



Chapter 3

Social and environmental determinants, household food insecurity

Maria João Gregório, Pedro Graça

1. Food insecurity as a public health problem

Food security is defined as a situation that exists when “all people, at all times, have physical and economic access to sufficient, safe and nutritious food to maintain a healthy and active life” (1). It is a multilevel concept, which includes four main dimensions: availability related to food supply; accessibility in order to ensure the physical and economic access to food; adequacy to meet nutritional needs in quantity and quality while respecting individual food preferences and cultural issues (utilization); and, lastly, stability of the guarantee of food security over time (2). According to the food security definition, it is a broad concept where all these dimensions are largely affected by a considerable number of factors related to: public policies of different sectors, food production/industry/distribution food systems, marketing and advertising of food, social support networks and individual determinants related to food choice behaviour (Figure 1).

Recently, the guarantee of food security became a priority action for public health, in order to reduce the social gap in diet and diet-related non-communicable diseases. Indeed, there is strong evidence to support that food insecurity is negatively associated with diet quality (3) and linked to a large number of health conditions (4), such as hypertension (4), hyperlipidemia (4), diabetes (4, 5), cardiovascular diseases (4) and obesity (6-8). Other studies also suggest a higher risk for poor general health and lower scores on the physical and mental health in food-insecure households (9).

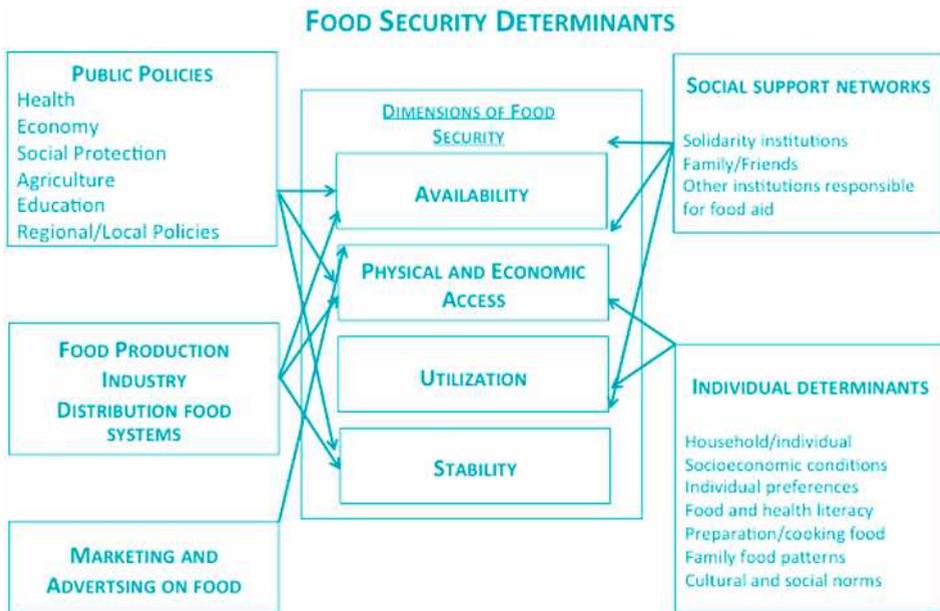


Figure 1: Determinants of food security.

