

Eating behaviour effects on health and school performance in adolescents

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Introduction

The strategic guidelines for a healthy diet resulted from the World Health Assembly held in Geneva (Switzerland) in May 2004 where a draft resolution of the Global Strategy on Diet, Physical Activity and Health was approved, providing a worldwide set of options to improve the health status of the population and reduce the enormous expenditure on the treatment of diseases¹.

During adolescence physical and psychological changes occur, dietary habits are instilled, with increased growth rates and these various changes also entail different nutritional and caloric needs²⁻⁵. According to data from the World Health Report 2002 of the Portuguese National Institute of Statistics and in accordance with other authors^{4,6-12}, a very significant growth in the consumption of animal products associated with excessive consumption of fats, especially saturated, with high calorie intake, excessive intake of salt and sugar, along with low intake of fruits, fruits and vegetables, are factors that favour malnutrition and diseases related to hypertension, obesity, cardiovascular disease, circulatory, diabetes, cancers and osteoporosis. Faced with this situation; Portugal, with a million obese people and a sharp growth of social and economic costs related to this type of pathology, from 2012, has developed a national strategy in the field of diet and nutrition embodied in the National Programme for Healthy Food Promotion (PNPAS). The strategy is based on the guidelines proposed by the World Health Organization, the European Commission, derived from experiences in countries such as Norway and Brazil and also the retrospective analysis of previous initiatives at national level¹³. The absence of a healthy diet, may lead to increased risk of coronary heart disease, decreased ability to concentrate and decrease of vitality (decrease of intellectual and physical performance); increased impetus to food intake in the next meal; increased propensity to eat sweets and foods high in simple sugars; and even nausea, sweating, and in extreme cases, faintness¹⁴⁻¹⁵. The diet must provide the necessary nutrients for learning, including proteins, unsaturated fats, complex carbohydrates and sugars. There are some foods particularly good for the brain which include green leafy vegetables, salmon, nuts, lean meats and fresh fruit. In addition, the brain also requires a wide range of trace elements such as boron, selenium, vanadium and potassium. Other evidence indicates that vitamin supplements and minerals can encourage learning, memory and intelligence, and studies to prove that sustained in dairy products (yogurt and milk) and green leafy vegetables (spinach and kale) are more efficient for transmission of nerve impulses and thus for learning¹⁶⁻¹⁷. Breakfast improves concentration, performance and mood; it improves the overall health^{14, 16, 18}.

Under the Food Education Campaign "Knowing to eat is knowing to live" in Portugal, a Wheel of Portuguese Food was created in 1977 and, later, in the 21st Century Operational Programme, with the collaboration of the Portuguese Consumer's Institute and the Faculty of Food Sciences and Nutrition of the University of Oporto (FCNAUP), a New Food Wheel was officially recognized in 2004, associated with the commonly used plate. Already responsible for the previous Food Wheel, teachers Sara Rodrigues and Bela Franchini created the current Mediterranean Food Wheel, considered human heritage by UNESCO, in a circular shape and pedagogical way (National Program for the Promotion of Healthy Eating- PNPAS)¹⁸. The Wheel of Mediterranean food, accepted by the Portuguese General Directorate of Health and integrated in PNPAS, characterized by abundant consumption of vegetables and fruit, olive oil as the principal fat and small amounts of fish or meat on the plate and conviviality

around the table. This type of diet promotes health and allows for the prevention of various chronic diseases like cardiovascular disease or certain types of cancer. It is a graphical representation based on the Portuguese Food Wheel aiming to emphasize the characteristics of the Mediterranean Food Standard (PAM), stressing not only the food component, but also the elements inherent in their lifestyle. The Mediterranean Diet is a complete and balanced food model with numerous benefits for health, longevity and quality of life, including school performance¹⁹. Water is an essential element in learning, due to the strong influence in maintaining stress levels. The fact that the brain is the organ with the highest percentage of water in its formation leads to dehydration and other consequences implies loss of attention and lethargy installation¹⁶. Water is at the centre of the Mediterranean wheel, as it is critical to cellular metabolism and because it is present in all foods and, although water is the best drink to satisfy thirst, other beverages containing no added sugar, alcohol or caffeine can be consumed²⁰. Thus, school performance is positively influenced by a healthy diet²¹⁻²².

