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Chapter

Epidemiology of Obesity in Children and Adolescents

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Abstract

The childhood overweight and obesity epidemic has become a global emergency in public health and a crucial challenge of the twenty-first century. Nowadays, childhood and adolescent obesity represent a significant public health problem both in developing and developed countries. Globally, above 340 million children and adolescents aged 5–19 years were overweight or obese in 2016. Childhood obesity is a critical burden because it can be associated with a higher possibility of obesity, premature death, and disability in adults, as well as early markers of cardiovascular disease. In Europe, childhood obesity remains a significant health challenge and is distributed disparately across and between countries and population groups. In 2019, over 398,000 children aged 6–9 years were severely obese in Europe. Particularly, Southern European countries such as Greece, Italy, Malta, San Marino, and Spain had one in five children obese in 2018. In Europe, different initiatives and actions have been launched in recent years to fight childhood obesity. However, the progress on combating obesity in children has been slow and inconsistent across the region. In this chapter, we have discussed the prevalence of obesity in children and existing policies to combat childhood obesity in the World Health Organization (WHO) European Region.

Keywords: obesity, overweight, childhood, adolescents, prevalence, epidemiology, policies, prevention

1. Introduction

Obesity in children is the most serious public health problem globally [1], as children are more likely to become obese adults in their future lives. Currently, childhood obesity represents a significant public health challenge in both developed and developing countries by increasing the burden of noncommunicable diseases (NCDs) [2]. Recent estimates suggest that over 38 million children younger than 5 years of age were overweight or obese in 2019 [3]. Over 340 million children and adolescents aged 5–19 years were overweight or obese in 2016 [3]. The prevention of diabetes mellitus and obesity in adults and children was one of the goals set by the World Health Assembly in 2013 [4]. The rapid increase worldwide in obesity is also analyzed in association with the economic causes because some differences were observed between high- and low-income settings. In high-income settings, the

higher prevalence of obesity is observed in disadvantaged and marginalized communities. In contrast, in low- and middle-income settings, the prevalence of obesity is higher in groups with higher socioeconomic status. This trend can be explained by socioeconomic inequalities, because in the high-income countries, commonly, the socioeconomic disparities improve the consumption by the poor people of inexpensive, energy-dense foods and beverages.

Furthermore, the increment of obesity prevalence by 23–33% was recorded for children in low-education, low-income, and higher-unemployment households. The family with low-income demonstrates a lower awareness that their children are overweight and then face a host of barriers to improving the diet, the activity behaviors, and the general health status [5]. Many economic consequences for public health strategies are related to the epidemic trend of childhood obesity.

The problem of childhood obesity has become a global public health concern, and the fight for its prevention is a commitment that involves all institutions. The prevention of obesity requires the implementation of surveys to monitor its evolution over time, the knowledge of its determinants, and the research and implementation of interventions, necessarily in a multisectoral and multidisciplinary context, as well as a continuous evaluation process. These actions are necessary for the implementation of evidence-based interventions, which must be supported by appropriate nutritional policies. Overweight and obesity at a young age are associated with various health or economic consequences, therefore it is important to analyze the causes and risk factors and identify the best prevention and treatment strategies. On the prevention of childhood obesity, the promotion of teamwork and the dissemination of information related to childhood obesity is one of the vital strategies to fight against childhood and adolescent obesity. Therefore, teamwork in health care is a crucial strategy for promoting public health and preventing childhood chronic diseases such as childhood obesity.

In Europe, childhood obesity remains a significant health challenge and is distributed disparately across and between countries and population groups [6]. Approximately, 398, 000 children aged 6–9 years were severely obese in Europe in 2019 [7]. Obesity in children is associated with immediate adverse consequences such as psychological problems [8] and lower educational attainment [9]. Also, it is associated with negative health effects later in life or adulthood, such as type 2 diabetes mellitus, hypertension, obstructive sleep apnea, dyslipidemia, and other noncommunicable diseases [10]. Childhood obesity is the outcome of an interaction between a complex series of factors related to environmental, genetic, and ecological effects [10]. Due to the speedily increasing prevalence of childhood obesity in Europe, various initiatives and actions have been launched in recent years in response to this alarming trend. As a result, the WHO European Childhood Obesity Surveillance Initiative has measured the trends in childhood obesity for over a decade [11]. It provides data to inform policy and practice to respond to the problem of childhood obesity [11, 12]. Also, the EU developed an action plan to tackle childhood obesity (EU Action Plan on Childhood Obesity 2014–2020) on February 24, 2014 [13]. However, the progress on combating obesity in children has been slow and inconsistent across the region. For instance, the latest data have shown that southern European countries such as Greece, Italy, Malta, Cyprus, San Marino, and Spain have the highest rate of childhood obesity (nearly one in five children are obese) [14]. On the other hand, Denmark, France, Ireland, and Norway are among countries with the lowest rates of obesity in children in either sex [14]. Hence, childhood obesity is still a so-called time bomb [15] for future demands for health services

and could jeopardize the progress toward achieving the Sustainable Development Goals (SDGs) [16].

The present chapter is aimed at (1) illustrating the prevalence of obesity in children and adolescents aged 5—19 years by the WHO European Region and (2) analyzing the effectiveness of the prevention strategies adopted in EU countries to combat childhood obesity from a social and legal point of view and pointing out the best strategies to reduce the prevalence of obesity in children and adolescents.