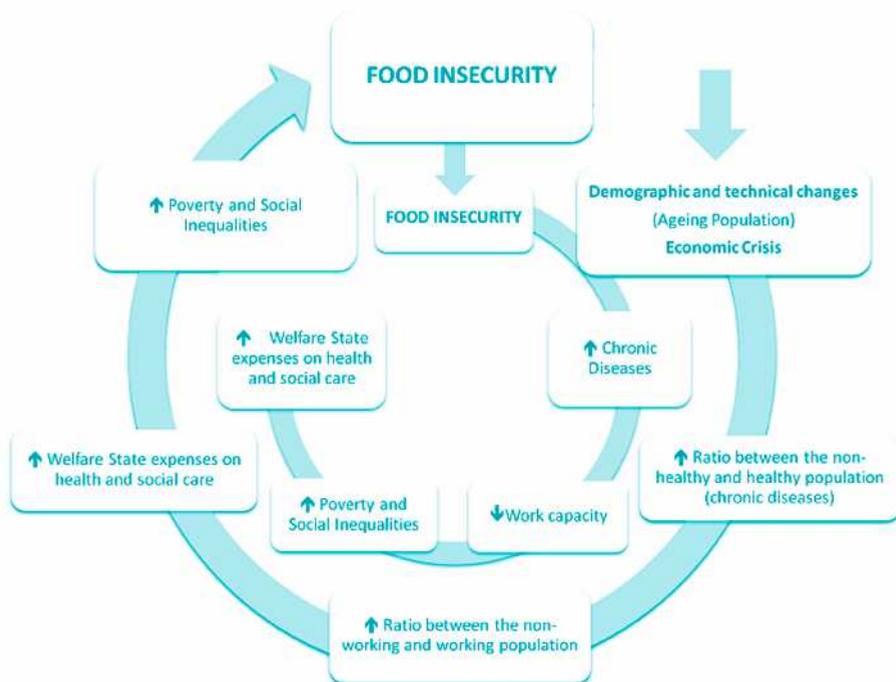


Figure 2: Impact of economic, political, social and demographic context on food insecurity.

Moreover, chronic disease and poverty and/or food insecurity appear to be strongly interconnected. Apart from the evidence suggesting that chronic diseases are more common in the most vulnerable groups of the population, it is also known that poverty and social exclusion can also be represented as a consequences of chronic diseases, because illness and disability have largely accounted for lost of productivity at work, leading to absenteeism and reduced efficiency. Thus, the interconnection between poverty, food insecurity and chronic diseases follows a vicious cycle, as represented in Figure 2.

2. Food insecurity in Portuguese households with children: Results from the EPHE Project

Data presented in this chapter was derived from the baseline evaluation period of the EPHE Project in Portugal. The EPHE evaluation study is a prospective two-year follow-up design, which aims to assess the behavioural change in some energy balance-related behaviours and their associated environmental determinants in children, according to their socio-economic status, and its sustainability over time in communities of seven European countries, including Portugal (10). In Portugal, Maia was the selected community, a city situated in the north of the country, in the metropolitan area of Porto. Our sample included 241 families with children aged between 6 and 8 years old, from two public schools in this community. We analysed data from the baseline evaluation period (2013) of the EPHE Project in Portugal. Data on child's energy balance-related behaviours and associated determinants were collected using the EPHE parental self-reported questionnaire (10) and household food security was assessed by the six-item USDA questionnaire (11).

2.1. Food insecurity in EPHE Portuguese households with children

A total of 228 Portuguese households with children from the EPHE evaluation study in Portugal were included in this analysis. Portuguese children included in the study had a mean age of 6.8 ± 0.8 years. During the 12 months in analysis, 25% (n=56) of the households reported to be food-insecure. From those food-insecure households, 21% (n=47) were considered in low food security level and 4% (n=9) in very low food insecurity (Figure 3).

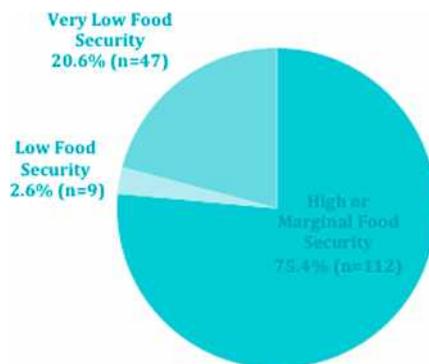


Figure 3: Food security status in EPHE Portuguese households with children (n=228).

2.2. Child's energy balance-related behaviours according to household food insecurity

Table 1 shows that children of food-secure households consumed fruit, salad or grated vegetables, raw vegetables and cooked vegetables significantly more frequently per week, compared to those of food-insecure households. Contrarily, higher values of fruit juices amount, weekly fruit juices consumption, frequency of soft drinks consumption per week, soft drinks amount, soft and diet soft drinks weekly consumption, were observed in children of food-insecure households when comparing to their counterparts of food-secure households.

Furthermore, children of food-insecure households watched TV more frequently during the weekdays and spent more screen time per week (Table 1).