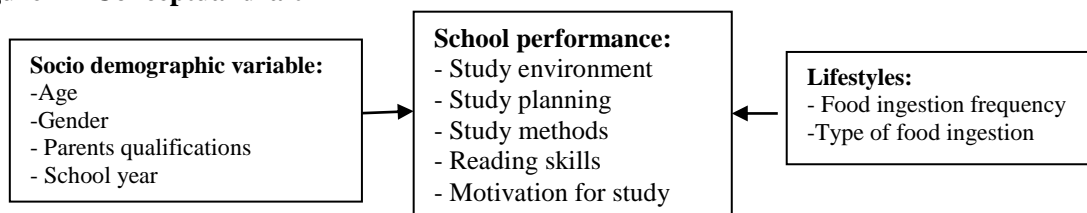
To promote healthy eating habits, it is very important to teach the family and the children/teenagers^{2, 4, 8, 16, 23-24}, as it is the family that will instil the habits kept in the adolescents' life, until they achieve full independence in relation to food. The authors assume that in addition to the family, the school, in cooperation with health services, local authorities and other community structures, offers privileged conditions for the development of this process. Implementing health promotion strategies with the school community, explaining the importance of healthy eating for motor development and for the development of reading and writing in their students, can be a very effective strategy and promoter of learning in young people.

For these reasons, we assume that food errors begin in the family and they usually get worse during adolescence, associating with serious public health problems and also reflecting in school, especially in decreased school performance. So we set out to study the eating behaviour and the way it interferes with school performance (study environment, study planning, study method, reading skills, motivation to study, overall school performance) in adolescents

Participants and Methods

At the core of this issue is the question: what are the factors associated with the school performance of adolescents? This, as comprehensive question, led us to reflect on a range of variables that can influence school performance and the research question was chosen: does the type of diet influence on school performance? To plan the study, the following conceptual diagram was designed (Figure 1)

Figure 1 – Conceptual draft



We conducted a descriptive and analytical cross-sectional study. The sample consisted of 380 adolescents attending the 7th, 8th and 9th grades in school year 2011/2012, 2nd and 3rd Cycle Basic School in the Viseu Municipality, Portugal. Most of the sample was female (50.8%), aged between 11

and 17 years, 66.1% residing in the city. Data were collected through a self-reported questionnaire with sociodemographic variables, frequency and type of food and the Fermin scale 2005 to evaluate school performance consisting on the dimensions: study environment, study planning, study methods, reading skills and motivation to study. We were based in the classification used in the HBSC study coordinated by Margarida Matos, and considering the different types of foods, beverages consumed and the frequency with which teens consume them, allowed for the classification of the type of food in unhealthy diet (fries, burgers, hot dogs, sausages, colas and other soft drinks), intermediate and healthy food (fruit, vegetables, milk, juices, yogurts, meat, fish)^{23, 25}. The project was submitted to the Ethics Committee of the School of Health of Viseu and then authorization was requested to the school directors and parents. The statistical analysis was processed using SPSS (Statistical Package for Social Sciences) version 21.0 for Windows.

Results:

With regard to meals, 7.3% of the teens said they never or almost never have breakfast.

When asked to speak out about the type of products they consume and how often they do it, the results indicate that the milk (8 out of 10 students) and bread (7 in 10) are the most consumed daily. Yoghurts are also worth mentioning as it is a product consumed by 38% of the total sample. Products such as fish are consumed daily by 23.9% of adolescents, a figure that rises to 28.2% among those who consume between 1 to 3 days a week and increases to 37.6% in those who reported consuming it between 4 to 5 days a week. 1 to 3 times a week for young people (23.2%) who consume fruit juices, stressing that more than half of young people in this study (55.3%) consumed fruit daily and the boys eat less than girls ($X^2=12.140$; $p=0.007$). With regard to meat, it is consumed daily for 44.5% of all respondents.

Vegetables consumption seems to be regular, as there are substantially approximate percentages for those who consume in a daily basis (27.4%), 4 to 5 days per week (32.4%) and 1 to 3 days a week (24.7%). It should be noted that students in the overall, consume 1 to 3 times a week either sweet treats (40.8%), chips (38.9%), burgers or sausages (37.9%) and processed meats (38.9%). The boys consume more often chips (78.6% vs. 66.8%; $X^2=10.41$; $p=0.015$) and burgers (73.8% vs. 57.5%; $X^2=21.522$; $p=0.000$) and processed meats (66.8% vs. 55.4%; $X^2=12.125$, $p=0.007$).