2. Epidemiology

2.1 Prevalence

Data on the prevalence of obesity in children and adolescents aged 5—19 years in the WHO European Region were taken from the Global Health Observatory (GHO) data [17]. By geographic area, the highest crude prevalence of childhood obesity was observed in Mediterranean countries in 2016, ranging from 7.6% to 13.8% for either sex. In particular, Greece, Malta, Italy, Cyprus, Andorra, Turkey, and Israel among the Mediterranean countries had the highest prevalence of childhood and adolescent obesity in 2016 (**Table 1**). In 1980, Oriental European countries had a prevalence of less than 2%, ranging from 0.3 to 1.9%. However, in 2016, it changed completely, and the prevalence was more than 4%, ranging from 4.2 to 11.1% (**Table 1**). The prevalence in all northern European countries, except Iceland, increased by over 100% between 1980 and 2016, but in Iceland, it increased by 94% in the same period (5.1% in 1980 and 9.9% in 2016). In 2016, among the Western European countries, the United Kingdom (UK) and Germany had the highest childhood obesity. In contrast, Armenia, Azerbaijan, and the Republic of Moldova among Eastern European countries with relatively low prevalence levels (**Table 1**). The prevalence distribution in Oriental Europe countries showed relatively small when compared to the other areas in Europe in 2016. However, EU member states (Bulgaria, Czechia, Hungary, Lithuania, Poland, Slovakia) among Oriental countries had higher prevalence levels (**Table 1**).

2.2 Trends

Obesity in children aged 5–19 years in almost all European regions have increased rapidly from 1980 to 2016. Mainly EU member states have shown increasing trends in the prevalence of obesity in children and adolescents during the study period. Notably, Greece and Croatia have shown secular trends in the prevalence of childhood obesity among EU countries in the Mediterranean Region (**Figure 1**). Besides, the prevalence in the United Kingdom tripled for either sex from 1980 to 2016, ranging from 3.4 to 10.2%, respectively (**Table 1**). Similarly, in France and Spain, the prevalence almost tripled from 1980 to 2016: for example, in France, it ranged from 3% in 1980 to 8.1% in 2016 and in Spain, passing from 3.8% in 1980 to 10.8% in 2016 (**Table 1**). In Slovakia, the prevalence of obesity in children has increased from 0.6% in 1980 to 8.1% in 2016 (**Table 1**). On the other hand, in Cyprus, Lithuania, Portugal, and the Netherlands, the prevalence has increased more than five times over 36 years in each country (**Table 1**). In contrast, in Italy, Malta, and Belgium, the magnitude of childhood obesity has doubled from 1980 to 2016. As shown in **Table 1**, in Poland, the prevalence has increased from 1% in 1980 to 9.1% in 2016, while in Bulgaria, it grew by more than eight times in the same

	1980			1990			2000			2010			2016		
	M (%)	F (%)	T (%)	M (%)	F (%)	T (%)	M (%)	F (%)	T (%)	M (%)	F (%)	T (%)	M (%)	F (%)	T (%)
Mediterranean Region															
Turkey	0.7	0.8	0.7	2.3	2.5	2.4	5.2	5.3	5.2	9.3	8.7	9	12.1	10.9	11.5
Cyprus	3.7	1.8	2.7	8.5	4.2	6.4	11.9	6.1	9.1	14.1	7.6	10.9	15.5	8.7	12.2
Israel	7.5	5.9	6.7	9.8	7	8.4	11.8	8.1	10	13.4	9	11.3	14.2	9.5	11.9
Andorra	8.8	7	7.9	11.9	8.6	10.3	13.4	9.3	11.4	14.5	10	12.3	15	10.4	12.8
Malta	8.6	7.2	7.9	11.2	8.2	9.8	13.2	9.4	11.4	14.9	10.5	12.7	15.7	11.1	13.4
Portugal	2	1.7	1.9	4.4	3.5	3.9	7.9	6.4	7.2	10.4	9.2	9.8	10.7	10.2	10.4
Spain	4.7	2.8	3.8	7	3.8	5.4	9.3	5.1	7.3	11.8	7.2	9.5	13.1	8.4	10.8
Albania	0.4	0.2	0.3	1	0.6	0.8	2.6	1.5	2.1	6.1	3.6	4.9	9.5	5.5	7.6
Croatia	1.3	0.7	1	3.1	1.7	2.4	5.9	3.2	4.6	10.3	5.7	8.1	13.8	7.9	10.9
France	3.2	2.9	3	4.5	3.7	4.1	6.2	5	5.6	7.9	6.3	7.1	8.9	7.2	8.1
Greece	5.8	3.6	4.7	8.5	4.9	6.7	11.2	6.6	9	14.8	9.1	12	16.8	10.7	13.8
Italy	6.2	4.2	5.2	8.2	5.1	6.7	12.2	7.2	9.3	13.3	9.3	11.4	14.5	10.4	12.5
Montenegro	0.4	0.2	0.3	1.3	0.7	1	3.7	2	2.9	7.2	3.9	5.6	9.7	5.3	7.6
Northern Region															
Iceland	5.8	4.4	5.1	8.2	5.5	6.9	10.2	6.3	8.1	11.5	6.7	9.1	12.5	7.2	9.9
Ireland	1.4	1.5	1.5	3	3.1	3.1	5.3	5.6	5.4	8.5	8	8.3	10.4	9.1	9.8
Denmark	3.7	3.3	3.5	6	4.5	5.3	8.1	5.2	6.7	8.8	4.9	6.9	9.4	4.9	7.2
Estonia	1.7	1.7	1.7	2.6	2.3	2.5	3.6	2.8	3.2	5.6	3.7	4.7	7.8	4.7	6.3
Finland	3.4	1.5	2.5	6.7	3	4.9	9.3	4.2	6.8	11.1	4.9	8.1	12.4	5.6	9.1