2.3. Social and environmental determinants of child's energy balance-related behaviours according to household food insecurity

Besides the child's energy balance-related behaviours assessment, the EPHE Project also tried to evaluate the social and environmental determinants that might be associated with a child's energy balance-related behaviours. The evaluated social determinants included:

- parenting practices regarding healthy lifestyle of children, parental ability to encourage and facilitate child's healthy behaviours;
- parental permission for energy balance-related behaviours of the child;
- parental behaviour avoiding negative modelling of unhealthy lifestyle;
- parental behaviour communicating healthy beliefs to their children;
- parental rewarding/comforting practices allowing their child unhealthy behaviours;
- parental inability to manage child's behaviours, parental knowledge on recommendations and child's nagging behaviour.

Physical environmental determinants include availability of food at home and related situations where economic determinants like price issues can affect food choices.

The differences regarding the social and physical environmental determinants of child's energy balance-related behaviours according to household food insecurity are presented in Table 2.

2.4. Social determinants

2.4.1. Parental practices related to a child's healthy lifestyle

The results for the social determinants related to parental practices, showed that parental demand and insistence for children to eat fruit every day was significantly

more common in food-secure households. Parental allowance for fruit and vegetable intake was also higher in the food-secure households, whereas it was lower for soft drink intake and computer games use, compared to the parental allowance in food-insecure households.

Parents from food-insecure households were more likely than the parents from food-secure households to tell their children that drinking fruit juices, soft drinks and watching TV/playing computer games may lead to making them fat (communicating health belief). Additionally, parents from food-insecure households were also more likely to avoid negative modelling, for fruit juice intake and for watching TV (Table 2).

Parents of food-insecure households tend to allow more frequently their children to drink fruit juices and soft drinks and play computer games as a rewarding and comforting practice. They were also more likely to report an inefficacy in retaining rules with regards to television viewing and computer exposure. Parents of food-secure households ate vegetables together with their children more frequently than parents from food-insecure households. Additionally, parents from food-insecure households were more likely to drink fruit juices and soft drinks together with their children (Table 2).

2.4.2. Parental knowledge on recommendations

Parental knowledge on recommendations related to vegetable consumption was greater for parents from food-secure households, while no significant differences were found for parental knowledge on fruit-related recommendations (Table 2).

2.4.3. Child's nagging behaviour

Children from food-insecure households were more likely to try to watch TV and play computer games when it was prohibited (nagging behaviour) (Table 2).

2.4.4. Determinants of the physical environment

Considering the physical environmental determinants, significant differences according to household food security situation were found only for home availability of fruits and vegetables. Parents of food-insecure households reported lower frequency of fruit and vegetable availability in their households (Table 2).

2.4.5. Economic environment

Food insecure households were more sensitive to the price of foods. Parents of food-insecure households were more likely to report that *"I do not give to my child some foods because they cost too much"*, compared to food-secure households.

Table 1: Rounded median values and quartiles (q₁-q₃) for child's energy balance-related behaviours (dietary, sedentary and sleeping behaviour) associated with food insecurity.

Energy balance-related behaviour	Food Security status	N	Median (q ₁ ;q ₃)	P value
1. Dietary behaviour				
1.1 Fruit and vegetable consumption				
Fruit (frequency/week)*	Food security	171	7 (6;7)	0.00
	Food insecurity	55	6 (5;7)	
Salad or grated vegetables (frequency/week)*	Food security	170	6 (4.75;7)	0.00
	Food insecurity	56	5 (4;6)	
Raw vegetables (frequency/week)*	Food security	170	4 (2;5)	0.01
	Food insecurity	55	3 (1;4)	
Cooked vegetables (frequency/week)*	Food security	172	6.5 (6;7)	0.01
	Food insecurity	56	6 (5;7)	
1.2 Fruit juices consumption				
Fruit juices amount (ml)				
Weekly fruit juices consumption (ml/week)	Food security	172	580 (250;580)	0.00
	Food insecurity	56	580 (520;580)§	
Weekly fruit juices consumption (ml/week)	Food security	171	107.1 (35.7;248.6)	0.02
	Food insecurity	56	248.6 (65.2;455.7)	
1.3 Soft drinks and diet soft drinks consumption				
Soft drinks (frequency/week)*	Food security	171	5 (0;1)	0.03
	Food insecurity	56	5 (0.5;3)§	
Soft drinks' amount (ml)	Food security	170	250 (250;580)	0.00
	Food insecurity	56	580 (250;830)	
Weekly soft drinks intake (ml/week)	Food security	169	35.7 (0;82.9)	0.01
	Food insecurity	56	41.4 (17.9;145.4)	
Weekly diet soft drinks intake (ml/week)	Food security	171	0 (0;0)	0.03
	Food insecurity	56	0 (0;0)§	
2. Sedentary behaviour				
TV weekdays (h/day)†	Food security	172	1 (0.5;2)	0.00
	Food insecurity	56	2 (1;2)	
TV use (h/week)†	Food security	172	10 (7;16)	0.01
	Food insecurity	55	15 (9;18)	
Total screen time (h/week)†	Food security	172	15.3 (11;20)	0.02
	Food insecurity	55	20 (11.5;25)	
3. Sleeping behaviour				
Wake up time (weekdays)*	Food security	171	4 (3;4)	0.01
	Food insecurity	56	4 (4;4)§	