Teens with parents with better (secondary or higher) academic qualifications reveal better school performance, and this is significant for study methods ($p=0.004$), motivation for study ($p=0.005$) and overall school performance ($p=0.019$).

The analysis of Table 1 shows that healthy eating is associated with academic achievement in the overall and in all dimensions of scale. The differences between groups are statistically significant, the post hoc tests locate these differences in study environment among those who make an unhealthy diet with making an intermediate diet ($p=0.000$) and among those who make an unhealthy diet with those that have a healthy eating diet ($p=0.000$). For study planning, study method, reading skills, motivation to study and overall school performance, we found significant differences ($p=0.000$) among adolescents who

follow unhealthy diet with those who have a healthy diet.

Table 1 – Diet type and school performance

Diet Type	Average sorting			X ²	p
	Non healthy diet	Intermediate diet	Healthy diet		
School performance					
Study environment	166.46	181.70	220.31	21.464	0.000
Study planning	164.59	179.81	222.83	24.984	0.000
Study method	169.54	186.94	215.81	15.659	0.000
Reading Skills	166.82	179.61	220.23	21.164	0.000
Motivation for study	168.05	171.30	220.17	20.807	0.000
Overall school performance	163.11	177.59	224.95	28.194	0.000

Discussion

Results of this study are corroborated by a study in the Social Adventure Program²⁵, the HBSC which concluded that girls and younger teens (11 years) consume "... more often healthy foods (fruit, vegetables and milk). Healthy eating also relates to greater involvement with school, with family and with peers. On the contrary a less healthy diet relates to the existence of physical and psychological symptoms and a daily extended time in sedentary activities (4 hours or more a day watching television). We also found that between 7% and 8% of students do not have breakfast; but more boys have breakfast than girls, noting that about a fifth of girls do not have the habit of eating breakfast. This is a particular concern in that breakfast is the most important meal of the day, allowing the body to restore the energy expended during the night with the maintenance of all vital functions, carrying glucose to the brain and allowing higher concentration and learning capability during the day^{15, 27}.

More than half of the youngsters in the sample consume daily fresh fruit wherein the boys consume significantly less. The consumption of nuts is higher in the boys (16.6% vs. 6.2%; p=0.003). The Portuguese study of the Social Adventure team, held in 2010, representative of the national panorama corroborates the results we obtained, also revealing that most teens have breakfast every day during the week and weekend, with the boys having a higher percentage. Most adolescents referred to eating fruit and vegetables at least once a week, again with boys revealing the highest percentage¹¹.

Most of the studies analysed validate the results of this research: school performance is associated with the food consumed by the student^{11, 21-22, 26}.

In addition to the family, the school, in cooperation with health services, local authorities and other community structures offer privileged conditions for the development of food education and reiterate that diet has a strong impact on school performance, especially in terms of brain functioning, cognitive development and school success^{2, 16, 27}. Thus, the authors suggest a number of relevant strategies to increase levels of learning, including, talking to students about nutrition and about what best stimulates thinking, learning and recall (memory), in addition to requesting work on nutrition so that students search for the impact of various foods, which appear to be effective strategies for meaningful learning. On the other hand, to suggest students to engage on a personal reflection, sustained in a personal diary with records of what they ate and how they felt and how they leave the school, in addition to inviting special guests can bring novelty and credibility to the subject. Parents

and teachers can also lead by example, by following a nutrition with the motto "Eat to Learn".

By way of suggestions for future educational interventions and in schools, it proves to be pertinent to conduct consumer education activities that can actively engage students, working practical issues such as the review of advertising, reading labels, meal composition and its preparation; To investigate educational practices that promote changes in student behaviours; To intervene in the area of Nutrition Education at early levels of education so as to investigate its long-term effects; To produce and test materials created specifically for use in the multifocal approach within the Science, Technology, Society and Environment, in the Food theme, and finally, to suggest that one should assess different integrated strategies in Science Teaching, on the themes Food or Education for Health Promotion⁸.