	1980			1990			2000			2010			2016		
	M (%)	F (%)	T (%)	M (%)	F (%)	T (%)	M (%)	F (%)	T (%)	M (%)	F (%)	T (%)	M (%)	F (%)	T (%)
Netherlands	1.4	1.2	1.3	2.5	2	2.3	4.5	3.4	3.9	6.9	4.8	5.9	8.4	5.6	7
Norway	2.7	2.5	2.6	4.7	3.9	4.3	7.2	5.6	6.4	9.1	6.8	8	10.4	7.7	9.1
Sweden	3.3	2.5	2.9	4.7	2.9	3.9	6.5	3.6	5	7.4	4	5.7	8.6	4.7	6.7
Oriental Region															
Hungary	2	1.4	1.7	3.5	2.3	2.9	5.8	3.7	4.8	9.9	6.2	8.1	13.7	8.4	11.1
Kazakhstan	1.5	0.8	1.2	2.4	1.4	1.9	3.7	2.1	2.9	5.6	3.4	4.6	8.1	4.9	6.5
Lithuania	1.3	1.1	1.2	2.7	2.1	2.4	4.3	2.8	3.6	6.3	3.7	5	8.7	4.8	6.8
Armenia	1.3	1.2	1.3	2.2	1.9	2	2.8	2.3	2.6	3.8	3.2	3.5	5.3	4.2	4.8
Azerbaijan	0.9	0.7	0.8	1.5	1.2	1.3	2.2	1.8	2	3.5	2.9	3.2	5.3	4.4	4.9
Bosnia and Herzegovina	0.3	0.2	0.3	1	0.6	0.8	2.2	1.3	1.8	4.5	2.9	3.7	6.5	4.3	5.4
Bulgaria	1.6	1	1.3	3.4	2	2.7	5.9	3.5	4.7	10.1	5.8	8	13.6	7.8	10.8
Czech Republic	2.3	1.5	1.9	3.7	2.2	3	5.8	3.1	4.5	9.1	4.8	7	12.6	6.6	9.7
Poland	1.4	0.6	1	2.9	1.3	2.1	4.9	2.1	3.6	8.8	3.6	6.3	12.7	5.3	9.1
Republic of Macedonia	1.3	0.7	1	2.8	1.4	2.1	5.3	2.7	4	8.7	4.5	6.7	11.9	6.4	9.3
Republic of Moldova	0.4	0.3	0.4	1.1	0.8	1	2	1.4	1.7	3.2	2.1	2.7	5.1	3.3	4.2
Romania	0.8	0.4	0.6	1.7	1	1.4	3.6	1.9	2.8	7.1	3.7	5.4	10.7	5.4	8.1
Russian Federation	1.7	1.4	1.5	3.1	2.2	2.6	4.1	2.4	3.2	6.6	3.3	5	9.5	4.4	7.1

	1980			1990			2000			2010			2016		
	M (%)	F (%)	T (%)	M (%)	F (%)	T (%)	M (%)	F (%)	T (%)	M (%)	F (%)	T (%)	M (%)	F (%)	T (%)
Serbia	1	0.5	0.8	2.5	1.2	1.9	5.1	2.5	3.8	9.2	4.9	7.1	12.4	7	9.8
Slovakia	0.8	0.4	0.6	1.8	1	1.4	3.5	1.9	2.7	6.8	3.7	5.3	10.4	5.7	8.1
Occidental Region															
Switzerland	1.1	0.9	1	3.1	2.1	2.6	5	3.1	4.1	6	3.8	5	6.9	4.6	5.8
United Kingdom	3	3.8	3.4	5.2	6	5.6	8.3	8.6	8.5	10.3	9.6	9.9	10.9	9.4	10.2
Luxembourg	3.6	2.7	3.2	5.7	3.8	4.8	7.8	4.9	6.4	9.5	5.7	7.6	10.4	6.2	8.3
Belgium	4.5	4.6	4.6	6.3	5.2	5.8	7.5	5.6	6.6	7.8	5.5	6.7	8.2	5.8	7
Austria	3.5	1.8	2.6	5.6	2.6	4.1	7.9	3.6	5.8	9.8	4.8	7.4	11.2	6	8.6
Germany	3.8	2.7	3.3	5.9	3.7	4.9	8	4.8	6.4	9.7	5.8	7.8	11	6.8	8.9

Data source: Global Health Observatory (GHO) data [17]; M, male; F, female; and T, total.

Table 1.
Prevalence (%) of obesity in children aged 5–19 years by the WHO European region from 1980 to 2016.

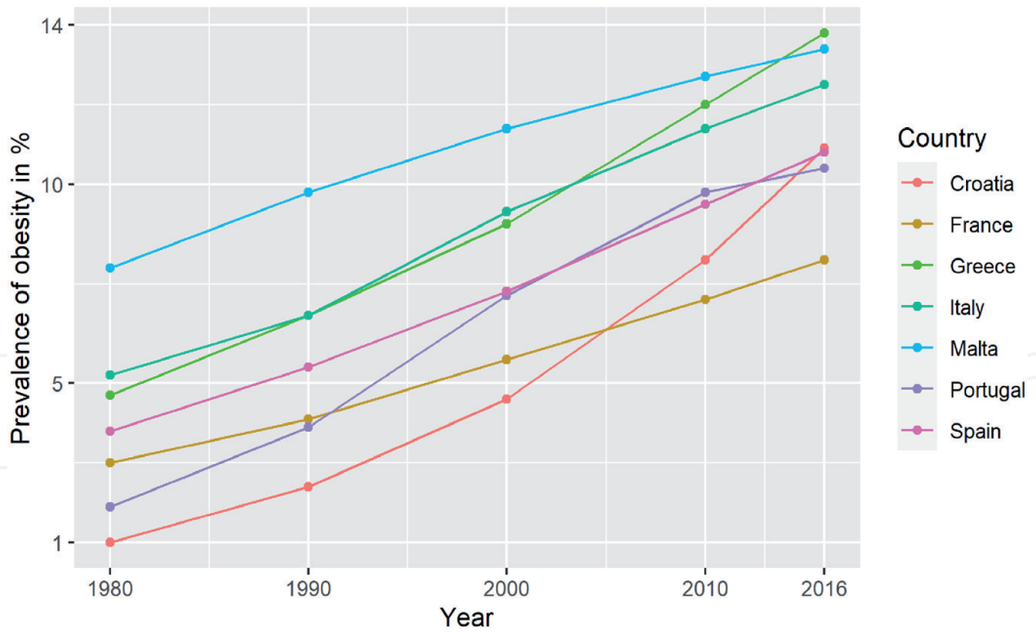


Figure 1.
Trends in the prevalence of obesity in children and adolescents aged between 5 and 19 years in the Mediterranean region EU countries from 1980 to 2016.

