important factor for fruit consumption.

As mentioned above, children have recorded vegetables consumptions rather low, whereas half of children did not eat any kind of vegetables over a 3-day period. This is a matter of serious concern regarding children's health. Given that adolescence is a growing period at a staggering rate and vegetables are the major sources of vitamins, minerals and

dietary fiber, an adequate intake of vegetables provided these nutrients, which is crucial for a healthy growth, and for preventing obesity and other chronic diseases. Several studies provided evidence in support of these important mechanisms (Delisle, 2005; Lobstein et al., 2015; Slavin & Lloyd, 2012). These results make the intervention programmes for promoting vegetables appear even more important, and its continuity must be ensured as long as children are growing, because these programmes might be the only effective strategy to face this perplexing trend (Khambalia et al., 2012).

In general, the results found in this study support findings of similar studies reviewed by Water et al. (2011) for children of the same age range; high levels of F&V intakes were found in five intervention studies, reductions in high energy dense foods were reported in one study as well sweet foods in two studies, soft drinks intake decrease was reported in two studies, which are in line with the results of this study. A detailed comparison with these studies is difficult due to different designs and to differences in outcomes measures. Additionally, no comparable Portuguese data among similar age group are available as far as one can know (Bemelmans et al., 2011; Gaspar et al., 2013).

Children attitudes changed positively immediately following the participative activity of each learning module. In all these activities children’s motivation for healthy changes were observed, which is encouraging. It is also noteworthy that, there was a great agreement between the behaviour changes observed in the current study and children attitudes expressed in the participative activities. Preferences and expectations can be useful information both to deepen knowledge about children trends, and create opportunities for continuous improvement for a more effective intervention. The low level in reported preferences of vegetables would leave the impression that the wide variety of these foods was never tasted. Also the high level of willing for trying sports is encouraging, giving a clear sign that implementing various dynamics in the active living field into interventions are well accepted by children.

The learning modules and participative activities, in which children have set goals and made commitments to change a specific behaviour or engage on a new behaviour, resulted in significant eating changes. Finding out children needs and focusing on specific behaviours that they are already prepared to change and implementing practical recommendations appeared to be a successful strategy. Also, participatory methods provided to children a positive feedback that they were more able to change their daily behaviours and were responsible for their decisions.

In the designing of the intervention, three elements of the programme seemed essential to the achievement of significant results: behaviour commitment based on the TTM of stages change, participative activities, and children involvement in their decision-making goals and feedback. Children at these ages make numerous decisions about their diet, nevertheless there is a general difficulty of taking the right decisions for everyday healthy eating even with adults. Therefore the learning modules were designed to convert healthy eating principles into practical and specific behaviours, but a regular guidance is required to support children for change behaviours. Furthermore, implementing the programme with this design allowed to perceive several possibilities of improving the programme, in order to be even more tailored to the target population.

This study has several strengths. This is one of the first Portuguese studies to evaluate the impact of a behavioural-change programme over a full school year. No Portuguese studies, to our knowledge, have reported any intervention approach based on TTM of stage change for several eating behaviours among children in early adolescence. The controlled design with baseline and post intervention measurements based on the repeated time-series design allowed observations over a one school year time period with the inclusion of eight different learning modules that would not have been possible using the single design of pre and post-intervention. Another strength of this study is that data analysis is based on a balanced sample by age and gender parameters.

An additional strength was that the intervention was conducted in a real world school setting, and showed it can be included in the school organization, implemented in different school subjects with different stakeholders.

Although the sample was ample, a larger sample may have resulted in more statistically significant effects. It was expected that all available children could be included, however some did not deliver the baseline evaluation (FR0) either/or some subsequent food records (inclusion criteria of this study), which led to the withdrawn several tens of children records.

A number of factors may have influenced these results, as this study was not without limitations. First, randomization was not possible and the study was conducted under the constraints of school based-research without a concurrent control group submitted to the 3-day food records. Second, the study was restricted to only one school and results may not be generalized to other populations. Third, results are not free of selection and attrition bias considering that children who participated in the study may have been those most motivated to change their behaviours. Fourth, dietary intakes were self-reported and underreporting is a

widespread problem in this research field. Measuring eating behaviours are relatively labor-intensive and are not free of expectancy bias, although the 3-day food record is considering the “gold standard” for monitoring eating behaviours (Thompson & Byers, 1994).

Despite these limitations, there has been little published research on the development of effective and sustainable intervention to improve children’s eating behaviours in Portugal. It is expected that these results can have important implications for improving the design of other school programmes that intended to promote healthy eating and active living in young people.

In addition, participatory activities allowed to document the children’s attitude and behaviour changes, which were of great value for this research. With respect to gender differences, this factor was not an important component in this analysis to draw strong conclusions about gender differences. Boys and girls have different food preferences and perceptions; hence aspects concerning gender differences should be subject of careful research.

The study supports preliminary evidence that PHS-pro may be effective in promoting behaviour changes to improve children eating patterns for preventing overweight and obesity. The failure in obtaining some positive results indicates that PHS-pro strategies need to be improved to be effective in increasing children’s fried food and vegetables consumption in future PHS-pro implementation. A number of interesting ideas were raised by this study for future research, in order to extend the programme to other ages, and promoting healthy eating over the adolescence period coordinating an ongoing intervention and tailored to the real population needs.

Finally, this pilot research did not involve changes in children’s family environment, in particular because of the time and conditions allocated to the research, but it is one important issues to be taken into account in further research.

## Chapter 5

### *Study 4: The impact of the “Planning Health in School” programme on two obese adolescent twins: a case study*

#### **ABSTRACT**

**Background:** Obesity has a strong negative burden on children’s personal health, in their families and in the overall public health care system. Effective interventions to reduce and solve obesity are required. In this context, the “Planning Health in School” programme (PHS-pro) was designed and implemented in the academic year 2011-2012. It integrated healthy eating and active living issues to guide young people towards healthy behaviours, encouraging them to be active participants in their own changing processes. The PHS-pro involved 449 adolescents of grade 6 (11-12 years old). This case study evaluates the PHS-pro impact on nutritional status of two obese twins, a boy and a girl of 11 years old.

**Methods:** Adolescents were subjected to three assessments: before PHS-pro implementation (baseline), after it (8 months) and 12 months later (follow-up). The evaluation included anthropometric measurements: weight, height and waist circumference (WC) and eating and lifestyle behaviours (food frequency consumption and lifestyle habits questionnaires, seven food records and a semi-structured interview).

**Results:** At baseline, the boy and the girl were both considered obese by Cole and collaborators’ standards (2000), with a body mass index (BMI) of 37.50 kg/m<sup>2</sup> and 26.46 kg/m<sup>2</sup>, and a WC of 117 cm and 91cm, respectively. After the programme, (8 months) improvements on attitudes, behaviours and anthropometric parameters were found: the boy decreased the BMI value by 10% and lost 9.0 cm in his WC (5,8% less), remaining in the obese category; the girl decreased the BMI by 8% and lost 8.7 cm in her WC (9.6% less), moving from obese to overweight category. At follow-up time (12 months) a slight increase in the anthropometric parameters were found in both twins, but they did not come back to their baseline values.

**Conclusions:** Participation in the programme promoted positive changes on twins’ attitudes and behaviours, as well as on nutritional status, showing that the PHS-pro had a long-term effect, at least till the last assessment, one year later.

**Keywords:** childhood obesity, school-based intervention, nutritional status, twins, case study

## 5.1 BACKGROUND

Obesity has a strong negative burden on the individual health of children, in their families and in the overall public health care system of a nation. Effective interventions to reduce and solve obesity are required and prevention is the most effective answer (Busse, 2010).

Since 1980, the prevalence of obesity has doubled worldwide and currently is a problem crossing cultures and countries (Finucane et al., 2011). Among children, the numbers show similar proportion (Lobstein & Jackson-Leach, 2006). Childhood obesity increases significantly the early risk of chronic diseases linked to diet and physical inactivity, with disastrous economic forecasts (Knai, Suhrcke, & Lobstein, 2007). Costs are unbearably high to treat the subsequent diseases on the entire population, who requires urgently motivation and guidance to change their habits, in order to choose prevention through healthy eating and active lifestyle.

Several studies have confirmed the growing trend of a very low consumption of fruit and vegetables and a high consumption of high fat and energy dense foods, as well as lack of breakfast among adolescents (Martens et al., 2005), which worsens the current situation.

A recent meta-analysis of health promotion interventions advances that the most effective interventions should increase people’s understanding about the habits usually practised and should involve the participants in the process of behaviour change, in order to show positive results and to have more chances to achieve public health goals when compared with passive interventions, delivering only information on obesity risks (Michie, Abraham, Whittington, McAteer, & Gupta, 2009). Taking all this into consideration, an educational programme called “Planning Health in School” (PHS-pro), was built and an implementation methodology was developed for testing the effectiveness of the strategies implemented and, at same time, investigates the facilitating factors in order to observe positive changes in Portuguese children’s eating behaviours (Vieira & Carvalho, 2011). The PHS-pro integrates healthy eating and active living issues to guide young people towards healthy behaviours, encouraging them to be active participants in their own changing processes. PHS-pro main purpose is to prevent obesity and other chronic diseases linked to nutrition and physical inactivity. PHS-pro was implemented to grade-6 children along a full academic year (2011/2012) in a Portuguese school EB2/3 and this case study evaluates its impact on two obese twins of 11years old.

## 5.2 METHODS

PHS-pro comprised the development of eight learning modules implemented along a full academic year separated by two evaluations (Vieira & Carvalho, 2011), which details are presented in Chapter 2 of this thesis. Globally the PHS-pro intervention involved 219 children (115 boys and 104 girls) distributed over nine classes (mean age of  $11.2 \pm 0.6$ ).

Two evaluations were performed, before (baseline) and after eight months (post PHS-pro), using the following methodological procedure with two phase-approaches for collecting data:

- (1) Anthropometric assessment to collect body composition measures: weight, height and waist circumference (WC) and calculation of body mass index (BMI). All measures were taken according standardized international procedures (WHO – World Health Organization, 1995). International cut-offs points of Cole (2000) by age and gender were used for classifying the prevalence of overweight and obesity. For WC, the reference values of McCarthy (2001) by age and gender were adopted to correlate the percentile curves with the deposition of intra-abdominal fat mass, being percentile 90 ( $\geq P90$ ) the cut-off point used to identify the excessive central fatness (H David McCarthy, Ellis, & Cole, 2003).
- (2) The application of a self-report questionnaire composed of three distinct sections: a 58-item food frequency questionnaire (FFQ) adapted from Lopes (2000) to evaluate eating habits; 8-question food basic knowledge assessment; sport and physical activities and leisure evaluation such as television, videogames and computer.

Throughout the PHS-pro, a major objective was to monitor dietary practices and to evaluate the adolescents' progress after each learning module. In this way, the 3-day food record was chose as the principal tool method for measuring the food consumption and the usual food choices of adolescents, allowing them to report all the food and beverages they consumed for 3 days in high detail (Fisberg et al., 2005). For this propose, a food record was built to be adapted to the features of the research (M. Vieira & G. S. d. Carvalho, 2013). Seven 3-day food records were applied after each of the eight learning modules over the PHS-pro period. Details of this methodology are described in Chapter 4 of this thesis.

The PHS-pro post-evaluation also included a questionnaire supported by semi-structured interviews to obtain adolescents' insights about potential changes observed related to eating behaviour and lifestyle during the programme.

This case study concerns two obese twins, a boy and a girl of 11 years old. They participated in the PHS-pro and, as for the other adolescents, they delivered the food records and were subjected to three evaluations: before the programme (baseline), immediately after the end of the programme (post PHS-pro) and twelve months after (follow-up evaluation).

### 5.3 RESULTS

Figures 5.1 and 5.2 show the twins’ anthropometric data separately and their progression along the three evaluations. At baseline, both twins were considered obese according to the international cut-off points of Cole (2000): the boy had a BMI of 37.5 kg/m<sup>2</sup> (the cut-off point value for obesity in boys with 11 y-old is 25.10) and the girl 26.46 kg/m<sup>2</sup> (the cut-off point for obesity in girls with 11 y-old is 25.42). Regarding the WC, the observed values of 117 cm for the boy and 91 cm to the girl, put them on P95 in the reference values of McCarthy (2001).

After ending the programme, these two anthropometric measures changed for the better: the boy decreased 10.0% in BMI value followed by a cutback of 9 cm in WC (5,8% less), but remained in the category of obese (Figure 5.1); the girl decreased 8.0% in the BMI and 9.6% less in the WC measure, diminishing 8.7 cm, changing from the classification of obese to overweight (Figure 5.2).

During the PHS-pro both adolescents grew in height (159.53 cm to 163.40 cm for the boy and 146.33 cm to 150.87 cm for the girl) and lost weight (95.4 kg to 89.9 kg for the boy and 56.6 kg to 55.4 kg for the girl), being the loss most markedly in the boy, who lost 5.5 kg (Figures 5.1 and 5.2).

Twelve months after the PHS-pro finished, at the follow-up evaluation, both twins showed a slight increase in all anthropometric measures: the boy continued obese<sup>2</sup> (BMI 34.13 and WC 108.63 cm) but did not return to the initial values of BMI and WC recorded at baseline (37.4 and 117,10 cm, respectively); at the follow-up the girl kept the category of overweight<sup>3</sup> (BMI 26.54 and WC 88.93 cm) as at the end of the PHS-pro (24.34 and 82.53 cm, respectively) and was no more obese as she was at the baseline (26.46 and 91.27 cm, respectively) as Figures 5.1 and 5.2 show.

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<sup>2</sup> BMI cut-off point of Cole for obesity in boys of 12.5 years old is 26.43

<sup>3</sup> BMI cut-off point of Cole for obesity in girls of 12.5 years old is 27.24



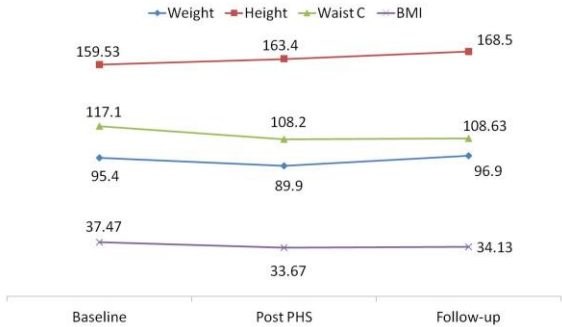


Figure 5.1. Anthropometric data of the boy

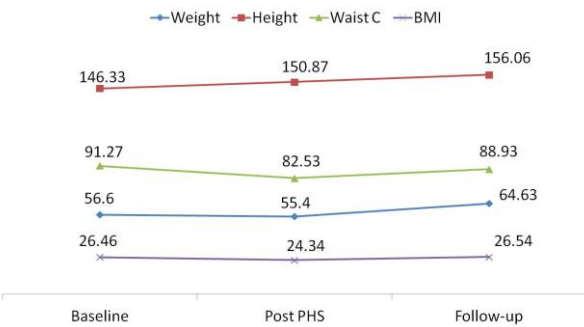


Figure 5.2. Anthropometric data of the girl

On the basis of data collected through FFQ, the eating habits improved in both twins. The boy’s changes were noted in the decrease of the frequency consumption of high fat and high added-sugar foods in a weekly basis, while in the girl, the major changes were in the increase of the consumption frequency of fruits and dairy products. Specifically, the boy reported: eating less smoked meats as smoked ham, salami; decreasing the frequency of cookies and biscuits consumption from “2 to 3 times per week” to “never or less than one time per week”; reducing the consumption of patisserie products (croissants, donuts, pastries and cakes), processed sausages, French fries and sauces (mayonnaise and ketchup) lowering from “one time per week” to “never or less than one time per week”. He also stopped eating daily cereal flakes and bread at lunch and dinner.