* Responses categories: 1. Never; 2. Less than one day per week; 3. One day per week; 4. 2-4 days per week; 5. 5-6 days per week; 6. Everyday, once a day; 7. Everyday, twice a day; 8. Everyday, more than twice a day.

† Responses categories: 1. Not at all; 2. 30 min/day; 3. 1 h/day; 4. 2 h/day; 5. 2.5 h/day; 6. 3 h/day; 7. 3.5 h/day; 8. 4 or more h/day.

‡ Responses categories: 1. At 5 a.m. or earlier; 2. At 6 a.m.; 3. At 7 a.m.; 4. At 8 a.m.; 5. At 9 a.m.; 6. After 9 a.m..

§ P values according to Mann Whitney U test.

|| Higher Means Ranks values for fruit juices amount, frequency of soft drinks per week, weekly diet soft drinks and for wake up time at weekdays were found for children of food insecure households.

Table 2: Rounded median values and quartiles (q₁-q₃) or social and environmental determinants of child's energy balancerelated behaviours (dietary, sedentary and sleeping behaviour) associated with food insecurity.

Energy balance-related behaviour	Determinants	Food Security status	N	Median (q ₁ ;q ₃)	P value
	1. Social environment				
	1.1 Parenting practices				
Fruit consumption	Parental demand (tell their child to eat fruit every day) <i>Never (0) – Yes, always (4)</i>	Food security	172	4 (3;4)	0.01
		Food insecurity	56	3 (3;4)	
	Parental allowance (allows their child to eat much fruit as (s)he likes at home) <i>Never (0) – Yes, always (4)</i>	Food security	172	4 (3;4)	0.00
		Food insecurity	55	3 (3;4)	
Vegetables consumption	Parental allowance (allows their child to eat much vegetables as (s)he likes at home) <i>Never (0) – Yes, always (4)</i>	Food security	172	4 (3;4)	0.00
		Food insecurity	55	3 (2;4)	
Fruit juices consumption	Communicating health beliefs (tell their child that fruit juices make him/her fat) <i>Never (0) – Always (4)</i>	Food security	172	2 (0;2)	0.02
		Food insecurity	54	2 (1;3)	
	Avoid negative modelling (restrain themselves from fruit juices intake because of the presence of their child) <i>Never (0) – Always (4)</i>	Food security	172	1 (0;2)	0.04
		Food insecurity	55	2 (0;3)	
	Rewarding/comforting practice (give fruit juices to their child as a reward or to comfort him/her) <i>Never (0) – Always (4)</i>	Food security	172	0 (0;1)	0.00
		Food insecurity	56	1 (0;1.75)	
Soft drinks consumption	Parental allowance (If my child asks for a soft drink, I will give it to him/her) <i>Never (0) – Always (4)</i>	Food security	172	1 (1;2)	0.05
		Food insecurity	56	1 (1;2)	
	Communicating health beliefs (tell their child that soft drinks make him/her fat) <i>Never (0) – Always (4)</i>	Food security	171	3 (1;4)	0.04
		Food insecurity	56	3 (2;4)	
Rewarding/comforting practice (give soft drinks to their child as a reward or to comfort him/her) <i>Never (0) – Always (4)</i>	Food security	172	0 (0;0)	0.02	
	Food insecurity	56	0 (0;1)		