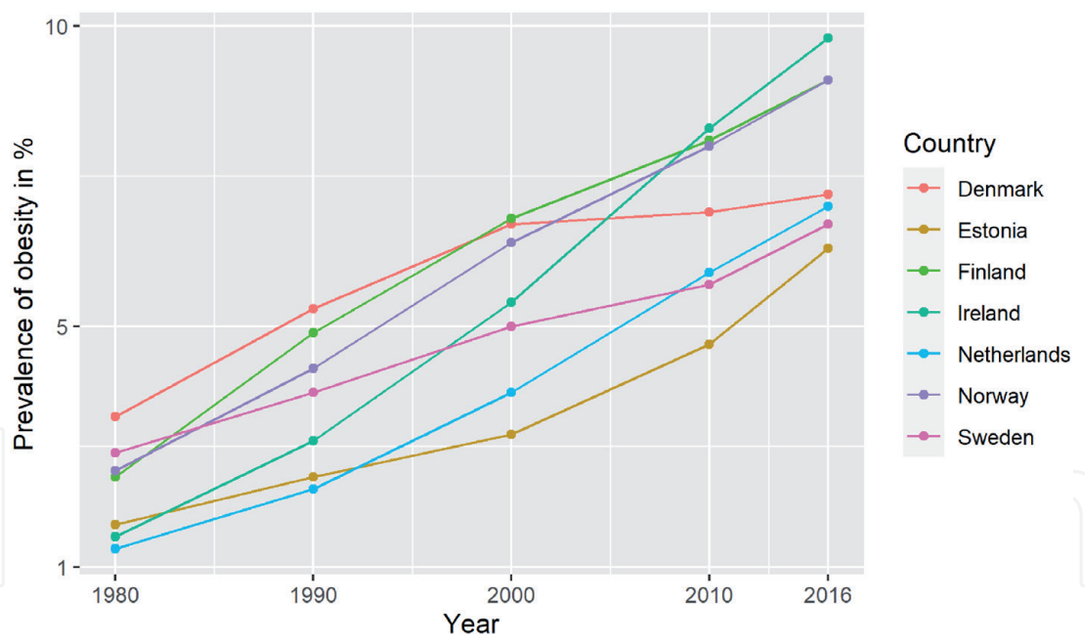


Figure 2.
Trends in the prevalence of obesity in children and adolescents aged between 5 and 19 years in the northern EU countries from 1980 to 2016.

period (1.3% in 1980 and 10.8% in 2016). In Ireland, the prevalence of obesity in children and adolescents has steadily increased over 36 years (1.5% in 1980 and 9.8% in 2016) (**Figure 2**). Mainly the prevalence level increased from 1.5 and 1.4%, respectively, for girls and boys in 1980 to 9.1 and 10.4% for girls and boys in 2016 (**Table 1**). Furthermore, the Oriental EU member states except for Lithuania all have shown consistently increased trends in the prevalence over 16 years (from 2000 to 2016) (**Figure 3**). Trends in the prevalence of obesity in children and adolescents aged 5–19 years have been presented in EU countries by geographic areas (**Figures 1–4**).

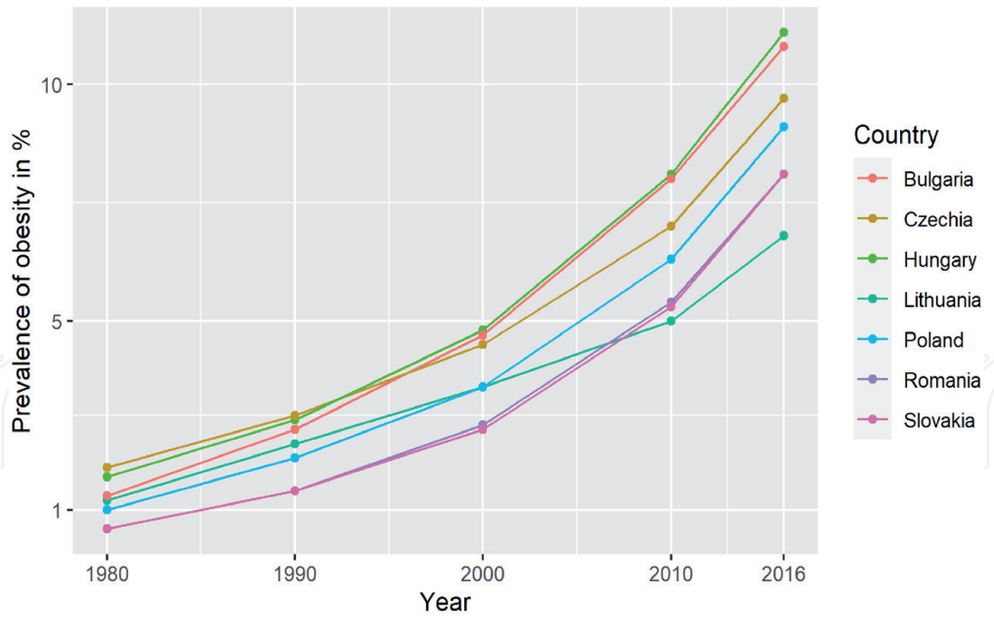


Figure 3.
Trends in the prevalence of obesity in children and adolescents aged between 5 and 19 years in the oriental EU countries from 1980 to 2016.