The girl reported improvements: in the increasing of milk intake by drinking “4 to 6 times per week” rather than “never or 1 time per week” and yogurt with a frequency of “4 to 6 times per week” instead of “2 to 3 times per week”; greater fruit consumption from “2 to 3 times per week” to “4 to 6 times per week”; and a positive breakfast change from not taking breakfast to doing it “2 to 3 times per week”.

Changes observed on twins’ eating habits through 3-day food record are presented in Table 5.1 Of the total of seven 3-day food records applied along the PHS-pro to monitor it, each twin delivered four 3-day food records properly filled in. Portions of vegetable soup, salad and fruit recorded on the four 3-day food records were summed and calculated the average portions.

Thus, during the PHS-pro, the boy recorded an increase on intake of vegetable soup (2 to 3) and salad (0 to 1) but a reduction in fruit (2 to 1), while the girl recorded an

improvement in vegetable soup (2 to 5) and decreased the fruit (3 to 0) and salad (4 to 3) consumption (Table 5.1). The food record applied at the follow-up, reported a decrease in vegetable soup intake for the boy (3 to 0), which might suggest the loss of the new behaviour of eating vegetable soup established along the PHS-pro. The girl increased even more the vegetable soup (5 to 6) but decreased salads (3 to 2).

**Table 5.1.** Consumption of vegetable soup, fruit and salad in the 3-day food record

Twins	Baseline	Post PHS-pro (Average of 4 food records)	Follow-up
<b>Boy</b>	Vegetable soup – 2	Vegetable soup – 3	Vegetable soup – 0
	Fruit - 2	Fruit - 1	Fruit - 2
	Salad - 0	Salad - 1	Salad – 1
	Total: 4 portions (1.33/day)	Total: 5 portions (1.66/day)	Total = 3 portions (1/day)
<b>Girl</b>	Vegetable soup – 2	Vegetable soup – 5	Vegetable soup – 6
	Fruit - 3	Fruit - 0	Fruit - 0
	Salad - 4	Salad - 3	Salad - 2
	Total: 9 portions (3/day)	Total: 8 portions (2.66/day)	Total = 8 portions (2.66/day)

Knowledge about healthy eating and basic food were evaluated by eight questions. In the two evaluations moments, baseline and post PHS-pro, the boy answered correctly to all questions, getting a score of 100%; the girl improved from a score of 37.5% at baseline to 62.5% after PHS-pro.

Changes between baseline and post PHS-pro were detected in the questionnaire related to physical activity and sedentary habits: the boy reported that signed up in sport futsal, beginning to spend between 4 to 6 hours per week in its practice, while the girl said do not practicing any extracurricular sport and remained inactive.

With regard to the time spent watching television: the boy reported to spend less time daily, from “2 to 3 hours” for “30 minutes to 1 hour”; the girl spent “30 minutes to 1 hour” and continued unchanged.

The questionnaire for measuring the twins’ perception was supported by semi-structured interview, in order to understand whether they changed their eating behaviour and lifestyle in the course of the PHS-pro. The boy defined his participation with the following statement: “ I changed my way of thinking” and recognized the need to make efforts to eat daily vegetable soup and salad because he even enjoyed eating these foods. The twin sister claimed that with the PHS-pro began to give more attention to what she ate, trying to include daily vegetable soup, salads and fish dishes. She also outlined, that she would enjoy doing

some physical exercise and participating in matches. In addition, after PHS-pro she felt more confident in being able to change her weight with healthier lifestyle habits.

## 5.4 DISCUSSION

To the best of our knowledge, this case study is the first to track a pair of obese twins participating in a school-based intervention to promote healthy eating and physical activity. Although the results of this single case study cannot be generalized, it may be of interest in the context of lifestyle-related illnesses diseases and its prevention (Farooqi & O'rahilly, 2000), since the heterozygous twins share a common gene pool and live in the same socioeconomic environment, with a family that provides the same resources and way of living.

In relation to the variables under study related to nutritional status, in general terms, both twins had a beneficial evolution with the PHS-pro and that persisted further to the follow-up assessment, justifying the value of the educational intervention. Twins showed a reduction of their BMI values and WC measures and did not return to the baseline values. These results were mainly influenced by changes in food choices and eating behaviours of both adolescents. Indeed the PHS-pro did help to develop motivation and skills to choose healthy behaviours.

Twins' lifestyle habits, specially their eating behaviours were monitored, revealing an unbalanced dietary pattern at baseline: low income of fruit, vegetables, pulses and dairy products, which are well-known for being rich in vitamins, dietary fibers and minerals like iron and calcium. Additionally, both twins had a frequently consumption of foods high in calories plus high sugar beverages. These behaviours were also associated with physical inactivity. Taking into consideration that each food record corresponds to three days of records, from the onset of the programme, the two adolescents reported a very low consumption of F&V. Even though the overall improvement in the intake of these foods during the programme clearly shows that the twins continued to have a poor consumption of F&V, remaining far behind the daily recommendations in order to supply the adequate quantities of vitamins, minerals and dietary fibers, considered essential nutrients in their age for complete physical and intellectual development. Indeed, an inadequate nutrition is harmful for a correct growth (Delisle, 2005).

As the PHS-pro developed, there were improvements in twins’ attitudes and behaviours, giving clear indications of their greater concern and awareness to adopt healthy eating habits and become more physically active. These new attitude and behaviours have provided visible changes that have had an impact on the adolescents’ nutritional status at the end of the programme.

## **5.5 CONCLUSION**

The participation of these two obese twins in the PHS-pro has changed their attitudes and behaviours toward a healthy diet and lifestyle, thus enabling a positive evolution on their nutritional status and that persisted, at least, one-year upon PHS-pro completion. Hence, this case study suggests that, although the PHS-pro is an educational intervention targeted to prevent overweight and obesity, it showed to be useful in weight reduction even when children are already obese. Additionally, as children and adolescents become increasingly more independent to make their own choices, the implementation of programmes like this one, should be kept over time, without gaps or great breaks, to support healthy behaviours along adolescence.

To conclude, this case study show that it can be possible to follow children during childhood, guiding their growth and encourage them to change behaviours, to get results step-by-step in a consistent and sustained way to stop the rise of the obesity rates. This kind of PHS-pro approach showed to be of great efficiency to act at the most critical period of human obesity development, the period from adolescence to adulthood.

## Chapter 6

### *Study 5: Costs and benefits of the “Planning Health in School” programme*

#### ABSTRACT

**Background:** School-based programmes for preventing childhood obesity have been shown to be effective in improving eating and other lifestyle habits as well as improving anthropometric outcomes, but few intervention programmes with a controlled design have included an economic evaluation. This study evaluates the costs and benefits of the “Planning Health in School” programme (PHS-pro) that promoted healthy eating and active living for Portuguese grade-6 children, aged 10-14 years.

**Methods:** The anthropometric outcomes: height, weight, waist circumference (WC), BMI and waist-height-ratio (WHtR), and the behaviour changes in 219 children of intervention group (IG) were compared with 230 children of control group (CG). A standard economic evaluation was used to determine the cost-benefits of the intervention, following the societal perspective approach. PHS-pro intervention costs were estimated and compared to the direct costs of treating obese adults in Portugal based on a Portuguese study (Ribeiro V. 2010). The net benefit was measured by subtracting the delivery costs of the intervention per child from the total averted medical costs associated with treating an obese adult in Portugal.

**Results:** After PHS-pro, the IG increased in height significantly ( $p<0.001$ ), the WC had reduced significantly ( $p=0.015$ ), and the WHtR showed a significant reduction ( $p=0.002$ ) compared with CG. Furthermore, the IG consumed significantly fewer soft drinks ( $p=0.043$ ), and ate more fruit and vegetables compared with CG. PHS-pro costs were estimated as 7915.53€ with an average intervention cost of 36.14€/child attending to the programme. This is much lower than the average direct costs for treating an obese adult in Portugal, which was calculated as 3849.15€/year and would be equivalent to implementing the PHS-pro in 106 children. The PHS-pro net benefit was positive in 3813.01€ as the monetary benefits clearly overcame the monetary costs. A costing projection for implementing the PHS-pro over a full school year to a larger young population would be estimated as 18.18€/child.

**Conclusions:** The cost-benefits analysis provided evidence that the PHS-pro was economically feasible especially if compared with the medical costs for treating adult obesity. The PHS-pro can be a beneficial investment to prevent overweight over childhood and adolescence, which are developmental stages that determine adulthood chronic diseases.

**Keywords:** cost-benefit, economic evaluation, costing projection, school-based intervention, childhood obesity.

## 6.1 BACKGROUND

Most children who are overweight or obese will continue with excessive weight into adulthood, increasing their risk for premature morbidity and mortality, which calls for considerable resources (C. B. Ebbeling et al., 2002; Reilly & Kelly, 2011).

The economic burden of this epidemic is substantial as a growing body of literature demonstrates in both America and Europe (Cawley, 2010; von Lengerke & Krauth, 2011). In Europe the costs of adult obesity is found to be between 1.9% and 4.7% of the total annual healthcare costs, and 2.8% of total hospital costs were related to overweight and obesity (Lehnert et al., 2013).

Portugal has followed this world trend, characterized first by the progressive increase of the prevalence of childhood overweight and obesity, and consequently by a significant economic impact on obese patients, their families and on society as a whole. A recent meta-analysis study with 9-11 year-old Portuguese children indicated overweight/obesity prevalence in a range from 19% to 35%, placing Portuguese children with excess weight in the top five of the European countries (Gomes et al., 2014). Obesity-attributable direct medical costs in Portugal were first estimated in 1996 representing 3.5% of the healthcare expenditures (Pereira, Mateus, & Amaral, 1999). Later, due to an increase in the prevalence of overweight and obesity among all socio-economic groups, the health care costs rose to 6.9% in 1999 (Veiga, 2008). The most recent Portuguese study about the economic impact of obesity found that the direct cost associated with the hospital inpatient care attributable to obesity was 0.92% of total health expenditure, corresponding to 85.9 million euros (Ribeiro, 2010). These figures illustrate the direct costs only, not including the indirect costs which take account of the value of productivity losses caused by presenteeism, absenteeism, disability, and premature mortality (Lehnert et al., 2013).

Significant increases in the prevalence of obesity over the next two decades has been estimated, mostly severe obesity (Finkelstein et al., 2012). If nothing is done to reduce the new cases of obesity, a heavy impact on obesity-related healthcare costs is expected and consequently inability to sustain the health system. These are clear signs that effective interventions with potential to provide substantial health and economic benefits are urgently required worldwide, including in Portugal.

In response to this need, a research project was designed to developed a new school-based children prevention obesity intervention called “Planning Health in School” programme

(PHS-pro) grounded on the Transtheoretical Model (TTM) and the stages of change (James O Prochaska et al., 2008). The PHS-pro design was strongly committed to providing an effective, easy-to-implement, and sustainable method for helping children to change their behaviours, guiding them towards healthy choices. Additionally, the PHS-pro methodological basis was created in a way that ensures that the programme can be expanded to the subsequent school grades, to prevent obesity in the long-term. The effectiveness of the PHS-pro is presented in Chapter 3, which demonstrates that the implementation of the programme improved children's nutritional status as analysed by several anthropometric measures, and supported by positive changes on children's eating behaviours and physical activity, also described in Chapter 3 and 4.

Several school-based programmes for preventing childhood obesity have been shown to be effective in improving eating and other lifestyle habits, with positive anthropometric outcomes, but few programmes with a controlled design have included an economic evaluation (Gortmaker et al., 2015; Waters et al., 2011). Because there is a lack of data concerning this issue, measuring implementation costs can help decision-making on resources allocation for funding programmes to improve health and prevent obesity (Gortmaker et al., 2015). In this context, this study research question can be formulated as follows: is the school-based programme PHS-pro a beneficial investment for tackling the rise in childhood overweight and obesity?

Therefore, the purpose of this study was to identify and estimate the PHS-pro implementation costs resulting of one-year school intervention that promoted healthy eating and active living in Portuguese grade-6 children, aged 10-14 years.

## **6.2 METHODS**

### ***- The effectiveness of PHS-pro***

The programme focused on changing children behaviours to improve healthy eating and increase an active living during adolescence: increasing consumption of fruit and vegetables and reducing of energy-dense snacks consumption; increasing water intake and reducing of soft drinks consumption; increasing physical activity through active play after school and weekends, together with increasing sports activity and reducing TV viewing time. A non-randomized control group pretest-posttest study was performed to evaluate the effectiveness of PHS-pro intervention in a school setting. The PHS-pro was conducted in the urban town of

Trofa (population in 2011, 38.999) in the Metropolitan Region of Porto, north of Portugal (Pordata - Base de Dados Portugal Contemporâneo, 2011). The four existing elementary schools of Trofa, Porto, were invited to enroll in the PHS-pro. All children attending grade-6 were assigned either the intervention or control groups. Of the 504 children available for the trial, 449 boys and girls (219 in the intervention group and 230 in control group) attended to the two assessments: baseline and follow-up evaluations.

One learning module of 45-minutes was offered monthly, totaling eight learning modules over the academic year, to encourage children to make healthy choices in their daily behaviours. The primary outcome of the PHS-pro included several anthropometric measures: height, weight, waist circumference (WC), BMI and waist-height-ratio (WHtR) collected before and after the intervention to compare the two groups. Lifestyle behaviours were used as secondary outcomes to evaluate change from baseline to follow-up and were self-reported by children. Detailed methodology is described in Chapter 2.

Results based on an analysis of the effectiveness of the intervention demonstrated that children in the intervention group (IG) had great improvements in the anthropometric measures compared with control group (CG). The IG grew significantly more in height (3.6 cm) compared with the control ones (3.1 cm;  $p < 0.001$ ). The WC had reduced significantly in the IG (-0.4 cm) whereas in the CG increased (+0.3 cm;  $p = 0.015$ ), and the WHtR of the IG showed a significant reduction ( $p = 0.002$ ) compared with the CG. In weight and BMI analyses there were no significant difference between groups ( $p > 0.05$ ), although very slightly better results were found in the IG. Details regarding trial methodology and trial outcomes are presented in Chapter 3.

#### ***- Economic analysis approach***

An economic analysis was used to determine the costs of the intervention, following the societal perspective approach as recommended in other studies (Wang et al., 2008; Wang, Yang, Lowry, & Wechsler, 2003). A societal perspective for economic evaluation is considered a classical approach to assessing the profitability of societal investments, once costs and benefits are incorporated, facilitating informed discussions and decisions about access and use of new interventions (Jönsson, 2009).

In this study, the costs and health outcomes after the PHS-pro intervention are compared with a “no intervention” alternative in the control group. For this analysis, intervention costs were estimated and compared to the direct costs of treating obese adults in Portugal (Ribeiro, 2010). The reference year for costing was 2012, the year that the PHS-pro



implementation finished (2011-2012). The net benefit was measured by subtracting the delivery costs of the intervention per child from the total averted medical costs associated to treat an obese adult in Portugal. In addition, since the PHS-pro showed significant improvements in the overall children's anthropometric measures, a costing projection analysis was calculated in order to report a future implementation scenario to replicate the PHS-pro in a larger area of intervention, using the best available data for the eligible young population.

### **- Intervention Costs**

The PHS-pro activities were identified according the two phases of the programme in order to check the resources requirements. *Phase 1* corresponds to the designing and developing the PHS-pro and *Phase 2* with the implementation of PHS-pro (see Chapter 2).