Energy balance-related behaviour	Determinants	Food Security status	N	Median (q ₁ ;q ₃)	P value
Sedentary behaviour (Television and computer exposure)	Parental allowance (If my child asks if (s)he is allowed to play computer games I will allow it) <i>Never (0) – Always (4)</i>	Food security	172	2 (2;3)	0.04
		Food insecurity	56	2 (1;2)	
	Parental allowance (allows their child to play computer games whenever (s)he wants) <i>Never (0) – Always (4)</i>	Food security	171	2 (1;2)	0.03
		Food insecurity	56	1 (0;2)	
	Avoid negative modelling (restrain themselves to watch TV for leisure time) <i>Never (0) – Always (4)</i>	Food security	171	1 (0;2)	0.03
		Food insecurity	56	1 (0;2)	
	Negotiating (When I prohibit my child from watching TV, I find it difficult to stick to my rules and (s)he starts negotiating) <i>Never (0) – Always (4)</i>	Food security	172	0 (0;1)	0.02
		Food insecurity	55	1 (0;2)	
	Negotiating (When I prohibit my child from playing computer games, I find it difficult to stick to my rules and (s)he starts negotiating) <i>Never (0) – Always (4)</i>	Food security	172	0 (0;1)	0.05
		Food insecurity	56	0.5 (0;1)	
	Rewarding/comforting practice (allows their child to play computer games as a reward or to comfort him/her) <i>Never (0) – Always (4)</i>	Food security	172	1 (0;1)	0.01
		Food insecurity	55	1 (0;2)	
	Communicating health beliefs (tell their child that watching TV/playing computer games make him/her fat) <i>Never (0) – Always (4)</i>	Food security	171	1 (0;2)	0.04
		Food insecurity	56	2 (0.25;2)	
1.2 Parental knowledge					
Vegetables consumption	Parental knowledge on recommendations (recommendations for vegetables consumption) <i>None (1) – 5 or more pieces/portions per day (8)</i>	Food security	168	5 (5;6)	0.04
		Food insecurity	55	5 (4;6)	
1.3 Performing energy balance related behaviours (EBRB) together					
Vegetables consumption	Performing EBRB together with the child (We often eat vegetables the whole family together) <i>Never (0) – yes, always (4)</i>	Food security	172	2 (1;2)	0.00
		Food insecurity	56	1 (1;2)	

Energy balance-related behaviour	Determinants	Food Security status	N	Median (q ₁ ;q ₃)	P value
Fruit juices consumption	Performing EBRB together with the child (drink fruit juices together with your child) <i>Never (0) - yes, always (4)</i>	Food security	172	2 (2;3)	0.00
		Food insecurity	56	3 (2;4)	
Soft drinks consumption	Performing EBRB together with the child (drink soft drinks together with your child) <i>Never (0) - yes, always (4)</i>	Food security	172	2 (1;3)	0.01
		Food insecurity	56	2 (2;3)	
1.4 Child's nagging behaviour					
Sedentary behaviour (Television and computer exposure)	Nagging behaviour (If I prohibited my child from watching TV for leisure time, (s) he would do it anyway) <i>Never (0) - yes, always (4)</i>	Food security	172	1 (0;1)	0.02
		Food insecurity	55	1 (0;2)	
	Nagging behaviour (If I prohibited my child from playing computer games for leisure time, (s)he would do it anyway) <i>Never (0) - yes, always (4)</i>	Food security	172	0 (0;1)	0.04
		Food insecurity	56	1 (0;1)	
2. Physical environment					
2.1 Home availability					
Fruit consumption	Home availability (In my home, there are usually different kinds of fruits available) <i>Never (0) - yes, always (4)</i>	Food security	172	4 (3;4)	0.00
		Food insecurity	56	3 (2;4)	
Vegetables consumption	Home availability (In my home, there are usually different kinds of vegetables available) <i>Never (0) - yes, always (4)</i>	Food security	170	3 (3;4)	0.00
		Food insecurity	56	2.5 (2;3)	
	Home availability (Vegetables served with dinner (or lunch) at your home) <i>Never (0) - Always (4)</i>	Food security	170	3 (3;4)	0.00
		Food insecurity	56	3 (2;3)	
3. Economic environment					
3.1 Price influence					
Dietary behaviour	I do not give my child some foods because they cost too much	Food security	171	- 1 (-2;0)	0.00
		Food insecurity	56	0 (-1;1)	

* P values according to Mann Whitney U test.