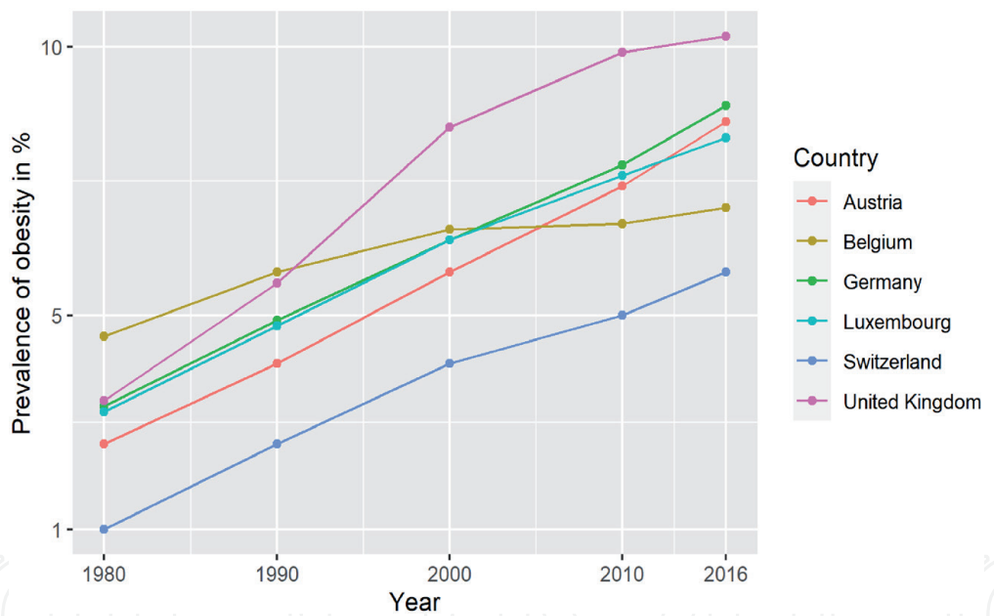


Figure 4.
Trends in the prevalence of obesity in children and adolescents aged between 5 and 19 years in the occidental EU countries from 1980 to 2016.

3. Policies

The alarming proportions reached by childhood obesity in many countries pose an urgent and serious challenge, also concerning the most serious consequences of obesity on health. Obesity can produce effects immediately on a child's health, educational performance, and quality of life, or chronic illnesses in adults, which are very likely to remain obese. The policy to tack childhood obesity is slow and inconsistent and then to review and resolve this gap, in 2014, the Commission on Ending Childhood obesity has been established. Moreover, the "Strengthening Nutrition Action of Food and Agriculture Organization of the United Nations and World Health Organization-United Nations decade of Action on Nutrition 2016-2025,"

describes that in the same year (2014). The Second International Conference on Nutrition (ICN2) listed obesity and overweight among the malnutrition forms. It focused the attention of 164 member States of FAO and WHO, about the need to change the choices of the food systems for better diets and a healthier planet. The unhealthy diets, maternal and child malnutrition, are considered as the current top risk factors for one-quarter of global deaths.

Furthermore, the number of people of all ages who are affected by diet-related noncommunicable diseases (NCDs) has increased. The documents produced by ICN2 make up the roadmap for the governments of the world to eradicate hunger and prevent all forms of malnutrition such as undernutrition, micronutrient deficiency, overweight, and obesity. One year later, has been adopted the 2030 Agenda for Sustainable Development ("2023 Agenda") and its Sustainable Development Goals (SDGs) at the United Nations (UN) General Assembly. In 2015, the United Nations mentioned the prevention and control of noncommunicable diseases as a top priority in the Sustainable Development Goals, and obesity listed as a risk factor for noncommunicable diseases [18]. The Global Action Plan for the Prevention and Control of Non-communicable Diseases 2013–2020 assess policy options for member states per their legislation for the selection and for undertaking actions from among the policy options about the monitoring, the disease registries, and the surveillance of NCDs.

Regarding the surveillance, the WHO indicates the surveillance of the key risk for the NCDs considering behavioral and metabolic risk factors as for example the use of alcohol, the physical inactivity, tobacco use, unhealthy diet, overweight, and obesity, raised blood pressure, raised blood glucose, and hyperlipidemia, and determinants of risk exposure such as marketing of food, tobacco, and alcohol [19]. Moreover, to accelerate the actions on nutrition, the UN General Assembly, in 2016, proposed that the period from 2016 to 2020 should be a UN Decade of Action on Nutrition (Nutrition Decade), providing a clearly defined, time-bound, and cohesive framework for all countries and stakeholders to increase nutrition investments and implement policies and programs to improve food security and nutrition, reach the six global nutrition targets 2025, and the diet-related global noncommunicable disease (NCD) targets. Modifying possible risk factors as the reduction of an unhealthy diet is one of the "best buys" for the prevention and control of noncommunicable diseases (NCDs) proposed by the World Health Organization [20].