To estimate the costs, direct costs on human and material resources were considered (from September 2011 to June 2012). Human resources costs were based on the amount of time involved for the implementation of the activities and the value was hourly wage according to the expert technical equivalent salary of a Portuguese public employee (Ministério das Finanças, 2008). Human costs also included the time spent on tasks indirectly related to the PHS-pro implementation (PHS-pro design, school meetings, teachers and parents meetings). Transportation costs were concerned with transport between schools in Trofa and calculated according travel expenses current legislation (Ministério das Finanças e da Administração Pública, 2010). Other costs included equipment for the anthropometric assessments, and printing documents; these costs were calculated by summing the purchase receipts.

To estimate per capita intervention costs, the method suggested by Wang (2008) was followed, which considers the total intervention costs divided by the 219 children who received the intervention and achieved significant improvements on the nutritional status.

No additional time for school extra lessons was required as the PHS-pro was designed to be included in the children's grade science curriculum.

## **6.3 RESULTS**

Table 6.1 provides a summary of costs reported by item type, quantity and unit cost information. More than a half of the PHS-pro intervention costs (66.8%) were allocated to *Phase 1*, which included the PHS-pro designing, the preparation of schools and two

evaluations (baseline and follow-up) with a calculated value of 5289.33€. The most expensive item was human resources, taking 83.9% of the total costs, and are based on the hourly wage for managing and delivering the PHS-pro activities (4438.65€, the sum of the wage hours), followed by the development of contents which accounted for 17.6% of the total costs (932€).

The intervention costs for delivering the education activities in *Phase 2* were 2626.2€, which is only half of the investment to run *Phase 1*. Considering that, one can discern that a great deal of costs was allocated to work with the control group, who did not benefit of the PHS-pro, still these costs were necessary to carry a controlled design.

The total costs were estimated as 7915.53€ to implement the PHS-pro during a full school year, in approximately ten months. The per capita net intervention costs was calculated as the total programme costs divided by 219 (the number of children of the intervention group) with a net value of 36.14€ per child.

Table 6.2 shows the calculated costs of PHS-pro by *Phase 1* and 2 (data summarized from Table 6.1) and the obesity-attributable direct medical costs from the most recent national data (Ribeiro, 2010) for estimation of costs savings. According to these data and assuming that every obese child will continue to be obese in adulthood, implementing the PHS-pro with a net intervention cost of 36.14€/child as the PHS-pro, is much lower than the average direct costs for treating one adult obese in Portugal which was calculated in 3849.15€/year. This cost is equivalent to implementing the PHS-pro on 106 children each year. Therefore, the PHS-pro net benefit was positive at 3813.01€ as the monetary benefits clearly outweighed the monetary costs.

Additionally, the cost evaluation of implementing the PHS-pro enables the inference of a costing projection in a programme replication scenario to extend it to a larger group of children. Given this, the Metropolitan area of Porto was chosen to conduct a projection of costs, covering the existing 170 elementary schools and 42953 children distributed in 1652 classes (Pordata - Base de Dados Portugal Contemporâneo, 2012). As a result, it was calculated that the annual cost of implementing the PHS-pro in all classes covering the region of Porto would be approximately 780.789.93€ as described in Table 6.3.

The cost estimation of scaling up the PHS-pro for reaching to all children in the area of Porto, would allow to low the intervention costs. The per capita intervention cost would be approximately 18.18€/child (Table 6.4), which is even more economically feasible compared with the net intervention cost of the pilot version of PHS-pro (36.14€).

**Table 6.1.** One-school year intervention costs of PHS-pro

<b>PHS-pro</b>	<b>Items</b>	<b>Quantity</b>	<b>Unit Costs (€)</b>	<b>Total costs in 2012 (€)</b>	
<i>Phase 1 - Designing &amp; preparation of schools</i>					
	<b>Human Resources</b>	School-boards meetings	12	23.3/h	279.60
		Teachers meetings	2	23.3/h	46.60
		Parents meetings	10.5	23.3/h	244.65
	<b>Transportation</b>	Developing content	40	23.3/h	932.00
		Transfers between schools	170	0.36/km	61.20
	<b>Materials</b>	Printing (questionnaires, informed consents, information cards)	14204	0.022/printing	312.48
		Portable digital scale	1	130	130.00
		Portable stadiometer	1	150	150.00
		Flexible band	3	4	12.00
Subtotal					2168.53
<b>Baseline Evaluations</b>	<b>Human Resources</b>	Lifestyle questionnaire application	21	23.3/h	489.30
		Anthropometric Assessment	42	23.3/h	978.60
	<b>Transportation</b>	Transfers between schools	250	0.36/km	90.00
	<b>Materials</b>	Supplies	1	5	5.00
<b>Follow-up Evaluations</b>	<b>Human Resources</b>	Lifestyle questionnaire application	21	23.3/h	489.30
		Anthropometric Assessment	42	23.3/h	978.60
	<b>Transportation</b>	Transfers between schools	250	0.36/km	90.00
Subtotal					3120.80
<b>Total costs of Phase 1</b>					<b>5289.33</b>
<i>Phase 2 - Implementation</i>					
	<b>Human Resources</b>	Learning Modules	8x9 classes	23.3/h	1677.60
	<b>Materials</b>	Printing (food records, activities)	15709	0.022/printing	345.60
	<b>Transportation</b>	Tranfers to intervention school	500	0.36/km	180.00
	<b>Human Resources</b>	Workshop "Cooking is Science"	18	23.3/h	419.40
	<b>Transportation</b>	Tranfers to intervention school for the workshop	10	0.36/km	3.60
Subtotal					2626.20
<b>Total costs</b>					<b>7915.53</b>

**Table 6.2.** Costs of PHS-pro by *Phase* compared with the direct cost of obesity in Portugal

	<b>PHS-pro</b>	<i>Phase 1</i>	<i>Phase 2</i>
Total Costs (€)	7915.53	5289.33	2626.2
Children enrolled		449	219
Average cost per child (€)		11.78	11.99
<b>Per capita net intervention costs (€)</b>	<b>36.14</b>		
<b>Obesity-attributable medical costs (Ribeiro, 2010)</b>			
Direct medical costs (€)	85.890.000.00		
Annual hospital inpatient episodes	22314		
<b>Average cost per adult obese/year (€)</b>	<b>3849.15</b>		
<b>PHS-pro net benefit (€)</b>	<b>3813.01</b>		

These projection numbers take into account the effect of economies of scale allowing dilution of the costs of the implementation. Moreover, the total costs to apply the PHS-pro to all children of the region of Porto (780.789.93€), would correspond to only 0.91% of the total medical costs per year (85.900.000.00€) for treating obesity in Portugal as estimated by Ribeiro (2010).

**Table 6.3.** Costing projection of PHS-pro implementation in the Metropolitan area of Porto

<b>PHS-pro</b>	<b>Items</b>	<b>Quantity</b>	<b>Unit Costs (€)</b>	<b>Total cost (€)</b>	
<i>Phase 1- Designing &amp; preparation of schools</i>				<i>78834.78</i>	
<b>Human Resources</b>	School-boards meetings	170	23.3/h	3961.00	
	Teachers meetings	170	23.3/h	3961.00	
	Parents meetings	1652	23.3/h	38491.60	
<b>Transportation</b>	Developing content	100	23.3/h	2330.00	
	Transfers between schools	6800	0.36/km	2448.00	
<b>Materials</b>	Printing (questionnaires, informed consents, information cards)	1030872	0.022/printing	22679.18	
	Portable digital scale	17	130	2210.00	
	Portable stadiometer	17	150	2550.00	
	Flexible band	17	12	204.00	
<i>Evaluations</i>				<i>244105.60</i>	
<b>Baseline</b>	<b>Human Resources</b>	Lifestyle questionnaire application	1652	23.3/h	38491.60
		Anthropometric Assessment	3304	23.3/h	76983.20
	<b>Transportation</b>	Transfers between schools	6800	0.36/km	2448.00
	<b>Materials</b>	Supplies	1652	5	8260.00
<b>Follow-up</b>	<b>Human Resources</b>	Lifestyle questionnaire application	1652	23.3/h	38491.60
		Anthropometric Assessment	3304	23.3/h	76983.20
	<b>Transportation</b>	Transfers between schools	6800	0.36/km	2448.00
<i>Phase 2- Intervention</i>				<i>457849.55</i>	
	<b>Human Resources</b>	Learning Modules	13216	23.3/h	307932.80
	<b>Materials</b>	Printing (food records, activities)	3092616	0.022/printing	68.037.55
	<b>Transportation</b>	Transfers to intervention school	6800	0.36/km	2448.00
	<b>Human Resources</b>	Workshop: extra activity	3304	23.3/h	76983.20
	<b>Transportation</b>	Transfers to intervention school	6800	0.36/km	2448.00
<b>Total costs</b>				<b>780.789.93</b>	

**Table 6.4.** Costing projection of PHS-pro compared with treating obesity in Portugal

Metropolitan Area of Porto, Portugal (2012)	
Number of elementary schools	170
Average number of classes	1652
Number of children registered	42953
<b>Total costs estimation (€)</b>	<b>780.789.93</b>
<b>Intervention cost per child (€)</b>	<b>18.18</b>
Obesity-attributable medical costs (Ribeiro, 2010)	
Direct medical Costs (€)	85.890.000.00
<b>Percentage related to the obesity-attributable medical costs</b>	<b>0.91%</b>

## 6.4 DISCUSSION

This is an exploratory study aiming to report the intervention costs of a Portuguese intervention on a pilot basis, and to estimate whether it could be economically feasible to scale up PHS-pro.

An economic analysis of an intervention only makes sense whether the intervention is effective. The PHS-pro demonstrated significant improvements on children’s anthropometric measures after one year of intervention followed by substantial health changes on eating behaviours, in particular a higher consumption of fruit and vegetables and lower consumption of soft drinks. However, it cannot be expected the effects would be sustained over the subsequent years of adolescence, unless the intervention is maintained.

This study found that the implementation of PHS-pro had a net intervention cost of 36.14€/child over a full school year. Moreover, scaling up the programme to a larger population, it allows to lower the intervention costs to 18.18€/child, which is economically feasible to ensure a long-term implementation of the programme. In fact, these analyses can serve the important function of performing further evaluations into a wide rational framework and clearly perceive that paying the costs of a prevention programme to guide a child over eight elementary school years (18.18€ multiplied by 8 school years) represent an investment value at such low costs compared with the costs of obesity over adulthood (3849.15€/year multiplied by the years of life with obesity).

These findings suggest that the costs of undertaking a school-based intervention to follow children during the years of adolescence are much more economical than doing nothing, and in the future to bear the high costs of treating obesity (Ribeiro, 2010).

As the results show, the costs of implementing preventive measures were rather positive, which means that any investment in this area will bring an exceptional cost savings to the national health system of obesity related diseases and their treatments that require expensive costs. A prevention programme implemented over the elementary school years through childhood and tailored specifically for acting locally as the PHS-pro is able of doing so, may have great potential to report great results on health promotion.

An extensive review by the Cochrane Collaboration (Waters et al., 2011) of preventing children's obesity interventions examined several programmes and strategies and warned that no studies had included a formal economic evaluation, and reinforced the urgent need for analysing economic data and costs estimation of conducting intervention. One study, for decreasing sugar beverage consumption in adolescents (Cara B Ebbeling et al., 2006), estimated the costs for delivering the intervention as US\$ 35 per student over 25 weeks. This is in line with the PHS-pro costs of 36.14€/child. A few more studies reported by Waters et al. (2011) presented their intervention costs. However the design of these studies and their components and strategies are very different, making a straightforward comparison with PHS-pro costs extremely difficult. Wang and colleagues (2003) estimated costs of US\$14 per student per year and Wang also reported costs of an after-school programme to prevent obesity among elementary school students with a net intervention costs per capita of US\$317 (Wang et al., 2008).

More recently, the Australian programme "Be Active Eat Well" calculated costs of AU\$344 per child (Moodie et al., 2013). A combination of nutrition and physical activity intervention in China estimated the intervention costs to be US\$26.8 per child (Meng et al., 2013). Most of the studies that reported costs to find the cost-effectiveness of the interventions gave special emphasis on quality-adjusted life years (Brown et al., 2007), explored the disability-adjusted life years or focused on cost per unit of BMI reduction. However for these kind of analysis it is necessary to make several assumptions and, as Gortmaker (2015, p. 105) stated, "assuming that effects of childhood interventions persist over decades may be unrealistic". Hence it is not a relatively simple task to translate costs and benefits or cost-effectiveness of interventions into pragmatic decisions for public health actions to counter obesity.

Considering the great prevalence of overweight and obesity found in Portuguese children, all children during adolescence growth are at risk and should have access to an educational intervention aimed at encouraging regular healthy habits. As far as it is known, the current practice in Portugal does not include this kind of intervention. The literature reports a few Portuguese school interventions, but these have not been accurately assessed, and in addition they were only short-term studies, both of which are decisive factors in determining their effectiveness (Gaspar et al., 2013). Thus, the calculated PHS-pro intervention costs could not be compared with other alternative studies in Portugal.

It is worth noting a few considerations concerning this study and its limitations. The extent and the scope of obesity and related costs are quite extensive and this study has solely investigated the PHS-pro intervention costs by comparing them with the direct medical costs, which represents a small portion of the total costs of obesity (Ribeiro, 2010). Hence, all the others costs such as the indirect costs, which includes morbidity and mortality costs (Lehnert et al., 2013) were not considered, since there are no Portuguese updated data available (von Lengerke & Krauth, 2011).

Also, in the present study the staff training costs were not considered, since this was the first PHS-pro implementation, and it was undertaken on a pilot basis, so the costs associated with training staff members to subsequently implement the programme in several schools simultaneously were not considered. However, in a future scenario of replicating the programme at schools costs of staff training should be evaluated and included. Based on the field experience acquired during the programme implementation, we estimated that to deliver the PHS-pro in each school, at least two health educators would be needed, a nutritionist and a trainee-assistant, for carrying out the education activities and the multifaceted work developed with the school staff.

Despite the limitations of the study, it was possible to initiate a research based on estimated costs of prevention programmes for children obesity in Portugal, which is a very useful issue for political decision-making in the public health field, still largely unexplored. The concept of ‘scaling up’ health promotion interventions is, at present, a new imperative in the public health and health promotion policy context. The transition of an intervention from a research setting into a practical implementation stage demands a change of scale, which ensures substantial information, allowing decision-making for widespread implementation (Milat, King, Bauman, & Redman, 2012).

In summary, this work highlighted the investment needed to implement a prevention programme, which potentially promises public health medium-term gains. After showing to



be effective, the PHS-pro is economically attractive and it is a beneficial investment for tackling the rise in childhood overweight and obesity, when compared with the range of costs presented by other studies.

PHS-pro for grade-6 children can be a means of responding to the challenges that obesity prevalence imposes by guiding young people to healthy choices and daily behaviours over their childhood. One of our main plans for the future is to analyse the cost-effectiveness of the PHS-pro. We have not conducted it within our research due to the fact that we have no information regarding some Portuguese national data that will be required to perform such analysis in a deeper way.



## Chapter 7: General discussion

The main purpose of this thesis was to develop a behavioural-change programme, the PHS-pro, to be a healthy eating and active living educational model for Portuguese children of grade-6 and conduct the first effectiveness trial to evaluate the impact of it.

The previous chapters describe the designing and implementation of the PHS-pro, over a full school year, in order to support a healthy weight for a healthy nutritional status to prevent obesity and diet-related diseases. To accomplish this, specific goals were established and five studies were undertaken. This general discussion starts with some methodological issues regarding the study design, measurements and implementation of the PHS-pro and identifies strengths and limitations. This is followed by the main findings of the five studies evaluating the PHS-pro intervention. Finally, some recommendations are given for future research and practical implications that arose from this work, taking particular consideration of the national picture.