3. Conclusions and recommendations

According to the EPHE data, about 25% of the portuguese households with children analyzed in this study were food-insecure with 21% of those households at a low food security level. More specifically, these households reported some inability to acquire enough food due to economic constraints, a reduced quality or variety in their diet without significant reduction of their food intake. In contrast, 4% of the food-insecure households reported that their families experienced changes in eating patterns including the reduction of food intake during the last 12 months due to economic constraints.

Our data showed significant differences between child's energy balance-related behaviours and according to the household food security situation: fruit and vegetable consumption, fruit juices and soft drink intake and total screen time (mainly due to the time spent watching TV) were more prevalent in children from food-insecure households.

In addition, we tried to identify some social and physical environmental determinants that might explain the differences found between the food-secure and food-insecure households in child's dietary and sedentary behaviours. As our study shows, there is strong evidence that food prices are one of the most important determinants of food choices in low-income groups (12). As such, higher costs of healthy foods and lower costs of energy-dense foods might explain dietary behaviours of low-income or food-insecure individuals (12-16). Food availability in the home environment, which is closely linked to economic determinants, also seems to be an important factor that determines food-choice behaviour, with particular reference to fruits and vegetables. Previous studies have shown that food-insecure households report less availability of healthy foods at home (17) and that food availability at home was considered as an important determinant of diet quality in food-insecure children (18).

These data suggest differences in several risk factors for childhood obesity and overweight in a sample of Portuguese families with children. It provides evidence for action regarding the determinants of these behaviours, particularly in those related to family environmental determinants. Physical environmental factors of child's energy balance-related behaviours, such as food costs and availability of healthy foods, seem to be relevant determinants of food choices amongst food-insecure individuals. These findings support the most recent international guidelines from policy documents in the field of food and nutrition. These documents suggest that there is a need to move away from policy interventions focused on citizens' empowerment, to policy interventions that enable changes in food environments. Promoting availability and supporting the physical and economic access to healthy foods is particularly important when aimed at reducing social inequalities in health (19-21). Furthermore, some parental practices that seem to be linked with childhood obesity were more prevalent amongst food-insecure households. To our knowledge, such parental practices could be considered as important targets for interventions to reduce social inequalities in childhood obesity. All these findings will be used to adapt, tailor and improve the EPODE approach implemented via the Maia programme. The EPODE model aims at

changing behaviours through multi-factorial strategies, focused both on individual behaviour and the environment. Modifying habits requires changing perceptions, the microenvironment (e.g. schools, homes, neighbourhoods) and the macro-environment (e.g. education and health systems, governments, the food industry and society's attitudes and beliefs) so that healthy behaviours prevail. The EPHE Project and its results show that interventions must be adapted to fit the local context and needs from all socio-economic groups.

In conclusion, several inequalities in child's dietary and sedentary behaviours were revealed, and at the same time, factors related to the home food environment and to parental food practices seems to be associated with household food insecurity. Furthermore, this research gives us new insight regarding the different energy balance-related behaviours of children, as well as the environmental and parental practices related with these child behaviours that might explain the link between household food insecurity and childhood obesity.

Our outcomes suggest that future interventions aiming at reducing inequalities in childhood obesity and overweight, should consider social and physical environmental determinants of the child's energy balance-related behaviours. Thus, community-based interventions tailored to the local environment might be a type of intervention that should be taken into consideration when the objective is reducing inequalities in childhood obesity.