All reports proposed by the international organization of public health proposed a no single intervention to resolve childhood obesity and overweight but analyses and interventions about the environmental context and three critical periods in the life-course. The first is the preconception and pregnancy, infancy and early childhood, and finally, older childhood and adolescence. Therefore, the prevention and the treatment of obesity require a whole-of-government approach in which the policies of all sectors are across the same target, which the health, the eradication of harmful health impacts, and thus improve population health and health equity. The Commission on Ending Childhood Obesity collected and an organic package of recommendations to address childhood obesity and achieve strategic objectives. As a result, the first object is tacking the obesogenic environment because the major negative elements are the unhealthy diet and physical activity of children. The second goal is the reduction of the risk to develop the obesity development factors able to change the biology and behavior of children before birth and through infancy. The last is the treatment and cure of children or young people with notified obesity. Consequently, the areas identified by the commission to define the preventive actions are the promotion of healthy foods intake, physical activity, the cure preconception, and pregnancy care, the early childhood diet, and physical activity, the health, nutrition, and physical activity for school-age children and finally the weight management. The first recommendation concerns the promotion of healthy food intake

and the reduction of sugar-sweetened beverages by children and adolescents. Among the actions promoted are listed the development and diffusion of appropriate and context-specific nutrition guidelines for adults and children, the implementation of a tax on sugar-sweetened beverages, and the marketing of foods and nonalcoholic beverages to children. Besides, the description of the nutrient-profiles to identify unhealthy foods and beverages associated with a standardized global nutrient labeling system. The Codex Alimentarius Commission proposes a standardized system of food labeling for all packaged foods and beverages, which can support the nutrition and health education [21]. In association with the correct labeling system could be improved, also, the public education of both adults and children about nutrition literacy and the interpretation of front-of-pack. This recommendation is included in the recommendation 14 of United Nations decade of Action on Nutrition 2016–2025, concerning saturated fat, sugars, salt, and trans-fat reduction has been focused on the promotion of a healthy diet to stop the consumption and sale of highly processed foods, growing fastest in lower-middle-income countries. The actions to prevent and control NCDs include the reduction of salt intake, and the setting of target levels for the amount of salt, reformulating food products. Furthermore, the action plan has been indicated the elimination of industrial trans-fats and the reduction of sugar consumption through taxation on sugar-sweetened beverages. The availability, and consequently, the high consumption of these products, is the principal cause of health problems such as obesity and other diet related NCDs. The reduction of sedentary behaviors in children and adolescents, focusing on physical activity programs, is the second recommendation and includes the definition of advice to children, adolescents, parents, caregivers, teachers, and health professionals on healthy body size, physical activity, sleep behaviors and appropriate use of screen-based entertainment. The same recommendation promotes the improvement, during the recreational time, for all children (including the children with disabilities), of physical activity favoring adequate facilities at school or in public areas. Recent epidemiologic data show a decline from the age of school about physical activity. About 81% of adolescents have insufficient physical activity lower than 60 minutes each day. Obesity is more linked with physical activity because it creates a vicious cycle, which increases body fat levels and decreases physical activity. The recommendation about the prevention of childhood overweight and obesity regarding all guidelines promoted introduces the protection of the diet in women during pregnancy, the improvement of child nutrition status and growth, and finally, the promotion of physical activity to address sedentary lifestyle from the early stages of life. The best keys to these recommendations are breastfeeding promotion and protection because they have a crucial role in the reduction of childhood obesity risk. Indeed, the diagnosis and management of hyperglycemia and gestational hypertension, the monitoring of gestational weight gain, the correct diet, and lifestyles during pregnancy are key preventive factors against childhood overweight and obesity. To ensure healthy child development, policies should provide advice not only on healthy eating but also on appropriate sleep time, sedentary or screen time, physical activity, or active play for the age group of 2–5 years. The school is also a fundamental environment to promote the correct lifestyles, especially about the diet. Two aspects can be improved at school, the promotion of standardized meals, in accordance with guidelines, without unhealthy foods with sugar, sweetened beverages or energy-dense, nutrient-poor foods etc. but characterized by the introduction of fresh fruits, vegetables, and safe drinking water. The secondary aspect is the improvement of knowledge's on children about health education within the core curriculum of schools and practical experiences of food preparation available to children, their parents, and caregivers.

Finally, the six recommendations of the commission are the correct weight management in children and young people suffering from obesity and overweight,

developing multicomponent services concerning physical activity, nutrition, and psychological support. These supports are delivered by professional and treated teams, as part of Universal health coverage. The responsibilities of these actions are divided by different structures at different levels. The first is the WHO and concerns the institutionalization of each measure across all technical areas of WHO, and regional and country offices. Furthermore, it provides the consultation and technical support for action at global, regional, and national levels, with international agencies, and the governments of each Member States. Each Member States are supported by International organizations, and define political commitment against childhood obesity, coordinate all sectors and institutions engaged for policies about nutrition, food, agriculture, sport and recreation, urban planning etc. Collect and record all data on BMI-for-age of children and define the national targets for childhood obesity. The other structures are represented by nongovernmental organizations (NGOs), the private sector, the philanthropic foundations, and academic institutions [22].