### *– The studied population*

As outlined at the starting point of the PHS-pro designing, all children attending grade-6 were recruited to obtain a representative sample of children in a socio-economic and delimited geographical living region of Portugal (see section 2.4.4, Chapter 2). This goal was accomplished and it was possible to organize two balanced samples of subjects (IG and CG children), and carry out the quasi-experimental design previously selected. Accordingly, the effectiveness of the PHS-pro was evaluated in a non-randomized control group pretest-posttest study. As this study design was not randomized (see section 2.3.2, Chapter 2) there is always a risk of selection bias, however both groups were homogeneous regarding age and gender, and had high participation rates and low dropouts.

The similarity of both groups was an important issue for comparison between children exposed (IG at intervention school) and not exposed (CG at control schools) to the PHS-pro. At baseline, it was found that IG and CG children differed regarding paternal education level, and maternal and paternal occupation (Table 3.2, Chapter 3). As regards the anthropometric measures, CG was significantly heavier and consequently the BMI was higher (Table 3.3, Chapter 3); moreover significantly more children of CG were overweight (33.0%) and obese (15.2%) as compared to IG children (27.4% were overweight and 10.5% were obese). For the eating and physical activity patterns, the two groups did not differ (Table 3.5, Chapter 3). Such factors have to be considered, because the impact of the PHS-pro can be different

whether it is implemented in other populations. However, findings of PHS-pro can be relevant for replicating in larger studies in other regions and in other group ages.

*- Measures and process evaluation*

Both quantitative and qualitative measures were used for evaluating the effectiveness of the PHS-pro and the process evaluation of the implementation. Children's nutritional status changes were assessed by an anthropometric assessment in two evaluation times (baseline and follow-up) using standard procedures, and one single examiner performed all measurements. Height, weight and WC measurements were selected as primary outcome measures to evaluate the effectiveness. Additionally, BMI and WHtR were also calculated. Although BMI is frequently used as outcome measure, it is not a reliable measure due to its low sensitivity for the percentage of body fat, and is not the suitable method to assess adiposity change in children. Instead, WC can identify fat tissue change over time with more accuracy (Brambilla et al., 2013). Anyhow, BMI measure served for screening the children's weight status into thinness, normal weight, overweight and obesity and classified children according the international cut-off points of Cole (2000; 2007).

The BMI screening results, at baseline, allowed perceiving the prevalence of overweight and obesity in the studied population for comparison with the national and international trends. Likewise, as it was previously planned, BMI provided the access of each child's nutritional status, allowing the delivery of the nutritional status information to parents in individual information cards (baseline and follow-up cards) at the end of the programme, ensuring data privacy and confidentiality.

Eating, physical activity, sedentary behaviours and food knowledge were assessed by questionnaire in both groups (CG and IG children). Questions regarding behaviours were adapted from existing questionnaires (Cade et al., 2002; Eaton et al., 2010; Lopes, 2000; Thompson & Byers, 1994). The questionnaire was pilot tested in a population with similar background (same region, same grade and age). Self-reports to evaluate eating and physical activity behaviours are commonly used to assess behavioural data of children, however this kind of data are susceptible to report bias by inaccurate responses and errors in recall (Livingstone et al., 2004; Thompson et al., 2010). Therefore, behavioural data of the PHS-pro studies should be treated with considerable caution.

For measuring change on eating behaviours after each learning module and over the PHS-pro intervention, the 3-day FR was the selected method to collect dietary intake. The FR is considered the most accurate method, both in qualitative and quantitative terms, to describe

food eaten (Crawford et al., 1994; Thompson & Byers, 1994). Although FR applications were carried out under careful instructions to accomplish, and closely followed by teachers, many children did not follow the instructions and several tens of food records were withdrawn. Two main reasons were found for this: food record forms loosed and uncompleted or inaccurate data. However, of the seven FR applications, the FR return was above 60%, with the exception of one time that fell to 44% (see section 2.6.2, Chapter 2). Also girls showed to be more involved in the 3-day FR returns (54%) compared to boys (46.0%).

As mentioned above, it became clear that most children considered the FR a tedious task and not well accepted for at least two reasons: first, the 3-day FR was applied several times, becoming a repetitive task over the intervention, seen as one more school's homework. This issue was considered during the PHS-pro designing; still the FR application after each educational module was crucial to evaluate the effectiveness of the different modules of the PHS-pro; the second reason may have been caused by the too long and relatively labour-intensive of the 3-day FR, since it was not one but three days, and this may have contributed to discourage filling it.

Apart from these limitations, measuring food intake among free-living individuals is considered a challenging task and self-reported data is a widespread problem in the research field (Kirkpatrick et al., 2014). Underreporting unhealthy behaviours such as high-dense foods and soft drink intake and overestimation of F&V intake could result of recall errors or social desirability, which create bias (Klesges et al., 2004; Livingstone et al., 2004; Robinson, Thomas, Aveyard, & Higgs, 2014). Therefore, the interpretation of the studies outcomes must be treated with considerable caution.

The PHS-pro was subjected to a proper process evaluation regarding the contents and structure of the programme implementation, which allowed to explore the impact of specific intervention strategies to achieve the aims of the programme and its outcomes. Additionally, the process evaluation provided information about particular strengths and weak points from the perspectives of participants, as presented in Chapter 2.

Data for the process evaluation of PHS-pro implementation were mainly qualitative and measured through questionnaires, focus group, and researcher observations recorded and grouped in structured field notes (Oakley, Strange, Bonell, Allen, & Stephenson, 2006). In this sequence, the process evaluation revealed that the PHS-pro was largely accepted by children, since most of them referred that their eating behaviours changed during the programme and considered the PHS-pro a valuable tool to improve their healthy habits. Furthermore, the feasibility and the acceptability of the programme were assessed throughout

teachers' inputs, which supported the idea of spreading of the programme format to other grades.

The overall process evaluation measures also revealed that the programme was implemented as designed, except the plan of training the school community (teachers, kitchen staff) that failed. In addition, other unplanned school activities emerged and the programme was able to adapt for taking part in them.

Children participation achieved high rates, reached to all the recruited participants and there were no dropouts. In fact, the only boy who refused participating in the programme, subsequently decided to participate and was accepted, although his participation data were not included.

For the process evaluation regarding the economic costs of the programme, the researcher field notes were decisive by providing the necessary information to conduct the cost-benefit analysis of the programme (see Chapter 6). In short, the process evaluation of the intervention provided support to draw conclusions about its implementation and acceptability, but also helped to determine whether it can make a difference in children's lives, as Baranowski and colleagues advocate (2003).

In summary, these methodological issues may, at least to some extent, be the foundation to explain the positive results of the programme found on children's nutritional status and behaviour changes.

## **7.1 MAIN FINDINGS OF STUDY 1**

Well-designed interventions are urgently needed for preventing childhood obesity in Portugal. Study 1 (presented in Chapter 2) aimed to describe the step-by-step development of PHS-pro, in which research design, theoretical support, educational components and the process evaluation were addressed. The implementation of the PHS-pro was analysed by the participants' views on the several components of the intervention. Such insights gathered among children participants and teachers allowed the process evaluation of the PHS-pro implementation.

Children's views about the programme components and the perception of their individual changing process of behaviours were obtained by questionnaire. The participation rate met almost the entire sample (99.1%). The findings showed a good acceptance and compliance, with the entire sample agreeing about the overall educational components (learning modules, workshop participation and literary contest). By contrast, the 3-day FR

was the less approved activity, explained by the fact that the application occurred seven times over the intervention, which became a repetitive task. Nevertheless, of the seven deliveries, the returning was steadily above the 60%.

Children's perceptions about behaviours changes showed that they were able to identify their own positive changes (84.6%) indicating improvements on fruit (40.6%), and vegetable soup consumptions (27.6%) that are consistent with the results presented in Chapter 4. Likewise, almost all children supported the idea that the PHS-pro can help young people to eat healthier (98.2%).

Teachers' inputs were provided by questionnaire and followed by a focus group for a SWOT analysis. The literary contest was considered such a successful experience that promoted commitment and cohesion among children. According to teachers, other PHS-pro components were well accepted, with the exception of the 3-day FR, for the reasons appointed above, and confirmed by them. To sum up, teachers were very enthusiastic about the idea of extending the PHS-pro to other school grades.

These findings contributed to perceive which components of the intervention and strategies were successful or not. Furthermore, they helped to find out improvements to be incorporated in further adaptations of the PHS-pro in order to increase acceptability among children and enhance efficiency and feasibility for sustainable long-term intervention.

Some methodological issues should be considered for a proper interpretation of the results found in the distinct studies presented subsequently. The development of the PHS-pro started with two basic assumptions: behavioural focus and participation of children on their change process. Having this in mind, the programme was designed under the TTM of behaviour change, which provided guidance in the process of change, allowing to interpret children's stage of change such as the way how children were specifically prepared for change (James O Prochaska et al., 2008). In fact, to improve the likelihood of effectiveness, interventions need to be based on behaviour change theories that focus on promoting action (Brug, Oenema, & Ferreira, 2005).

The assessment of the baseline stage of change (section 2.5.2, Chapter 2) allowed to clarify children's stage of readiness to change behaviours and conduct the PHS-pro according with their intention of change. This strategy unlocked an important answer in relation with children real needs, which was consequently critical to line-up PHS-pro contents for developing children's knowledge and skills, and facilitating the adoption of adequate eating and healthy behaviours.

The TTM was applied to multiple health-related behaviours and demonstrated to be an

effective and flexible model for promoting behaviour changes, particularly in healthy eating, physical activity, and F&V intake (Armitage, 2009; Glanz et al., 1998; S. S. Johnson et al., 2008; James O Prochaska et al., 1994). Therefore, the main strength of this study was the theoretical support of the programme grounded on TTM, the stages of change and the processes of change. All these were applied on the designing, on the overall planning of the PHS-pro components and on the assessment of children's baseline stage of change, allowing to measure the motivation to change. A growing body of evidence has showed that interventions designed in light of behavioural theory are more likely to be effective and result in changes than those where there is lack of theoretical base (Baranowski et al., 2003; Glanz & Bishop, 2010).

As far as we know, PHS-pro is the only formal Portuguese programme model to apply the stages of change and the core constructs of the TTM, for developing skills towards healthy behaviours among Portuguese children over a full school year.

Another successful approach of PHS-pro conception was the application of the participatory methodology principles (Simovska, 2012; Soares et al., 2004), seeking for an active participation of children for their own change process. The PHS-pro designing enabled children to take part of distinct and various activities: the selection of topics, active participation during the learning modules, the literary contest and the workshop, all strengthening the engagement of children in the overall programme.

Findings of Study 1 (Chapter 2) suggest that children's active participation must be highly considered to increase their motivation, and children's inputs can lead to a better acceptance of the intervention and better outcomes as shown in Figure 2.3, Chapter 2.

A rigorous preparation process of the school setting was required for a successful implementation of PHS-pro. Several procedures such as the recruitment of schools, ethical issues, the evaluation of the school setting conditions, as well as the commitment of teachers had to be established and parents had to be involved, which took a long preparation, but strengthened the implementation.

It appears consistent that the three elements above mentioned showed to be essential for a successful implementation of PHS-pro: behavioural focus based on the TTM of stages change, active participatory activities and children involvement over the process implementation, and the early planning of the programme and preparation of school environment.



## 7.2 MAIN FINDINGS OF STUDY 2

The PHS-pro resulted in some changes on the anthropometric measures of children, eating behaviours and physical activity and had a positive impact on knowledge about healthy basic foods.

### - *Effects of PHS-pro on the anthropometric measures*

The main effects of the programme regarding anthropometric measures were evaluated in Study 2 (Chapter 3).

We hypothesized that the implementation of PHS-pro, a behavioural change educational intervention about healthy eating and active living issues in grade-6 children, over an academic year, would lead to positive changes in their anthropometric measures for a healthy nutritional status. The primary aim was to determine anthropometric changes on children following the PHS-pro as compared to a control group.

The results showed that PHS-pro was effective in improving some anthropometric measures toward a healthy nutritional status of IG children. Favourable changes and significant intervention outcomes were found on height and WC among boys and girls; height change was stronger for boys, and WC change was stronger for girls. This outcome is particularly exciting as long as WC is an accurately indicator of fat tissue changes (Brambilla et al., 2013).

No significant intervention effects on weight and BMI were found, however IG had a less steep increase in BMI, among girls and boys compared to the CG. At same time, both boys and girls of IG had a more pronounced increase in weight than boys and girls of CG. This may be attributed to the fact that IG children increased their height more than CG, which implied a bone tissue gain and contributed for weight gain.

School-based interventions for primary prevention of overweight and obesity are heterogeneous in design and methodologies, participants, age groups, school systems, outcome measures, among other aspects, disabling results comparison. Also, few intervention trials showed impact on weight status of children and adolescents (Waters et al., 2011).

There has been little research investigating WC changes in children, the majority of studies on school-based programmes have used BMI as the principal effectiveness measure. However, our WC results are in agreement with two previous intervention studies (Sanigorski et al., 2008; Taylor et al., 2007).

*- Effects on eating behaviours and physical activity*

The effects of PHS-pro on eating behaviours and physical activity were assessed, being the secondary aim of Study 2 (Chapter 3). Children's eating behaviours were assessed using a FFQ for five-food clusters evaluating health-risk eating habits: F&V, soft drinks, high-energy dense food, high sugar food and high fat food.

At baseline, children of both groups (IG and CG) did not meet F&V recommendations of 5 servings per day (WHO – World Health Organization, 2003). Improving F&V intake was one priority target of PHS-pro. An adequate daily consumption of F&V provides a wide range of indispensable nutrients for a proper growth and development whilst prevents diet-related chronic diseases. Concurrently, recent surveys pointed out that fruit consumption decreased with the increasing age (Currie et al., 2012; Inchley & Currie, 2016) and initiatives that prevent and counteract this trend are required.

After PHS-pro, the results were encouraging, as F&V intake showed a significant improvement from 2.8 to 3.2 servings/day in IG children, while CG decreased from 3.2 to 3.0 servings/day. An analysis of seven school-based nutrition programmes seeking to increase F&V consumption has shown weaker results (Howerton et al., 2007) than those of this study. Conversely, the most recent Cochrane review about intervention programmes for children (Waters et al., 2011) reported five studies that significantly improved F&V consumption.

A significant intervention effect was found on soft drink consumption: IG children significantly decreased the intake from a median of 0.7 to 0.5 servings/day, while CG remained the stable intake of 0.5 servings/day. Comparable findings to this PHS-pro's outcome were found in two school-based programmes (James et al., 2004; Taylor et al., 2007).

No positive effects on high sugar, high fat and high dense energy snacks consumption were found. The lack of intervention effects on these eating behaviours targets was somehow disappointing. There might be at least a couple reasons why there was no evidence of change on these self-reported consumptions. First of all, PHS-pro offered eight educational contents, in which there were more time engaging children for promoting healthy food choices than avoiding unhealthy ones, as PHS-pro was not a restriction-oriented behavioural intervention. A second reason for the lack of positive changes could be that these food products were addressed at the final of the programme in the last learning module and that may not have enough impact to achieve changes. Another possible explanation could be that the FFQ is not sensitive enough to detect changes in such food categories, although it was previously validated for the target population.