References

1. WORLD FOOD SUMMIT (1996). *Declaração de Roma sobre a segurança alimentar e plano de ação da Cimeira Mundial de Alimentação*. Roma.
2. FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS (2008). An Introduction to the Basic Concepts of Food Security [Internet]. EC-FAO Food Security Programme. The four dimensions of food security. Available at: <http://www.fao.org/docrep/013/a1936e/a1936e00.pdf>.
3. KIRKPATRICK SI, TARASUK V (2008). Food insecurity is associated with nutrient inadequacies among Canadian adults and adolescents. *J Nutr.* 138:604-12.
4. SELIGMAN HK, LARAIA BA, KUSHEL MB (2010). Food insecurity is associated with chronic disease among low-income NHANES participants. *J Nutr.* 140:304-10.
5. SELIGMAN HK, BINDMAN AB, VITTINGHOFF E, KANAYA AM, KUSHEL MB (2007). Food insecurity is associated with diabetes mellitus: Results from the National Health Examination and Nutrition Examination Survey (NHANES) 1999–2002. *J Gen Intern Med.* 22:1018–23.
6. PAN L, SHERRY B, NJAI R, BLANCK HM (2012). Food insecurity is associated with obesity among US adults in 12 states. *J Acad Nutr Diet.* 112:1403–09.
7. TOWNSEND MS, PEERSON J, LOVE B, ACHTERBERG C, MURPHY SP (2001). Food insecurity is positively related to overweight in women. *J Nutr.* 131:1738–45.
8. EISENMANN JC, GUNDERSEN C, LOHMAN BJ, GARASKY S, STEWART SD (2010). Is food insecurity related to overweight and obesity in children and adolescents? A summary of studies, 1995–2009. *Obes Rev.* 12:e73–e83.
9. STUFF JE, CASEY PH, SZETO KL, GOSSETT JM, ROBBINS JM, SIMPSON PM, ET AL (2004). Household food insecurity is associated with adult health status. *J Nutr.* 134:2330–35.
10. MANTZIKI K, VASSILOPOULOS A, RADULIAN G, BORYS J-M, PLESSIS H, GREGÓRIO MJ, ET AL (2014). Promoting health equity in European children: Design and methodology of the prospective EPHE (Epoque for the Promotion of Health Equity) evaluation study. *BMC Public Health.* 14:303.
11. UNITED STATES DEPARTMENT OF AGRICULTURE, ECONOMIC RESEARCH SERVICE (2012). Household Food Security Survey Module: Six-Item Short Form Economic Research Service, USDA. Available

- at: http://www.ers.usda.gov/datafiles/Food_Security_in_the_United_States/Food_Security_Survey_Modules/short2012.pdf.
12. DREWNOWSKI A, DARMON N (2005). Food choices and diet costs: An economic analysis. *J Nutr.* 135:900-04.
 13. DARMON N, BRIEND A, DREWNOWSKI A (2004). Energy-dense diets are associated with lower diet costs: A community study of French adults. *Public Health Nutr.* 7(1):21-27.
 14. MAILLOT M, DARMON N, VIEUX F, DREWNOWSKI A (2007). Low energy density and high nutritional quality are each associated with higher diet costs in French adults. *Am J Clin Nutr.* 86:690-6.
 15. DREWNOWSKI A, SPECTER SE (2004). Poverty and obesity: The role of energy density and energy costs. *Am J Clin Nutr.* 79:6-16.
 16. DREWNOWSKI A, DARMON N, BRIEND A (2004). Replacing fats and sweets with vegetables and fruit - A question of cost. *Am J Public Health.* 94(9):1555-59.
 17. NACKERS LM, APPELHANS BM (2013). Food insecurity is linked to a food environment promoting obesity in households with children. *J Nutr Educ Behav.* 45(6):780-4.
 18. RASMUSSEN M, KROLNER R, KLEPP KI, LYTLE L, BRUG J, BERE E, ET AL (2006). Determinants of fruit and vegetable consumption among children and adolescents: A review of the literature. Part I: Quantitative studies. *Int J Behav Nutr Phys Act.* 3:22.
 19. WORLD HEALTH ORGANIZATION (2011). Action plan for implementation of the European Strategy for the Prevention and Control of Non-communicable Diseases 2012-2016. WHO Regional Office for Europe, Copenhagen. Available at: http://www.euro.who.int/__data/assets/pdf_file/0003/147729/wd12E_NCDs_111360_revision.pdf.
 20. WORLD HEALTH ORGANIZATION (2013). WHO European Region Food and Nutrition Action Plan 2014-2020. WHO Regional Office for Europe, Copenhagen.
 21. LORING B, ROBERTSON A (2014). Obesity and inequities - Guidance for addressing inequities in overweight and obesity. WHO Regional Office for Europe, European Office for Investment for Health and Development, Copenhagen.