In Europe, the EU Action Plan on Childhood Obesity 2014–2020 translates the international guidelines with the purpose of demonstrating the shared of EU Member States to addressing childhood obesity; set out priority areas for action and a possible toolbox of measures for consideration and finally propose ways of collectively keeping track of progress. The EU Action Plan considers the presence of three types of stakeholders which are: the 28 EU Member States, the European Commission, and international organizations such as the WHO and finally civil society (e.g., nongovernmental organizations (NGOs), industry, research institutes, and associations). The national, regional, and local level was represented by the specific authorities. Each area defined in the EU action plan is in agreement with the areas proposed by the Global Action Plan, and to evaluate the efficacy of the intervention for each region were defined as specific indicators. Regarding the area for action 1: Support a healthy start in life the first operational objective is, for example, increase the prevalence of children that are breastfed, the indicator is the % of children breastfed and the final target the achievement of 20% in 2020 of children with adequate periods of exclusive breastfeeding according to national recommendations. The area of action 2 is about the promotion of healthier environments, especially at schools and preschools, and the main priority is the establishment of children's health as a priority at schools, and for example, the first operational objective is to "provide the healthy option and increase daily consumption of fresh fruit and vegetables, healthy food and water intake in schools (with a targeted focus on schools in underprivileged districts)." The action is the development of preschool and school meals with fruits, vegetables, and drinking milk following the existing EU guidelines. The indicators are, for example, the number of member states implementing frameworks on preschool and school meals, and the target to achieve in 2020 is 90% of the member states participating in the program. The other areas are the improvement of healthy options regarding the availability of healthy food choices to children and the target of restriction related to vending machines. Area number 4 has the goal to limit the exposure of children to advertisements for food/drinks high in fat, sugars, and salt. The improvement of family knowledge and information's on the daily food and health choices of children of action number 5. The last two areas of action are number 6 to encourage physical activity, and number 7 is related to the monitoring and evaluation of children's nutritional status and behaviors. At this moment, the assessment of the effectiveness of the Action Plan that can be analyzed is referred to in 2018, because the final assessment will be defined at the end of 2020. The initial results compare the activities improved before 2014 with the activities promoted with the EU Action Plan in each action area [23]. The results show an improvement of actions relatively the guidance around the pregnancy, the policies on vending machines, energy drinks, and reformulation of food and especially the concentration of salt.

4. Prevention strategies adopted by European states

Despite the important engagement of the European countries in reversing the progress of obesity, the incidence of overweight subjects remains alarming, particularly if considering the young population. Childhood weight gain has, in fact, a severe impact on health and psychosocial outcomes, deeply affecting individual and family's quality of life. Research shows that overweight children are more likely if compared to normal weight ones, to become obese adults and so to develop chronic conditions. The recent increment of hours dedicated to "screen time" and the associated damaging effects on eating habits, together with little safe spaces to be active in, are essential factors influencing the level of physical activity and health among young. Also, cheaper and larger-portioned fast food, as well as the massive consumption of high-sugar products, must be taken into consideration. In 2014, in EU, the 7% of yearly national health budgets were spent on diseases correlated to obesity, and investigations showed how policies addressed to children obesity control would repay on investment of 6–10%.

For these reasons, in 2007, after analyzing the report by the WHO European Childhood Obesity Surveillance Initiative (COSI), the European Commission adopted the White Paper on a Strategy for Europe on Nutrition, Overweight and Obesity-related Health issues, composed of six major goals: better-informed subjects, physical activity, and healthier options promotion, supporting low socioeconomic groups and developing evidence and monitoring systems to support the program. The High-Level Group on Nutrition and Physical Activity and the EU Platform for Action on Diet, Physical Activity, and Health are the main instruments set up for implementation of the strategy. The first one enables governments to share health and economic analysis and enhances contact between governments and the EU platform for action on a diet, physical activity, and health. It also works on some priorities such as reducing children's exposure to marketing of foods high in fat, salt and sugars, physical activity, labeling, and public procurement of food, reducing health inequalities. The EU Platform is a forum for European level organizations, including Food business and consumer organizations, scientific associations, and NGOs. The high-level group can also be asked by the commission to prepare the groundwork for relevant prevention and promotion initiatives agreed by the steering group on promotion and prevention.

In 2013 the strategy went through an external evaluation to test its efficiency: the results were positive. However, they suggested a greater commitment to promoting physical activity. Besides, an Action Plan on Childhood Obesity addressed to a Europe-wide context was redacted, to lower young overweight by 2020. One of its main goals is to support a healthy start in life, encouraging breastfeeding and promoting the adoption of a healthy lifestyle both during the early stage of life and preconception period. Developing healthier school environments is the sequel, providing wholesome meals, with the proper nutritional intake, and also allowing adequate time to consume it. Making the healthy option more available in addition, both in schools and in the working environment, would encourage good eating behavior to be part of the routine. The fourth point is about making families informed in order to empower parents in planning a correct meal plan and schedule regular active leisure activities, which is also linked to the significant focus on the promotion of the physical activity. Last, the increase in monitoring and research, would, in the end, test the nutritional quality of food, health status, and habits of children, together with the collection of systematic data.

The main actors of the plan are 28 EU Member States, the European Commission, and a variety of civil society stakeholders such as NGOs, industry and agricultural sectors, University and research institutes. Another project, the Joint Action on Nutrition and Physical Activity (JANPA), was proposed as a contribution to the EU action plan on childhood obesity 2014–2020, focusing on specific

outcomes that can effectively contribute to nutritional and physical activity policies during childhood. It has the following objectives: economic evaluation of the cost of overweight and obesity in children with the aim to encourage public actions, promoting healthy nutrition and physical activity to pregnant women and families with young children, promoting healthier environments in schools and preschools, efforts at a local or at a national level regarding nutrition and physical activities, promoting healthy eating and drinking practices, and improving the information addressed to the consumer at the national level [13]. At the national level, many policies and programs have been adopted in recent years in Europe, aiming to prevent child obesity and improve its treatment and management.

4.1 Italy

Data from the Childhood Obesity Surveillance Initiative (2015–17) show that Italy is ranked first in Europe for child obesity, with 21% of children obese or overweight: taking into account this evidence, Italy has turned its attention not only to monitoring, but also to the population approach, using media, brochures, and education in schools and health-care facilities. These actions are part of the Italian Health Plan on Prevention. One of the objectives of this program is to reduce the preventable and avoidable burden of morbidity, mortality, and disability of noncommunicable diseases. Another initiative adopted in Italy is the program named "OKKIO all Salute," launched in 2007 as a part of the COSI initiative, to monitor children's weight, eating behaviors, physical activity habits, and their related risk factors among children of 6–10 years. From 2008, around 45.000 families took part in this project. Italy is also part of the international program HBSC (Health Behavior in School-aged Children), showing commitment to understanding factors influencing children's eating behaviors [24].