The practice of regular physical activity and sport was the focus of one module (the LM6, see Chapter 2). Children's physical activity were evaluated using a questionnaire adapted from YRBS (Eaton et al., 2010). Self-reported data allowed to perceive the strong context of sedentary habits that Portuguese children lived in. At baseline, both groups did not meet physical recommendations and were much below the 60 minutes/day. Portuguese school physical education ensures 135 minutes/week, which gives 19.3 minutes/day. Half of the children did not practice any sport or other extra-school physical activity. In addition, time spent with sedentary tasks was found to be very high, with half of the children reporting 90 minutes daily on these activities. After the intervention, there was a clear positive intervention effect on time spent in physical activities, as it was found a significant increase of 4.3 minutes per day in IG children, while it decreased significantly in the CG. Consistent with this finding, a recent systematic review involving 14326 children to access the effectiveness of interventions on physical activity showed an increase of 4 minutes/day (Metcalf et al., 2012), which is similar to our results.

For the time spent with sedentary activities no positive intervention effect was found, furthermore it was found a significant increase in IG children that reported to spend more time with these activities. In addition, PHS-pro educational intention was not limited the time in front of screens, but motivate children for physical activities to bring closer the balance between time dedicated to physical and sedentary activities.

In summary, PHS-pro did improve anthropometric outcomes effectively leading to better children's nutritional status and showed to be effective in reducing soft drink consumption, in improving daily F&V intake, and encouraging the dedication of more time to physical activities. These findings are promising, suggesting that PHS-pro intervention can contribute for promoting healthy behaviours, the major requirement to prevent children's overweight and obesity.

*- Differences in food-basic knowledge between children studied groups*

Food-basic knowledge was accessed in Study 2 (Chapter 3). This procedure was followed as a methodological strategy to confirm that the two-studied groups for comparison were in equal conditions, rather than a study's primary aim. Since the "Portuguese food wheel" is a subject matter of natural science curriculum in grade-6, both IG and CG were equally exposed. According to this, changes on food knowledge over the school year were evaluated by questionnaire. At baseline, there were no differences between groups regarding food-basic knowledge. After the school year, both groups had significant improvements compared to

baseline. Food knowledge can help promote children's healthier attitudes and choices, however, only knowledge is not enough to result into daily practice changes (Hesketh et al., 2005; Worsley, 2002).

### **7.3 MAIN FINDINGS OF THE STUDY 3**

The impact of the eight learning modules on children's eating behaviours was evaluated in Study 3 (Chapter 4). Children eating behaviours were evaluated using seven 3-day FR to determine behaviour changes for nine specific food behaviours and according to the learning modules goals: vegetable soup, fried food/high fat food, water, milk, soft drinks, fruit, vegetables, bread, high-energy dense food (Chapter 4, section 2.4.2). At baseline more than one-third of the children did not eat fruit and vegetable soup over a 3-day period, and more than half did not eat any sort of vegetables. In addition, soft drink consumption was a current behaviour for more than half of children with one or more servings in a 3-day period.

Such unhealthy dietary habits, in particular the low F&V intakes and the rising trend of high-sugar food and beverages (Ambrosini et al., 2012; Diethelm et al., 2012; Cara B Ebbeling et al., 2012; WHO – World Health Organization, 2009a), are taking children at great risk for obesity and related chronic diseases, such as diabetes, cardiovascular disease and cancer (Alberga et al., 2012; Reilly & Kelly, 2011).

In this Study 3, PHS-pro intervention led to several positive effects on children's eating behaviours. After intervention, there were significant changes on vegetable soup, milk products and fruit to higher consumption, while high-energy dense food and soft drink consumption significantly decreased. No positive effects on fried food, water, vegetables and bread were found. Most of the successful interventions with children of the same age range are in line with our findings: high levels of F&V intakes, reductions in high energy dense foods and soft drink intake (Waters et al., 2011).

The lack of consumption changes on fried foods and vegetables in salads or cooked were, in a way, disappointing. This can be explained by the fact that these foods are usually served at meals, and are not prepared by children or even decided by them. Such factors either facilitate or impeded such behaviours, consequently children did not have absolute control in such circumstances (Reinaerts et al., 2007). In contrast, fruit serving consumption significantly increased after the PHS-pro intervention. Reinaerts (2007) explained that fruit consumption is more under children's control and in the case that child chooses to eat fruit, availability is the only important factor for fruit consumption. For these reasons, it became

clear that parental involvement must receive more attention and have to be more intensive over the intervention. A continuous communication with parents seemed to be essential to support healthy meals at home. Although parental involvement was included in PHS-pro, it was restricted to two moments, at the onset of the programme and at the end of it. This strategy was intentional, because PHS-pro was a pilot version and it was of highest importance to investigate the impact of the components and strategies addressed to improve children's skills for healthy choices.

Children's attitudes, preferences and intentions toward healthy food choices were also assessed in Study 3 under Chapter 4. After the participative activities implemented in the context of the eight learning modules, it was clear that PHS-pro had an immediate impact, given that children attitudes changed positively and this was supported partly by the outcomes found on eating behaviours changes.

In all participatory activities children's motivation for healthy changes were observed. In activity 1 (A1), children expressed the commitment of improving vegetable soup intake and avoiding fried foods. A significant change was found on vegetable soup intake but not for fried foods. In A2, children's decision was increasing water and milk consumption, and decreasing sugar-sweetened soft drinks. This attitude was followed by a significant change in milk products servings, but not in water or soft drinks consumption. In A4, children's intentions of eating fruit in the day after the activity were evaluated, showing that all children had a positive attitude to improve fruit consumption. This result is coherent with the fruit behaviour change improvement found in FR4. Later, in A7, children were assessed regarding foods that can be part of a healthy snack. A great number of children identified correctly healthy foods for healthy snacks (95.5%) such as bread, milk products and fruit instead of high-energy dense foods or soft drinks. This result was followed by a significant decreasing intake of high-energy dense foods and soft drinks recorded on FR7. Therefore, there was a great agreement among behaviour changes observed and children attitudes expressed in the participatory activities.

Children preferences for vegetables were evaluated in A5. A great proportion of children (78.2%) reported having at least two favourite vegetable soups; for fresh salads, the majority (66.7%) had at least two preferences; vegetables served as a side dish received a similar acceptance by children (68.6%) reporting having two preferences. Such findings can support the idea that children enjoy eating vegetables. However, these must be their favourite ones and easily accessible. In that way, several strategies should be created to introduce to children other vegetables options and extend their choices of consumption.

Regarding children's intentions toward healthy living choices were assessed twice: at A3 it was proposed to identify the risk behaviour that family should avoid. The majority of children (75.2%) was able to determine the key change for a healthier family environment and most of them expressed the need of taking measures for changing habits. The A6 focused on active living such as physical and leisure activities. The great majority of children were not engaged in sports practice (56.6%), however they were motivated to participate in sports and other playful activities.

Comparing these results with previously conducted school-based interventions is unsuitable due to different designs and differences in outcomes measures.

In conclusion, the learning modules and participatory activities, in which children set goals and made commitments to change a specific behaviour or engage on a new behaviour, resulted in significant eating changes. Finding out children needs, focused on specific behaviours that they are already prepared to change, and then implementing practical recommendations appeared to be a successful strategy. In sum, applying these three elements: behaviour commitment based on the TTM of stages change, participatory activities, and children involvement in decision-making goals and feedback, seemed essential to achieve significant results and showed to be a promising intervention strategy.

#### **7.4 MAIN FINDINGS OF STUDY 4**

The impact of PHS-pro on a pair of obese twins' nutritional status was evaluated in Study 4 (Chapter 5). To our knowledge, this case study is the first to track a pair of obese twins participating in a school-based intervention to promote healthy eating and physical activity.

Having a pair of twins participating in the PHS-pro allowed to track them twelve months after the ending of the programme (follow-up evaluation). Both twins had a beneficial evolution over the programme (baseline and post PHS-pro evaluation), and that persisted until the follow-up evaluation. They had a reduction of the BMI values and WC measures after the end of the programme (post-PHS-pro) and did not return to the baseline values. They modified their attitudes and adopted healthier behaviours changing food choices and eating behaviours.

In summary, participation in the programme promoted positive changes on twins' attitudes and behaviours. Nutritional status of both twins improved, showing that the PHS-pro

had a long-term effect. Indeed, one-year after completion of the PHS-pro, the twins showed a better nutritional status compared to the values found at baseline. Although the PHS-pro is an educational intervention targeted to prevent overweight and obesity, it showed to be useful in weight reduction even when children are already obese.

## 7.5 MAIN FINDINGS OF STUDY 5

Costs and benefits of implementing the PHS-pro were determined using a standard economic evaluation in Study 5 (Chapter 6). PHS-pro intervention costs were estimated and compared to the direct costs of treating obese adults in Portugal (Ribeiro V. 2010). The net benefit was measured by subtracting the delivery costs of the intervention per child from the total averted medical costs associated to treat an obese adult in Portugal.

This study found that the implementation of PHS-pro had a cost of 36.14€/child per year, which is much lower than the average direct costs necessary for treating one obese adult in Portugal (3849.15€) per year. The PHS-pro net benefit was greatly positive (3813.01€) as the monetary benefits clearly overcame the monetary costs.

The importance of these findings lies in the fact that the cost of treating an obese adult each year can assure the implementation of PHS-pro on 106 children. Also, such costing estimation of the programme enabled the inference of a costing projection in a scenario of a programme replication to extend PHS-pro to a much larger group of children. According to the effect of economies of scale that allows dilution of costs, our findings suggest that the net intervention costs per capita can reach to 18.18€/child per year, leading to considerable savings. Therefore, PHS-pro could have great potential, since few resources and costs are needed to expand such intervention, and give the opportunity of preventing children becoming obese and unhealthy.

Few studies reported economic data and costs estimation of interventions (Waters et al., 2011). Consistent with our findings are those of Ebbeling (2006) who estimated similar costs of US\$35 per student for delivering an intervention to target sugar beverage consumption in adolescents, and of Meng (2013) who estimated a cost of US\$26.8 per child in a combined intervention of nutrition and physical activity, despite the slight exchange difference between the dollar and the euro. Wang et al. (2003) reached to an intervention cost of US\$14 per student per year in an obesity prevention programme.

In contrast to our findings, the “Be Active Eat Well” programme calculated higher

costs of AU\$344 per child (Moodie et al., 2013), as an after-school programme to prevent obesity among elementary school students with US\$317 per capita (Wang et al., 2008). However, as mentioned earlier, the design of the intervention studies and their components and strategies are very different, making extremely difficult a straightforward comparison between intervention costs.

This exploratory study is the first to estimate the costs of an educational intervention programme implemented in Portugal. This work highlighted the investment required to implement a prevention programme, which potentially promise public health medium-term gains. After showing to be effective, the PHS-pro is economically attractive and is a beneficial investment for tackling the rise of childhood overweight and obesity. Further research regarding cost-benefit of PHS-pro should point out for a deeper analysis to find out results of cost-effectiveness.

## **7.6 FUTURE RESEARCH AND PRACTICAL IMPLICATIONS**

The present thesis is the first Portuguese study to evaluate the impact of a behavioural-change programme over a full school year among children. Hence, the current work contributes to the body of knowledge in the largely unexplored area of interventions for preventing childhood obesity, and therefore offer evidence to guide practice of health promotion in schools. A number of interesting questions were raised after this pilot version intervention, and important issues to be addressed in future research for improving the PHS-pro educational model include several recommendations:

*- Increasing evidence of PHS-pro efficacy: other school environments, more age groups*

In 2011, it was involved the four existing schools of a small municipality integrated in the Metropolitan Region of Porto to implement the PHS-pro and evaluate effectiveness of the intervention. The intervention has focused on only one school and it is unknown whether the present results can be reproduced in other children and other school contexts. Consequently, to prove the effectiveness of this PHS-pro model in other children populations, it is essential to replicate the study in a larger sample and other school environments. Indeed, PHS-pro might be easily applicable in other regions, since it showed to be a workable approach in a complex setting such as school environment; all activities and components of the programme were carried out in accordance with the conceptual planning and embedded in the school year



activities, which conciliated school schedules, curriculum contents and infrastructures, school staff and family efforts.

Enrolling a great number of schools would make possible a randomized controlled trial, which would provide the best evidence for determining a causal relation between an intervention and its outcomes, however this kind of study design is often not feasible or unable to accommodate the complexity and flexibility of school-based programmes (Gortmaker et al., 2011; Rychetnik, Frommer, Hawe, & Shiell, 2002). Otherwise, as the sample size turns larger, schools are the unit of analyses. Schools environmental contexts vary widely, thus adopting a cluster-randomized trial is the ideal evaluation design, enabling the exclusion of contamination between groups and the risk of selection bias (Craig et al., 2008; Hawe, Shiell, Riley, & Gold, 2004).

Additionally, the programme could be extended to other age groups and implemented in a longitudinal approach. Hence, future research should take place with the PHS-pro involving even more children. Since the PHS-pro designing has a theoretical-based foundation, a long-term intervention can be developed over the school years. New contents tailored to the real population needs, according to children's interests and adjusted for each school grade can be created. That, therefore, leaves us the chance of involving other age groups for a long-term intervention. Moreover, larger scale implementation allows to improve strategies in increasingly effective ways, enhancing the guidance that young people should have to adopt healthy lifestyles towards positive and robust nutritional status and other health outcomes for a proper growth.

In Portugal, health programmes addressing childhood obesity prevention are scarce, and evidence of being effective is insufficient and weak (Filipe et al., 2015; Gaspar et al., 2013). The national need of long-term strategies for the prevention and effective management of obesity launched in 2004 by the Portuguese Health Ministry remains unfilled (Ministério da Saúde, 2004). Isolated actions such as offering fruit twice per week, or removing vending machines from the school environment are important but insufficient to address the complexity that surrounds obesity. Besides the generalized popularity of these actions, the results and the impact on well-being of children are unknown (Gaspar et al., 2013; Ministério da Agricultura e do Mar, 2014).

Considering the rapidly increasing prevalence of childhood obesity in Portugal it seems to be unavoidable a call to action using a systematic evidence-based perspective with a focus on cost-effective and sustainable strategies. A strategy to reverse this epidemic will require many interventions at many levels that may bring evidence from theoretical-based

approaches and that can be sustainable over the years (Gortmaker et al., 2011; Lobstein et al., 2015). Unquestionably, we urge for national support and leadership on health promotion to emerging research in obesity prevention and control so that we can begin to tackle the Portuguese obesity epidemic and remedy the difficult situation in which Portuguese children find themselves.

*- Measuring eating behaviour changes: to choose other methods for better evaluation*

To lead the Study 4 regarding the children's eating changes over the PHS-pro intervention, the 3-day FR was selected because such method is considered the "gold standard" for monitoring eating behaviours in intervention studies (Thompson & Byers, 1994). However, the process evaluation of the programme found that the 3-day FR was not a successful component among children because a large proportion considered it tedious and labour-intensive. So, the repetitive FR application was seen as the greatest threat in the programme implementation. Therefore, this strategy for measuring changes among children should be wisely weighted in future interventions, in particular in long-term implementations. In addition, for better evaluation in monitoring eating behaviours, it is strongly recommended to reduce the number of the 3-day FR applications in more widely spaced intervals and integrate other tools such as brief dietary assessment methods designed for brief measurement of specific dietary behaviours (Thompson & Byers, 1994). Other options could be to replace the 3-day FR by a 24HR (Lytle et al., 2004; Rosário, 2012).

In recent years several collecting methods such as image-based food records or web-base applications through wearable mobile devices have appeared. However, validity and reliability in large samples need to be examined (Bert, Giacometti, Gualano, & Siliquini, 2014; Gemming, Utter, & Mhurchu, 2015).

*- Implementing a training session for school staff*

In the conceptual design of PHS-pro, a training session for all teachers, school auxiliaries and kitchen staff was planned. However, at the onset of the intervention, that was not held for logistical reasons with the school year start (Chapter 2). This activity should be integrated as one more component in future interventions aiming to gather all active support and increase the awareness for healthy behaviours. All school participants should be involved, by providing them the information required and the guidelines about the programme for a more comprehensive understanding of the importance to achieve healthful behaviours, and all

together creating an environment that may conduce to that (Pérez-Rodrigo & Aranceta, 2001; Story, Nanney, & Schwartz, 2009).