A greater success in adopting healthy eating habits, can be through the use of strategies for nutrition counselling of adolescents with emphasis on proper communication and motivation to gradual changes, involving the whole family in the adoption of certain lifestyle, considering always more accessible types of food in every region of the country and the time of year²⁸. The Food Education and Education for Health Promotion proves to be relevant and necessary to contribute to the adoption of leading practices in the promotion of individual and collective health, through programs and appropriate teaching resources and adapted to their age, needs and degree of literacy. Guiding activities and establishing procedures are important to change bad habits, improve health and increase literacy in a perspective of learning throughout life and the exercise of an active and responsible citizenship. On the other hand, highlighting the relevance of youth/adult, that, while going through the education system, provide an opportunity that should be used to trigger a global educational action contributing to an integral formation contributing to a better quality of health throughout life.

Conclusions

About five out of every hundred teens do not eat breakfast, and about twelve in a hundred only eats it occasionally; this is worrisome in that breakfast is the most important meal of the day, sending glucose to the brain and allowing for a greater concentration and learning capacity for the day. Boys consume breakfast more often and one fifth of the girls never eat this meal.

What we know about this subject

In Portugal, the latest data¹⁸ suggest that the dietary pattern of the Portuguese population moved away from the recommendations for healthy eating, to an energy intake above requirements, with the consumption of saturated fat (16%) above the value recommended by the WHO and values below the recommended of grain, fruit and vegetables.

What this study adds

This study shows that adolescents with a healthy diet have better school performance.

It shows the prevalence of adolescents who have a healthy diet, which is only 42.6% (Men - 18.4%; Fem - 24.2%).

These figures are worrying and alert us to the need to intervene in a timely and effective manner, with adolescents and the community in general.

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References:

1. Portugal, Ministério da Saúde, Direcção Geral de Saúde. Programa nacional de intervenção integrada sobre determinantes da saúde relacionados com os estilos de vida. Lisboa: Direcção Geral de Saúde; 2004.
2. Nunes E, Breda J. Manual para uma alimentação saudável em jardins de infância. Lisboa: Direcção Geral de Saúde; 2001 [cited 2016 Jul 1]. Available from <http://www.dgs.pt/upload/membro.id/ficheiros/i005536.pdf>.
3. Blasco P, Fuentes I, Pons D. Hábitos alimentarios en la adolescencia temprana. In: Balaguer I. (Ed.) Estilos de vida en la adolescência. Valencia: Promolibro; 2002, p. 65-90.
4. Eisenstein E, Coelho SC. Nutriendo a saúde dos adolescentes: considerações práticas. *Adolesc Saude*. 2004 [cited 2016 Jul 1];1(1):18-26. Available from http://www.adolescenciaesaude.com/detalhe_artigo.asp?id=225
5. Fonseca H. Compreender os adolescentes: um desafio para pais e educadores. Lisboa: Presença; 2005.
6. Rodrigues M, Pereira A, Barroso T. Educação para a saúde: formação pedagógica dos educadores de saúde. Coimbra: Formasau; 2005.
7. Peres E, Moreira P. Alimentação de adolescentes e prevenção de doenças cardiovasculares. *Endocrinologia, Metabolismo e Nutrição*. 1993;2(4):267-273.
8. Augusto AL. Educação alimentar na formação de adultos: contributos para a educação promoção da saúde [master thesis]. Bragança: Instituto Politécnico de Bragança; 2011 [cited 2016 Jul 1]. Available from <https://bibliotecadigital.ipb.pt/bitstream/10198/6155/1/Disserta%C3%A7%C3%A3o%20Final.pdf>
9. Mendonça CP, Anjos L. Aspetos das práticas alimentares e da atividade física como determinantes do crescimento do sobrepeso obesidade no Brasil. *Cadernos de Saúde Pública*. 2004;20(3):698-709.
10. Matos, MG, Carvalhosa SF, Simões C, Branco J, Urbano J, Equipa do Aventura Social e Saúde. Risco e proteção: adolescentes, pais, amigos e escola. *Aventura Social e Saúde*. 2004 [cited 2016 Jul 1];8(1):1-12. Available from http://www.fmh.utl.pt/aventurasocial/pdf/risco_e_proteccao_adolescentes.pdf
11. Matos MG, Simões C, Tomé G, Camacho I, Ferreira M, Ramiro L et al. A saúde dos adolescentes portugueses: relatório do estudo HBSC 2010. Lisboa: Centro de Malária e Outras Doenças Tropicais /IHMT/UNL; 2012.
12. Portugal, Ministério da Saúde, Direcção Geral de Saúde. Plano nacional de saúde 2004/2010. Vol. 2, Orientações estratégicas. Lisboa: Direcção Geral de Saúde; 2004.
13. Graça P, Gregório MJ. A construção do programa nacional para a promoção da alimentação saudável: aspectos conceptuais, linhas estratégicas e desafios iniciais. 2015 [cited 2016 May 25];18:6-9. Available from http://www.apn.org.pt/documentos/revistas/RN_18.pdf
14. Teixeira P, Silva M. Repensar o peso: princípios e métodos testados para controlar o seu peso. Lisboa: Lidel; 2009.
15. Cahill LE, Chiuvè SE, Mekery RA, Jensen MK, Flint AJ, Hu BF, Rimm EB. Prospective study of breakfast eating and incident coronary heart disease in a cohort of male US health professionals. *Circulation*. 2013 [cited 2016 Jul 1];128(4):337-343. doi:

- 10.1161/CIRCULATIONAHA.113.001474
16. Jensen E. O cérebro, a bioquímica e as aprendizagens: um guia para pais e educadores. Porto: Asa; 2002.
 17. Nunes B. Envelhecer com saúde: guia para melhorar a sua saúde física e psíquica. Lisboa: Lidel; 2008.
 18. Portugal, Ministério da Saúde, Direcção Geral de Saúde. Portugal: Alimentação saudável em números 2015: programa nacional para a promoção da alimentação saudável. Lisboa: Direcção Geral de Saúde; 2016 [cited 2016 May 25]. Available from <https://www.sns.gov.pt/wp-content/uploads/2016/03/Relat%C3%B3rio-Portugal-Alimenta%C3%A7%C3%A3o-Saud%C3%A1vel-em-N%C3%BAmeros-2015.pdf>
 19. Universidade do Porto, Faculdade de Ciências da Nutrição e Alimentação. Roda da alimentação mediterrânica: cartaz da roda da alimentação mediterrânica [Internet]. [cited 2016 May 25]. Available from https://sigarra.up.pt/fcnaup/pt/noticias_geral.ver_noticia?p_nr=8186
 20. Portugal, Ministério da Saúde, Direcção Geral da Saúde. Alimentação: a nova roda dos alimentos [Internet]. Lisboa: Direcção-Geral de Saúde. 2011 [cited 2016 May 25]. Available from <https://www.dgs.pt/ficheiros-de-upload-1/alimentacao-roda-dos-alimentos.aspx>
 21. Florence MD, Asbridge M, Veugelers PJ. Diet quality and academic performance. J Sch Health. 2008;78(4):209-15.
 22. Stea TH, Torstveit MK. Association of lifestyle habits and academic achievement in Norwegian adolescents: a cross-sectional study. BMC Public Health. 2014;11(14):829-837.
 23. Aparício G, Ajudar a desenvolver hábitos alimentares saudáveis na infância. Millenium. 2010;38:283-298.
 24. Lins C, Alves I. Adolescência e alimentação saudável: desafios e estratégias. 2011 March 17 [cited 2016 May 25] In: Casa: Centro de Alimentação Saudável [Internet] 2007-2016. Available from <http://casaunb.blogspot.pt/2011/03/adolescencia-e-alimentacao-saudavel.html>
 25. Matos MG, Carvalhosa SF, Fonseca H. O comportamento alimentar dos jovens portugueses. Aventura Social e Saúde. 2001 [cited 2016 May 25];5(1):43-53. Available from <http://www.scielo.mec.pt/pdf/psd/v2n2/v2n2a03.pdf>
 26. Viana C. Em tempo de exames, ter cuidado com o cérebro começa à mesa das refeições. Público [Internet]. 2013 June 2 [cited 2016 May 25]. Available from <https://www.publico.pt/sociedade/noticia/em-tempo-de-exames-ter-cuidado-com-o-cerebro-comeca-a-mesa-das-refeicoes-1596104>
 27. Teixeira H. Alimentação e desempenho escolar [thesis]. Porto: Universidade do Porto; 2009 [Cited 2016 May 25]. Available from https://repositorio-aberto.up.pt/bitstream/10216/54560/4/130778_0948TCD48.pdf
 28. Graça P, Gregório MJ. Estratégia para a promoção da alimentação saudável em Portugal. Portugal Saúde em Números. 2015 [cited 2016 May 25];4:37-41. Available from http://www.alimentacaosaudavel.dgs.pt/activeapp/wp-content/files_mf/1445615271Artigosau_deemnu_meros.pdf