*- Investigating gender differences on eating behaviours changes over the programme*

Additional priorities for future research should include determining gender differences on eating behaviours and on physical and leisure activities during the intervention. In this first PHS-pro intervention, and as the primary outcome of the research, gender differences were studied using the objective measures of children's anthropometry to evaluate the impact of the programme on nutritional status. Eating behaviours changes in boys and girls were not explored. Though it was identified that the food records' returning process was more pronounced in girls and they were more engaged in delivering information than boys (Chapter 2), several tens of food records were withdrawn, as they did not respect the inclusion criteria for the study (Chapter 4), and so eating behaviours changes were conducted in a sample with no differences between genders. Therefore, this research did not undertake the gender effects analysis, yet it is recommended the assessment of outcomes by gender, such as other previous interventions have done (Waters et al., 2011) in order to achieve the long-term effects and for better tailoring the implementation.

*- Enhancing parents' involvement*

Parents' involvement should be more intensive in future interventions. Although parental involvement was included in the PHS-pro, it was restricted into two moments, at the onset of the programme and at the end of it, because it was of highest importance to investigate the impact of the components and strategies designed to improve children's skills for healthy choices (Chapter 2). However, in the process evaluation, teachers gave a strong advice to include a more continuous communication with parents. Indeed, to be truly successful, interventions require parents to get home environment supportive of healthy meals, regarding the availability of healthy foods such as fruit, vegetables, salads, and vegetable soup, as well as leisure and physical activity time. Home environment is one part of the broader environment in which children live, and home environmental factors have a key role influencing children eating behaviours (Haerens et al., 2008). Hence, these circumstances should potentially increase efforts in the encouragement of children for healthy choices.

Literature reveals that parental involvement during intervention leads to more favourable results, in particular direct strategies such as parents' attendance on didactic or workshops format or parent training sessions (Hingle, O'Connor, Dave, & Baranowski, 2010;

Stice, Shaw, & Marti, 2006).

*- Cooperating with other initiatives*

The design of PHS-pro was developed for being flexible enough to be able to connect and cooperate with other health initiatives at different levels. PHS-pro can cooperate with the local healthcare units, since the anthropometric assessment on the onset of the programme allows identifying high-risk children with obesity and sending them to healthcare programmes available with parental consent. PHS-pro is able to collaborate with parents' associations in local activities for health promotion, or even with community sports associations or public sports facilities that intent to organize physical activities for motivating young people to be active and play sports. Furthermore, PHS-pro is prepared to connect with other health programmes regarding the wellbeing of children.

As final words, it is our intention for future interventions to continue searching for new strategies to be tested and adapted into the programme. School-based interventions to be successful need to be implemented according to the age groups, which have distinct needs and interests, and should be repeated at regular intervals over time. The interventions designed to promote healthy behaviours in target children should ensure flexibility enough to adapt to schools circumstances and complexity environment contexts, rather than implement standardized and unvarying components and activities. Additionally, interventions should be supported by a theoretical approach focused on behaviour changes with achievable goals to become into practical actions, and not be limited to passing knowledge only. Parents, teachers, school staff and parents' associations need to be actively involved, ideally the overall local community, since all active support will increase public awareness for healthy behaviours to counter obesity epidemic.

## **7.7 FINAL CONCLUSIONS**

In the light of the foregoing, the results found in this thesis are promising, suggesting that PHS-pro can contribute to prevent overweight and obesity among children. Conclusions are listed and briefly described as follows:

- The health education intervention PHS-pro was found to have impact on children's anthropometric measures and in the improvement on eating behaviours and active

living.

- Substantial changes were found in several eating behaviours over the programme, with a higher consumption of vegetable soup, milk products and fruit, and the decreasing of high-energy dense food and soft drink consumption. PHS-pro may be an effective strategy in promoting behaviour changes to improve children eating patterns.
- Although PHS-pro is an educational intervention targeted to prevent overweight and obesity, the twins' case study showed that it could also be effective in assisting obese children to lose weight and improving their nutritional status.
- The PHS-pro was found effective and cost saving, being economically attractive and a beneficial investment to tackle childhood overweight and obesity, in particular when compared with the medical costs for treating obesity in Portugal.
- The PHS-pro educational model planned according to the TTM and participatory methodology principles can be effective in developing healthy eating behaviours to guide young people to a healthy development.



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## Appendices

### Appendix 2.1: List of topics proposed\*

Turma: \_\_\_\_\_ nº: \_\_\_\_\_

#### LISTA DE TEMAS PARA OS MÓDULOS FORMATIVOS

Ao longo deste ano letivo, vai decorrer na tua escola o projeto “Planear Saúde na Escola”. Vais poder saber mais sobre os alimentos e como podes fazer uma alimentação saudável para cresceres com saúde. Para isso, contamos com a tua participação.

Assim, na lista de 16 temas disponíveis para os módulos formativos deste projeto, podes escolher 8 dos temas apresentados e que tenhas interesse em saber mais.

Preenche com uma cruz (x) no quadrado em frente, para elegeres os 8 temas preferidos.

Mas, também queremos sugestões tuas! Portanto, podes sugerir um outro tema sobre alimentação: um que gostasses de ver ser tratado e que pensas que poderia ajudar-te a adotar hábitos alimentares saudáveis.

- a- A 10 passos de uma vida saudável
- b- Comer a sopa toda
- c- Legumes no prato
- d- 3 frutas por dia: sabes o bem que faz?
- e- Ricas leguminosas
- f- Os melhores lanches
- g- Água e leite para beber, ajudam a crescer
- h- Põe-te a mexer
- i- Comer fibras para ter fibra: onde estão?
- j- Treinar para ser saudável
- k- Quarteto fantástico: 4 alimentos saudáveis, 4 alimentos que gosto mais.
- l- Os 3 G's: Gomas, Gelados & outras Guloseimas
- m- A melhor cantina é a da minha escola
- n- Tudo com açúcar é demais!
- o- Frutas e vegetais são essenciais.
- p- Sugere um tema: \_\_\_\_\_

Obrigada pela tua colaboração!

\*Versão experimental de Margarida Vieira para fins de investigação, UMinho, 2011.

## Appendix 2.2: 58-item FFQ\*

### Projeto de Investigação em Estudos da Criança “Hábitos alimentares e estilo de vida”

Este questionário tem como objetivo compreender os hábitos alimentares e alguns aspetos do dia-a-dia dos adolescentes. Pretende, essencialmente, identificar as tuas escolhas alimentares e saber como preenches os teus tempos livres.

O questionário é anónimo (depois de preenchido recebe um código), pelo que pedimos que respondas com a máxima sinceridade sobre o que realmente comes e não o que pensas que é correto comer. Isto não é um teste e por isso não há respostas certas ou erradas. Por favor, não comentes as tuas respostas com os teus colegas, porque o importante é saber quais são os teus hábitos alimentares.

Presta atenção e responde a todas as questões.

A tua participação é importante. Agradecemos a tua colaboração!

Turma: \_\_\_\_\_ n.º: \_\_\_\_\_

Código: \_\_\_\_\_

#### QUEM EU SOU

Data: \_\_\_\_/\_\_\_\_/\_\_\_\_

(dia) (mês) (ano)

1. Data de nascimento: \_\_\_\_/\_\_\_\_/\_\_\_\_      2. Idade: \_\_\_\_\_ anos  
(dia) (mês) (ano)

3. Sexo:

Masculino     Feminino

#### A MINHA FAMÍLIA

##### Pai

4. Idade: \_\_\_\_\_

5. Profissão: \_\_\_\_\_

6. Escolaridade: \_\_\_\_\_

##### Mãe

8. Idade: \_\_\_\_\_

9. Profissão: \_\_\_\_\_

10. Escolaridade: \_\_\_\_\_

##### Irmãos

11. N.º de irmãos: \_\_\_\_\_

12. Idades: \_\_\_\_\_

13. Pessoas com quem vivo atualmente? \_\_\_\_\_

14. Andas a fazer algum tipo de dieta com o acompanhamento de um médico ou nutricionista?

Sim       Não

**FREQUÊNCIA DOS HÁBITOS ALIMENTARES**

Lê atentamente cada uma das frases, pensa nos teus hábitos alimentares durante o último ano e assinala com uma cruz (X) a resposta mais adequada, entre as cinco respostas possíveis.

Com que frequência comes ou bebes os alimentos a seguir referidos?	Nunca ou < 1 vez por SEMANA	1 vez por SEMANA	2- 3 vezes por SEMANA	4-6 vezes por SEMANA	Todos os DIAS
15 - Leite					
16 - Leite com chocolate (em pacote)					
17 - Iogurte (líquido ou sólido)					
18 - Queijo					
19 - Flocos de cereais					
20 - Pão branco (ex.: trigo, papo-seco, carcaça)					
21 - Pão de mistura (tipo centeio, integral)					
22 - Broa (pão de milho)					
23-Pão de forma (embalado em saco)					
24 - Tostas					
25 - Fiambre					
26 - Salpicão, chouriço, presunto, etc.					
27 - Manteiga					
28 - Margarina (creme de gordura vegetal, tipo Becel, Planta)					
29- Bolachas ou biscoitos					

Com que frequência comes ou bebes os alimentos a seguir referidos?	Nunca ou < 1 vez por SEMANA	1 vez por SEMANA	2- 3 vezes por SEMANA	4-6 vezes por SEMANA	Todos os DIAS
30 - Barritas de cereais					
31 - <i>Croissants, panikes, donuts</i> , pastéis ou bolos.					
32 - Fruta					
33- Fruta em calda					
34- Sopa de legumes no início do <b>almoco</b>					
35 - Hortaliças ou legumes ao <b>almoco</b> (cozidos, em salada, crus, etc.)					
36 - Sopa de legumes no início do <b>jantar</b>					
37 - Hortaliças ou legumes ao <b>jantar</b> (cozidos, em salada, crus, etc.)					
38 – Azeite (para temperar saladas, legumes, hortaliças ou outros alimentos)					
39 - Óleo: girassol, milho ou soja (para temperar saladas, legumes, hortaliças ou outros alimentos)					
40 - Carne					
41 – Salsichas					
42 – Toucinho, bacon					
43 - Carne enlatada (dobrada, feijoadas, etc.)					
44 - Peixe					
45- Peixe em conserva (atum, sardinhas, etc.)					
46 - Lulas, polvo, chocos					



<b>Com que frequência comes ou bebes os alimentos a seguir referidos?</b>	<b>Nunca ou &lt; 1 vez por SEMANA</b>	<b>1 vez por SEMANA</b>	<b>2- 3 vezes por SEMANA</b>	<b>4-6 vezes por SEMANA</b>	<b>Todos os DIAS</b>
47 - Camarão, amêijoas, mexilhão, etc.					
48 - Ovos					
49 - Arroz, massas					
50 - Ervilhas, grão ou feijão (na sopa ou no prato principal)					
51 – Batatas (cozidas, assadas, estufadas)					
52 - Batatas fritas caseiras					
53 - Batatas fritas de pacote					
54 - Croquetes, rissóis, bolinhos de bacalhau, douradinhos, etc.					
55 - <i>Pizza</i>					
56 - Hambúrguer					
57 – <i>Maionese</i> (para adicionar aos alimentos)					
58 – <i>Ketchup</i> (para adicionar aos alimentos)					
59 - Sobremesas lácteas (tipo pudins ou mistura com bolachas, etc.)					
60 - Chocolate					
61 - Gomas					
62- Rebuçados					
63- Gelados					

Com que frequência comes ou bebes os alimentos a seguir referidos?	Nunca ou < 1 vez por SEMANA	1 vez por SEMANA	2- 3 vezes por SEMANA	4-6 vezes por SEMANA	Todos os DIAS
64 - Açúcar (para adicionar a alimentos/bebidas)					
65 - Frutos secos (amêndoas, nozes, avelãs, amendoins, pistácios, etc.)					
66 - Compotas, geleias ou marmelada					
67 - Água					
68 - Sumos naturais					
69 - Sumos embalados (concentrados de fruta ou néctares)					
70 - Refrigerantes (cola, ice-tea, etc.)					
71- Café (incluído o que adicionas a outras bebidas)					
72 - Chá					

73 - Tomas o pequeno-almoço?

- Nunca
- 1 vez por semana
- 2 a 3 vezes por semana
- 4 a 6 vezes por semana
- Todos os dias

74 - Que quantidade de leite bebes, aproximadamente, por dia?

- Nenhum
- 1 Copo grande \* (250 ml)
- 2 Copos grandes
- 3 Copos grandes
- 4 ou mais

\* Copo grande= Copo tipo galão

75 - Costumas comer pão a acompanhar as refeições (almoço ou jantar)?

- Sim     Não

76- Quantos pães comes por dia?

- Nenhum
- Um
- Dois
- Três
- Quatro ou mais

76.1- Habitualmente o que costumava adicionar ao pão? Indica as duas opções mais frequentes.

1ª \_\_\_\_\_

2ª \_\_\_\_\_

77- Quantas peças de fruta comes por dia?

- Nenhuma
- Uma
- Duas
- Três
- Quatro ou mais

78- Que quantidade de água (torneira ou engarrafada) bebes, aproximadamente, por dia?

- Nenhuma
- 33 cl (garrafa pequena)
- 50 cl (garrafa média)
- 1.5 litros ( garrafa grande)
- Mais de 1.5 litros

79 - Costumas acrescentar sal aos alimentos no prato?

- Sim       Não

80 - Assinala todas as refeições que fazes durante o dia.

- Pequeno-almoço
- Lanche (meio da manhã)
- Almoço
- Lanche (meio da tarde)
- Jantar
- Antes de deitar

81 – Já alguma vez tomaste bebidas com álcool? (como cerveja, vinho, *whisky*, bagaço, vinho do porto, licor)

- Sim       Não

Se respondeste “**Não**”, passa à pergunta **82**. Se respondeste “**Sim**”, indica,

81.1- Que idade tinhas quando tomaste bebidas com álcool pela primeira vez? \_\_\_\_\_ anos

81.2- A primeira vez que bebeste vinho, cerveja ou outras bebidas com álcool estavas com os teus pais ou algum adulto?

Sim       Não

81.3- Atualmente com que frequência ingeres este tipo de bebidas, como cerveja, vinho maduro ou verde, licores?

	Nunca	Raramente	Todos os MESES	Todas as SEMANAS	Todos os DIAS
Cerveja					
Vinho					
Licor/ <i>whisky</i> ,					

81.4- Já alguma vez bebeste demais e ficaste embriagado?

- Não, nunca  
 Sim, uma vez  
 Sim, 2 a 3 vezes  
 Sim, 4 a 10 vezes  
 Sim, mais de 10 vezes

**OS MEUS CONHECIMENTOS SOBRE ALIMENTAÇÃO SAUDÁVEL**

82- Conheces a roda dos alimentos?

- Sim     Não

83 - Por quantos grupos é composta a roda dos alimentos?

- Cinco grupos mais água  
 Sete grupos mais água  
 Cinco grupos  
 Sete grupos

84 - Dos quatro grupos abaixo apresentados, indica o grupo, da roda dos alimentos, cujos alimentos devemos comer em maior quantidade, todos os dias:

- Leite e derivados  
 Carne, peixe, ovos  
 Gorduras  
 Hortícolas

85 - Os alimentos ricos em fibras alimentares são importantes porque contribuem para o bom funcionamento intestinal. Indica em qual dos grupos abaixo se encontram os alimentos ricos em fibras:

- Leite e derivados  
 Carne, peixe, ovos  
 Gorduras  
 Hortícolas

86- Indica qual o mínimo de peças de fruta (ex. maçã, banana, pera) deves comer por dia:

- Nenhuma  
 Uma  
 Duas  
 Três  
 Quatro ou mais

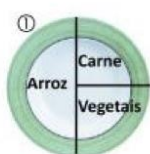
87 – O leite é um dos alimentos mais ricos em cálcio, um mineral fundamental para o teu crescimento e desenvolvimento. Indica quantos copos (copo tipo galão) deverás tomar por dia:

- Nenhum  
 1 copo  
 2 a 3 copos  
 4 copos ou mais

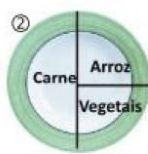
88- Na tua idade, em relação à quantidade de açúcar a ingerir por dia, no máximo, pensas que deve ser:

- Nenhuma
- 1 colher de sopa
- 2 a 3 colheres de sopa
- 4 colheres de sopa

89 – Dos 3 pratos apresentados, escolhe o que consideras mais saudável.



Prato 1



Prato 2



Prato 3

**ACTIVIDADE FÍSICA E LAZER**

90- Habitualmente como te deslocas para a escola?

- A pé
- Transportes públicos
- Carro
- Outros \_\_\_\_\_

91- Praticas algum desporto extra-escolar (desporto fora da escola, num clube ou ginásio)?

- Sim
- Não

Se respondeste “**Sim**” indica,

91.1 - O desporto praticas: \_\_\_\_\_.

91.2- O número de horas por semana que dedicas à prática de desporto:

- 0,5 hora (30 minutos)
- 1 hora
- 2 a 3 horas
- 4 a 6 horas
- 7 horas ou mais

92- Indica quanto tempo, por dia, passas a ver televisão:

- Nenhum
- Menos de 30 minutos
- Entre 30 minutos a 1 hora
- 2 a 3 horas
- 4 horas
- Mais de 4 horas

93- Indica também quanto tempo, por dia, dedicas a jogar no computador, *playstation* ou outros jogos interativos:

- Nenhum
- Menos de 30 minutos
- Entre 30 minutos a 1 hora
- 2 a 3 horas
- 4 horas
- Mais de 4 horas

Por favor, verifica se respondeste a todas as questões.

**Obrigada pela tua colaboração!**

## Appendix 2.3: Food record form\*

### O MEU DIÁRIO ALIMENTAR



Data de Entrega: \_\_\_\_/\_\_\_\_/\_\_\_\_

CÓDIGO: \_\_\_\_\_

NOME: \_\_\_\_\_ TURMA: \_\_\_\_ Nº \_\_\_\_\_

Por favor, mantem o teu diário sempre contigo para ires registando todos os alimentos e bebidas que consumes ao longo de todo o dia.

Escreve as marcas e as medidas que estão nas embalagens.

Podes também usar as medidas caseiras como a colher de sopa, a concha, o copo, a chávena almoçadeira ou de café, o prato, etc.

Por favor, regista só o que realmente comes e bebes. Tudo conta!

O teu diário tem instruções, nas páginas seguintes, para te ajudar no seu preenchimento.

Se tiveres alguma dúvida sobre o preenchimento do diário, ou precisares de ajuda, podes contactar-me, Margarida Vieira para [margvieira@yahoo.com](mailto:margvieira@yahoo.com) ou pelo telemóvel 966 934 997 ou a Professora Ana Maria.

Obrigada pela tua colaboração.



### Como preencher o diário:

Sempre que te surja alguma dúvida segue as seguintes instruções.

1. Anota o **dia da semana** (ex. segunda-feira, quarta-feira, sábado, etc.)
2. Anota a **data** (ex. dia 2 de Outubro de 2011)
3. Regista a **hora** de início da refeição ou do momento em que comeste/bebeste qualquer coisa.
4. Indica o **local** onde realizaste cada refeição (em casa, no refeitório da escola, no carro, no restaurante, na casa de parentes ou de amigos, etc.)
5. Descreve todos os **alimentos** (comidas e bebidas) que consumiste em cada refeição, por mais pequeno que seja.
6. Anota logo que possas tudo o que acabaste de comer. Evita deixar para o fim do dia, para não te esqueceres de nenhum pormenor.
7. Fornece o máximo de informações possíveis, como por exemplo:
  - a) O modo de preparação do prato (se é frito, assado, cozido, estufado, etc.);
  - b) Indica se comeste legumes e hortaliças, quais foram, se crus ou cozidos, e se temperaste com azeite, óleo, vinagre, etc.;
  - c) Diz se acrescentaste sal ou queijo ralado aos alimentos no prato;
  - d) Indica os nomes dos produtos, ou as marcas (por exemplo: gelados “Olá” ou cereais “chocapic”);
  - e) Anota se o alimento é fresco, em conserva, embalado;
  - f) Informa o tipo de pão que comeres (pão de forma, integral, papo-seco, broa);
  - g) Anota tudo o que adicionaste ao pão (manteiga, margarina, geleia, marmelada, fiambre, queijo, etc.);
  - h) Anota os diversos ingredientes que comeste nas saladas ou nas sanduiches (alface, tomate, cenoura, queijo, *maionese*, *ketchup*, etc.);
  - i) Informa sempre que possível a quantidade dos alimentos e o volume dos líquidos;
  - j) Anota o volume das bebidas: uma garrafa de 33 cl de água, uma lata de cola, ou néctar, etc. Se é refrigerante, se é *light*, *diet*, normal.
  - k) Podes usar medidas caseiras para como uma colher de chá, de sobremesa ou sopa;
  - l) Com a carne ou o peixe podes descrever se comeste uma coxa de frango ou uma posta de pescada, uma costeleta de porco, ou dois ovos, dois filetes de peixe, três rissóis, etc.
  - m) Anota se o leite é gordo, meio gordo ou magro. Se adicionas ou não chocolate em pó, ou se bebes leite achocolatado de pacote e de que marca é.
  - n) Informa qual foi a quantidade de açúcar que adicionaste, em pacotes ou colheres.

No final de cada dia, tens um local onde podes colocar algumas observações ou comentários que pretendas fazer.

### Algumas medidas que podem ajudar-te



### Anota a marca, a medida e se é lata, garrafa ou pacote



**Lata**



**Garrafa**



**Pacote**









**Appendix 2.4: Questionnaires “We want to know what you think” and “Your opinion counts”\***

**Turma:** \_\_\_\_ **nº:** \_\_\_\_

**QUEREMOS SABER O QUE PENSAS**

Durante este ano letivo participaste no projeto “Planear Saúde na Escola”. Agora, perto do final queremos saber o que pensas sobre o projeto e a tua participação.

Preenche com uma cruz (x) no quadrado em frente, para elegeres quais as **duas fases que gostaste menos**.

Também gostaríamos de ouvir sugestões tuas e ideias para as incluir em futuras edições, para melhorar o projeto e para que possa ser mais bem aceite por todos participantes.

- |   |                          |
|---|--------------------------|
| q- Questionários de Hábitos Alimentares             | <input type="checkbox"/> |
| r- Avaliações Antropométricas                       | <input type="checkbox"/> |
| s- Leitura do conto da Ratinha Rita pela Enfermeira | <input type="checkbox"/> |
| t- Concurso Literário                               | <input type="checkbox"/> |
| u- Módulos formativos nas aulas de Ciências         | <input type="checkbox"/> |
| v- Tems dos Módulos                                 | <input type="checkbox"/> |
| w- Diário Alimentar                                 | <input type="checkbox"/> |
| x- Cartão informativo das avaliações                | <input type="checkbox"/> |

Explica as razões de não teres gostado das duas fases que assinalaste:

- 1- \_\_\_\_\_  
\_\_\_\_\_
- 2- \_\_\_\_\_  
\_\_\_\_\_

Que sugestões ou ideias propões para o próximo ano:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Obrigada pela tua colaboração!

\*Versão experimental de Margarida Vieira, para fins de investigação, UMinho, 2011.

Turma: \_\_\_\_\_ nº: \_\_\_\_\_

**A TUA OPINIÃO CONTA\***

**Sobre o projeto “ Planear Saúde na Escola” responde:**

1 - Participaste com algum conto?

**Sim**       **Não**

2 – Ao longo destes meses enquanto se desenrolavam os módulos, mudaste os teus hábitos alimentares?

**Sim**       **Não**

Se respondeste **sim**, em quê?

(por exemplo: o que comias antes que deixaste de comer ou o que passaste a fazer que não fazias anteriormente, em relação à tua alimentação)

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3- Pensas que um projeto como este pode ajudar os jovens a ter mais cuidado com a alimentação?

**Sim**       **Não**

Se respondeste **sim**, em quê?

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Obrigada pela tua colaboração!

\*Versão experimental de Margarida Vieira, para fins de investigação, UMinho, 2011.



## Appendix 2.5: Questionnaire “Give us your opinion”

### A SUA OPINIÃO\*

O preenchimento deste questionário é anónimo e voluntário, mas a sua colaboração é essencial para complementar a consecução dos objetivos do projeto “Planear Saúde na Escola”.

Assim, com este questionário pretende-se saber o que pensa sobre algumas fases do projeto, quer como colaborador, quer como observador enquanto decorreram os módulos em sala de aula.

#### 1. Organização extra-aulas

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#### 2. Concurso Literário

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#### 3. Módulos formativos nas aulas de Ciências (temas, tempo de duração, aceitação pelos alunos, outras).

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#### 4. Diário alimentar

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#### 5. Outra

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O que propõe para futuras edições, para melhorar o projeto e para que possa ser mais bem aceite por todos participantes?

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\_\_\_\_\_ Obrigada pela sua colaboração!

\*Versão experimental de Margarida Vieira, para fins de investigação, UMinho, 2011.

**Appendix 2.6: Anthropometric assessment information card I and card II\***

 **1ª Avaliação Antropométrica**  
 Projecto "Planear a Saúde na Escola"  
 \_\_\_/\_\_\_/\_\_\_ data

Nome: \_\_\_\_\_

Aluno nº: \_\_\_\_\_ Turma: \_\_\_\_\_

Idade : \_\_\_\_\_ Peso: \_\_\_\_\_ kg Altura: \_\_\_\_\_ cm

IMC: \_\_\_\_\_ P.Cintura: \_\_\_\_\_ cm

O IMC (índice de massa corporal) é um indicador que permite avaliar a gordura corporal e determina se um indivíduo está abaixo ou acima do peso, considerado saudável.

Tabela de percentil do IMC em função da faixa etária

Idade	Sexo	Baixo Peso	Normal	Excesso Peso	Obesidade
10 anos	M	< 14.6	14.7 - 19.7	> 19.8	> 24.0
	F	< 14.6	14.7 - 19.8	> 19.9	> 24.1
11 anos	M	< 15.0	15.1 - 20.5	> 20.6	> 25.1
	F	< 15.1	15.2 - 20.6	> 20.7	> 25.4
12 anos	M	< 15.4	15.5 - 21.1	> 21.2	> 26.0
	F	< 15.6	15.7 - 21.6	> 21.7	> 26.7
13 anos	M	< 15.8	15.9 - 21.8	> 21.9	> 26.8
	F	< 16.3	16.4 - 22.5	> 22.6	> 27.8
14 anos	M	< 16.4	16.5 - 22.5	> 22.6	> 27.6
	F	< 16.9	17.0 - 23.2	> 23.3	> 28.6

Fonte: Cole et Al. (2000)

 **2ª Avaliação Antropométrica**  
 Projecto "Planear a Saúde na Escola"  
 \_\_\_/\_\_\_/\_\_\_ data

Nome: \_\_\_\_\_

Aluno nº: \_\_\_\_\_ Turma: \_\_\_\_\_

Idade : \_\_\_\_\_ Peso: \_\_\_\_\_ kg Altura: \_\_\_\_\_ cm

IMC: \_\_\_\_\_ P.Cintura: \_\_\_\_\_ cm

O IMC (índice de massa corporal) é um indicador que permite avaliar a gordura corporal e determina se um indivíduo está abaixo ou acima do peso, considerado saudável.

Tabela de percentil do IMC em função da faixa etária

Idade	Sexo	Baixo Peso	Normal	Excesso Peso	Obesidade
11 anos	M	< 15.0	15.1 - 20.5	> 20.6	> 25.1
	F	< 15.1	15.2 - 20.6	> 20.7	> 25.4
12 anos	M	< 15.4	15.5 - 21.1	> 21.2	> 26.0
	F	< 15.6	15.7 - 21.6	> 21.7	> 26.7
13 anos	M	< 15.8	15.9 - 21.8	> 21.9	> 26.8
	F	< 16.3	16.4 - 22.5	> 22.6	> 27.8
14 anos	M	< 16.4	16.5 - 22.5	> 22.6	> 27.6
	F	< 16.9	17.0 - 23.2	> 23.3	> 28.6
15 anos	M	<17.0	17.1- 23.2	>23.3	>28.3
	F	<17.5	17.6- 23.8	>23.9	>29.1

Fonte: Cole et Al.

\*Versão

experimental de Margarida Vieira, para fins de investigação, UMinho, 2011.

## Appendix 2.7: Consent forms

- Consent form for Control Schools

### **“Avaliação do estado nutricional dos adolescentes do 6º ano das Escolas do Concelho da Trofa”**

#### **Consentimento informado**

**Por favor leia com atenção as indicações contidas neste documento.**

**Antes de decidir se aceita que o seu educando participe neste estudo, gostaríamos de lhe fornecer alguma informação adicional.**

**Não hesite em pedir informações, se não estiver completamente esclarecido.**

**Os dados recolhidos são confidenciais.**

Chamo-me Margarida Vieira, sou nutricionista e frequento o Curso de Doutoramento em Estudos da Criança, na Universidade do Minho, em Braga.

O objeto de estudo da minha investigação é no âmbito da saúde infantil. O projeto de investigação denominado “Planear saúde na escola” pretende realizar um levantamento sobre o estado nutricional, hábitos alimentares e estilo de vida dos adolescentes inscritos no 6º ano das escolas do Concelho da Trofa.

No âmbito deste projeto, os adolescentes vão ser pesados assim como será feita a determinação das medidas da estatura e do perímetro da cintura em duas avaliações distintas, uma no início do ano letivo e outra no final do ano letivo, medidas recolhidas durante uma aula de educação física. Vai ficar a saber quanto mede e pesa o seu filho(a) ao receber um cartão com cada avaliação efetuada. Essas medidas, posteriormente, serão tratadas num estudo científico de forma a identificar o estado nutricional de todos os adolescentes envolvidos. Além da avaliação antropométrica será também efectuada uma recolha de dados, através de um inquérito com questões relacionadas com os hábitos alimentares e a actividade física de cada um.

O estudo não apresentará riscos aos participantes e terá como benefício proporcionar o conhecimento do estado nutricional dos adolescentes inscritos no 6º ano e que vivem no Concelho da Trofa.

Trata-se de um estudo em que a sua colaboração é imprescindível, uma vez que assim se obtêm informações completas de um Concelho do País, o Concelho da

Trofa, e que poderão ter utilidade no futuro para o desenvolvimento de programas de prevenção mais ajustados à população portuguesa.

Para que o seu filho(a) possa participar neste projeto, é necessário que o autorize **por escrito**, subscrevendo o termo de consentimento anexo, devolvendo-o, durante a próxima semana, ao Director de turma, na Escola.

A decisão de o seu filho(a) participar nesta investigação é apenas sua. Não há qualquer problema para si se recusar. Não haverá nenhum gasto com a participação do seu educando bem como não receberá qualquer pagamento com a sua participação.

Todos os dados recolhidos neste estudo são confidenciais e podem ser retirados da base de dados, a qualquer altura, caso seja essa a sua decisão.

No caso de ter alguma questão acerca do estudo, colocamo-nos à sua disposição para mais informações, através dos seguintes contactos:

Dra. Margarida Vieira

Telemóvel 966 934 997 ou por e-mail: margvieira@yahoo.com

**Se concordar em que o seu filho(a) participe, por favor, assine o termo de consentimento informado, pelo que agradecemos, desde já, por aceitar dar a sua importante contribuição para este estudo.**

**Com os melhores cumprimentos,**

Margarida Vieira

.....

<b>CONSENTIMENTO INFORMADO</b>	
Nome do Encarregado de Educação (pai/mãe) _____	
_____ dou o meu	
consentimento livre e esclarecido, para que o meu educando (filho/a)	
_____, faça parte do estudo denominado	
"Avaliação do estado nutricional dos adolescentes do 6º ano da Escola EB 2/3 de	
Alvarelhos". Autorizo a recolha de dados, uso e apresentação da informação de acordo	
com este documento. Ficaram claros para mim quais são os propósitos do estudo, os	
procedimentos a serem realizados, riscos e benefícios, as garantias de confidencialidade	
e de esclarecimentos permanentes.	
_____	Data: ____/____/____
Assinatura do Encarregado de Educação	
_____	
Assinatura do Pesquisador Responsável	

- Consent form for Intervention School

**“PLANEAR SAÚDE NA ESCOLA: UM MODELO EDUCATIVO PARA A  
ADOÇÃO DE HÁBITOS ALIMENTARES SAUDÁVEIS E UM ESTILO DE  
VIDA ATIVA”**

***Consentimento informado***

**Por favor leia com atenção as indicações contidas neste documento.  
Antes de decidir se aceita que o seu educando(a) participe neste estudo,  
gostaríamos de lhe fornecer alguma informação adicional.  
Não hesite em pedir informações, se não estiver completamente  
esclarecido.  
Os dados recolhidos são confidenciais.**

Chamo-me Margarida Vieira, sou nutricionista e frequento o Curso de Doutoramento em Estudos da Criança, na Universidade do Minho, em Braga. O objeto de estudo da minha investigação é no âmbito da saúde infantil.

**Qual é o objetivo deste projeto?**

O estudo pretende, através de um programa de intervenção educativa sobre hábitos alimentares saudáveis, estimular a adoção de comportamentos alimentares e um estilo de vida saudáveis, em adolescentes. Os comportamentos saudáveis estão identificados como sendo fundamentais para a promoção da saúde e na prevenção das doenças crónicas.

O estudo envolve os adolescentes inscritos nas turmas do 6º ano da Escola Napoleão Sousa Marques, na Trofa, como já teve oportunidade de ser informado.

Se concordar:

- primeiramente, será efetuada uma avaliação nutricional para recolher as seguintes medidas (peso, estatura, perímetro da cintura) e aplicado um questionário para identificar as escolhas alimentares e saber como são preenchidos os tempos livres;
- em seguida, será implementado (testado) um programa educativo sobre hábitos alimentares saudáveis e vida ativa;
- no final, será feita uma avaliação, idêntica à inicial.

Todas as avaliações efetuadas, agora e durante o período em que decorre o estudo, serão realizadas com o propósito de investigação.

**O que acontecerá se aceitar que o seu filho(a)/educando participe?**

Se aceitar que o seu filho(a) participe, ele apenas terá que ir à escola, no seu horário escolar, e comparecer nas atividades que estarão agendadas e que se irão desenrolar ao longo do ano letivo, o período em que decorrerá este estudo.

O estudo irá decorrer entre Setembro de 2011 e Junho de 2012 e compreenderá 3 períodos distintos:

- um primeiro período de análise e avaliação nutricional realizado durante uma aula de Educação Física, no 1º mês de aulas, Setembro. Vai ficar a saber quanto mede e pesa o seu filho, recebendo um cartão com as medidas, medidas essas que posteriormente serão tratadas num estudo científico de forma a identificar o estado nutricional de todos os adolescentes envolvidos;

- seguir-se-á um novo período de oito meses, de Outubro a Maio, em que receberá módulos formativos e interativos sobre temas ligadas à saúde e alimentação, e em que pode expressar as suas opiniões e construir novas competências sobre alimentação saudável e vida ativa e ficar apto a selecionar os alimentos e saber o que come, e simultaneamente pode participar num Concurso de Contos e Histórias, construindo um conto, uma história, em texto, banda desenhada, ilustrações ou outras técnicas de carácter artístico, cujo tema aborde os hábitos de vida saudável, realizado em grupo ou individualmente, para desenvolver as capacidades criativas e artísticas.

- no terceiro e último período, haverá uma nova avaliação em que as condições são semelhantes às do primeiro período, para a obtenção dos resultados da investigação.

**Quais os possíveis riscos e inconvenientes de aceitar em participar?**

O estudo não apresentará riscos aos participantes.

**Quais são os possíveis benefícios de aceitar participar?**

Não existe nenhum benefício direto se aceitar que o seu filho(a) participe neste estudo. Contudo, este estudo poderá contribuir para se obterem novas informações que no futuro poderão permitir elaborar programas de intervenções educativas mais assertivas e novas formas de trabalhar a saúde no ambiente escolar.

**Tenho que aceitar participar?**

A decisão de participar no estudo é apenas sua. Não há qualquer problema para si ou para o seu filho(a) se recusar.

**Posso retirar o meu consentimento?**

Pode retirar o seu consentimento em qualquer altura da investigação, se esse for o seu desejo. Todos os dados recolhidos neste estudo são confidenciais e podem ser retirados da base de dados, a qualquer altura, caso seja essa a sua decisão.

**Receberei um pagamento por participar neste estudo?**

Não haverá nenhum pagamento pela participação.

O seu filho(a) receberá, de forma gratuita, todas as atividades formativas e materiais que forem utilizados e necessários para o desenvolvimento da intervenção.

**Quem deverei contactar se necessitar de informação adicional ou ajuda?**

No caso de ter alguma questão acerca do estudo, coloco à disposição para mais informações os seguintes contactos:

Dra. Margarida Vieira

Telemóvel 966 934 997 ou por e-mail: margvieira@yahoo.com

**Se concordar em que o seu filho(a) participe, por favor, assine o termo de consentimento informado, pelo que agradecemos, desde já, por aceitar dar a sua importante contribuição para este estudo.**

**Com os melhores cumprimentos,**

**Margarida Vieira**

.....

<b>CONSENTIMENTO INFORMADO</b>	
Nome do Encarregado de Educação (pai/mãe) _____	
_____ dou o meu	
consentimento livre e esclarecido, para que o meu educando	
_____, faça parte do estudo denominado	
"Planear Saúde Na Escola: Um Modelo Educativo para a Adoção de Hábitos Alimentares	
Saudáveis e Um Estilo de Vida Ativa". Autorizo a recolha de dados, uso e apresentação	
da informação de acordo com este documento. Ficaram claros para mim quais são os	
propósitos do estudo, os procedimentos a serem realizados, riscos e benefícios, as	
garantias de confidencialidade e de esclarecimentos permanentes.	
_____	Data: ___ / ___ / ___
Assinatura do Encarregado de Educação	
_____	
Assinatura do Pesquisador Responsável	

## Appendix 2.8: Child's informed consent

### **“PLANEAR SAÚDE NA ESCOLA: UM MODELO EDUCATIVO PARA A ADOÇÃO DE HÁBITOS ALIMENTARES SAUDÁVEIS E UM ESTILO DE VIDA ATIVA”**

#### ***Consentimento informado***

**Por favor lê com atenção as indicações contidas neste documento.**

**Antes de decidires se aceitas participar neste estudo, gostaríamos de te fornecer alguma informação adicional.**

**Não hesites em pedir informações se não estiveres completamente esclarecido.**

**Os dados recolhidos são confidenciais.**

Chamo-me Margarida Vieira e frequento o Curso de Doutoramento em Estudos da Criança, na Universidade do Minho, em Braga. O objeto de estudo da minha investigação é no âmbito da saúde infantil e juvenil.

#### **Qual é o objetivo deste projeto?**

O estudo pretende, através de um programa de intervenção educativa sobre hábitos alimentares saudáveis, estimular a adoção de comportamentos alimentares e um estilo de vida saudáveis, em adolescentes da tua idade. Os comportamentos saudáveis estão identificados como sendo fundamentais para a promoção da saúde e na prevenção das doenças crónicas.

O estudo envolve os adolescentes inscritos nas turmas do 6º ano da tua escola, a Escola Napoleão Sousa Marques, na Trofa, como já tiveste oportunidade de ser informado.

Caso concordes em participar neste estudo:

- primeiramente, será efetuada uma avaliação nutricional para recolher medidas simples (peso, estatura, perímetro da cintura) e aplicado um questionário para identificar as tuas escolhas alimentares e saber como preenches os teus tempos livres;
- em seguida, será implementado (testado) o programa educativo sobre hábitos alimentares saudáveis e vida ativa;
- no final, será feita uma avaliação, idêntica à inicial.

Todas as avaliações efetuadas, agora e durante o período em que decorre o estudo, serão realizadas com o propósito de investigação.



**O que acontecerá se aceitares participar?**

Se aceitares participar, apenas terás que estar na escola no teu horário escolar e comparecer nas atividades que estarão agendadas e que se irão desenrolar ao longo do ano letivo, que é também o período em que decorrerá este estudo: entre Setembro de 2011 e Junho de 2012 e compreenderá 3 períodos distintos:

- um primeiro período, de análise e avaliação nutricional, que decorrerá durante uma aula de Educação Física, no 1º mês de aulas, em *Setembro*. Vais ficar a saber quanto medes e pesas, recebendo um cartão com as medidas, medidas essas que posteriormente serão tratadas num estudo científico de forma a identificar o estado nutricional de todos os adolescentes envolvidos;
- seguir-se-á um novo período, de oito meses, de *Outubro a Maio*, em que receberás módulos formativos e interativos, sobre temas ligados à saúde e alimentação, em que podes expressar as tuas opiniões e construir novas competências sobre alimentação saudável e vida ativa e fiques apto a selecionar os alimentos e saberes o que comes, e simultaneamente podes participar num Concurso de Contos e Histórias, construindo um conto, uma história, em texto, banda desenhada, ilustrações ou outras técnicas de carácter artístico, cujo tema aborde os hábitos de vida saudável, realizado em grupo ou individualmente, para desenvolveres as tuas capacidades criativas e artísticas.
- no terceiro e último período, *Junho a Julho*, haverá uma nova avaliação em que as condições são semelhantes às do primeiro período, para a obtenção dos resultados da investigação.

**Quais os possíveis riscos e inconvenientes de aceitar em participar?**

O estudo não apresentará riscos aos participantes.

**Quais são os possíveis benefícios de aceitar participar?**

Não existe nenhum benefício direto para ti se aceitares em participar neste estudo. Contudo, este estudo poderá contribuir para se obterem novas informações que no futuro poderão permitir elaborar programas de intervenções educativas mais assertivas e novas formas de trabalhar a saúde no ambiente escolar.

**Tenho que aceitar participar?**

A decisão de participar neste estudo é apenas tua, depois da autorização prévia do teu encarregado de educação. Não há qualquer problema para ti se recusar.

**Posso retirar o meu consentimento?**

Podes retirar o teu consentimento em qualquer altura da investigação, se esse for o teu desejo. Todos os dados recolhidos neste estudo são confidenciais e podem ser retirados da base de dados, a qualquer altura, caso seja essa a tua decisão.

**Receberei um pagamento por participar neste estudo?**

Não receberás nenhum pagamento com a tua participação.

Receberá apenas, gratuitamente, todas as atividades formativas e materiais que forem utilizados e necessários para o desenvolvimento da intervenção para que possas participar neste estudo.

**Quem deverei contactar se necessitar de informação adicional ou ajuda?**

No caso de teres alguma questão acerca do estudo, coloco à disposição para mais informações os seguintes contactos:

Dra. Margarida Vieira

Telemóvel 966 934 997 ou por e-mail: margvieira@yahoo.com

**Se concordares em participar, por favor, assina a folha do consentimento informado, na página seguinte e, desde já, agradeço por aceitares dar a tua importante contribuição para este estudo.**

**Margarida Vieira**

-----  
**CONSENTIMENTO INFORMADO**

Declaro que li e entendi toda a informação contida neste consentimento informado e que fui esclarecido(a) pela investigadora sobre todas as minhas dúvidas a respeito do estudo "*Planear Saúde Na Escola: Um Modelo Educativo para a Adoção de Hábitos Alimentares Saudáveis e Um Estilo de Vida Ativa*".

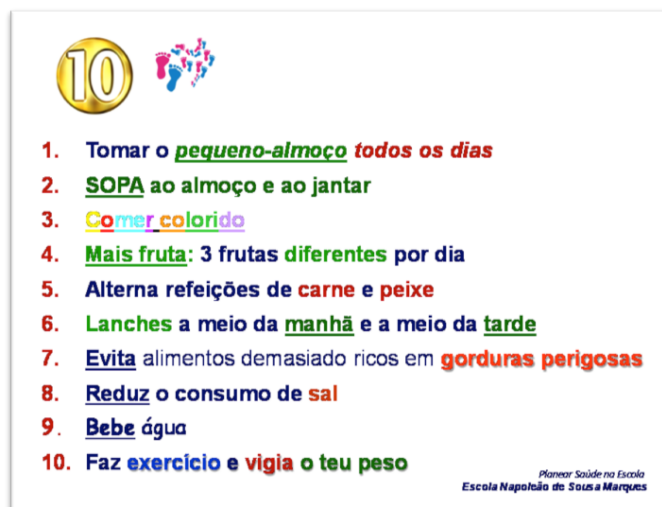
Concordo voluntariamente em tomar parte neste estudo para a investigação e autorizo a recolha de dados, uso e apresentação da informação de acordo com este documento. Ficaram claros para mim quais são os propósitos do estudo, os procedimentos a serem realizados, riscos e benefícios, as garantias de confidencialidade e de esclarecimentos permanentes.

\_\_\_\_\_  
Assinatura do(a) Voluntário(a)

\_\_\_\_/\_\_\_\_/\_\_\_\_  
Data

\_\_\_\_\_  
Assinatura do Pesquisador Responsável

Appendix 2.9: Card with '10 wise-steps for a healthier life' (Learning module-one)\*



\*Versão experimental de Margarida Vieira, para fins de investigação, UMinho, 2011.

**Appendix 2.10: A7 card-one and A7 card-two (Activity-seven in the Learning module-seven)\***

A7 card-one form. It features a light blue rounded rectangular box at the top containing the text "O melhor lanche". To the right of this box, there are three lines of text: "M7/1ª", "Nº: \_\_\_\_\_", and "Turma \_\_\_\_\_". Below the top box is a large, empty rounded rectangular box for writing.

A7 card-two form. It features a light blue rounded rectangular box at the top containing the text "Lanche saudável" and "O melhor lanche" stacked vertically. To the right of this box, there are three lines of text: "M7/2ª", "Nº: \_\_\_\_\_", and "Turma \_\_\_\_\_". Below the top box is a large, empty rounded rectangular box for writing.

\*Versão experimental de Margarida Vieira, para fins de investigação, UMinho, 2011.

**Appendix 3.1. Multiple linear regression analysis for adjustment of weight variable**

	<b>Coefficient</b>	<b><i>p</i>-value</b>
<b>Height</b>		
Sample group	-0.488	<0.001*
Weight	-0.021	<0.001*
<b>Waist Circumference</b>		
Sample group	0.756	0.006*
Weight	-0.032	0.009*
<b>WHtR</b>		
Sample group	0.007	0.001*
Weight	0.000	0.014*

\*:  $p \leq 0.05$ .