4.2 Malta

The increasing prevalence of overweight and obesity, especially among children, is a significant public health problem in Malta, as it has been estimated that 40% of school-aged children are overweight or obese. Different actions have been put in place to tackle this problem since the Maltese Presidency of the Council of the EU selected childhood obesity as one of its priority areas during its European Presidency in the first half of 2017. Considering the fact that children spend much time in school, particular attention was put to the school environment. In 2016, the government of Malta enacted the "Healthy Lifestyle Promotion and Care of Non-Communicable Diseases Act," which aimed to promote physical activity and balanced diets to achieve healthy lifestyles and reduce the noncommunicable diseases in all age groups. An intersectoral Advisory Council was set up, and one of its major initiatives was outlining a legislative tool for schools: there was a clear need for improving the school environment to help the whole school community to adopt healthier dietary patterns and lifestyle. The consumption of healthy foods and restrictions on products high in salt, sugar, and fats were encouraged, following nutritional criteria based on the WHO nutrient profiling model and carrying random inspections by specifically trained health practitioners.

In August 2018, the Maltese government issued subsidiary legislation to regulate the food being sold and provided by schools, implement programs for healthy eating, ban advertising or sponsorship of unhealthy foods, and ensure the provision of drinking water in schools. One of the divergences identified across EU states was in planning food procurement tenders for schools that promoted healthy eating and to allow their smooth implementation. It has been important to set clear specifications, with support from the Joint Research Centre and experts [24].

4.3 Poland

In Poland, a 2016 Regulation by the Minister of Health addressed groups of food intended for sale to children and adolescents in the education system. Besides, the School Program Strategy 2017/18–2022/23 has, as one of its goals, the promotion of a healthy, balanced diet among children and parents. In particular, it aims to change the eating habits of children by increasing the share of fruit and vegetables and the intake of milk. In Poland, the food industry is one of the most influential lobby groups, with well-organized representation and significant financial resources. Poland is also one of the participating countries in the Choices Program, an initiative introduced in the Netherlands in 2006 in response to WHO's call for the food industry to take an active voluntary role in tackling obesity. To reduce the consumption of salt, there has been an important consumer awareness initiative through media, schools, and health-care facilities, as well as 16% of salt reduction in bread by 2012. Concerning physical activity, it is mandatory in primary and secondary schools, and it is included in general teaching training [25].

4.4 United Kingdom (UK)

In some countries, reducing childhood obesity is a task shared by the Ministry of Health with the Ministry of Finance (responsible for taxes on food high in saturated fat and sugary soft drinks), the Ministry of Education (for school curricula, healthy nutrition education, and physical activity), and the Ministry of Agriculture and Food Industry (for free school fruit and vegetable schemes and sustainable healthy food supplies) [24]. This is the case of England, opposed to the approach of the Republic of Moldova, where a lack of multisectoral collaboration has been found. The UK Childhood Obesity Plan introduces for the first time a soft drink industry levy and the revenue will be invested in programs to reduce obesity and encourage physical activity, in addition to substantial restrictions for sailing and promoting high sugars and fat drinks or snacks, after the introduction of a tax on sugary drinks was announced in March 2016 and came into force in April 2018.

In some countries, television (TV), radio, and Internet services are regulated with some set standards for advertising to protect children from the overconsumption of unhealthy foods, and this is the case of England, where, the National Office of Communications since 2006, does not allow TV advertisements for such foods to be shown during or close to children TV programs. They also launched a sugar reduction program intending to remove sugar from the food's children frequently eat, paying attention that it is followed by a calorie restriction and not by compensation with extra fats. Also, supporting agricultural innovation by bringing together food business and researchers is part of the project. Support is also given to disadvantaged families, with the distribution of 60 million worth of vouchers that can be exchanged for fresh fruit and vegetables or vitamins. Of course, also physical activity is considered, and it is included in each day at school for at least 30 minutes. It should also be taken into consideration the GREAT commitment of the UK Government in enabling health professionals to support families' diet, as well as training them to face eating behaviors changes and promoting wellbeing [26].

4.5 Moldova

Concerning Moldova, concrete actions to face childhood obesity were only undertaken in 2012. The National Health Policy (2007–2021) was the first policy document that addressed obesity as a priority, involving the society and

government, but it was in 2014 when the Moldovan government endorsed the first National Food and Nutrition Program for 2014–2020 and the Action Plan for 2014–2016, with the specific objective to halt the rise of obesity prevalence among children and adults. The 31 July 2007, the Ministry of Health Decision forbids the marketing of energy-dense food with high-fat content and reduced nutritional value in institutions for children. In 2009, new laws prohibited marketing pressure on children to consume healthy drinks. After the Food Law was amended, selling and distribution of unhealthy food within 100 m by schools were banned. The Republic of Moldova became part of COSI from 2013 and participated in the third and fourth rounds of this initiative. Further in 2014, the government adopted the first National Food and Nutrition Programmed for 2014–2020 (NFNP) and its Action Plan with the aim of zero increase in obesity prevalence, employing compulsory nutritional labeling, limitations on advertising, together with the elimination of trans-fats and reduction of sugar and salt [24].

4.6 France

EPODE, or Ensemble, Prévenons L'Obésité Des Enfants (Together, Let us Prevent Childhood Obesity) was established in January 2004, based on the guidelines from the National Health Program recommendations. This program was developed based on the effectiveness observed from the Fleurbaix-Laventie Ville Santé Study, which started in 1992 and continuing, which showed a decrease in childhood obesity rate after the nutritional and physical activity initiatives were implemented in the two towns. The project is supported by the French Ministry of Health, in collaboration with more than five other Ministry, the French National Academy of Medicine, together with some partners like Nestle and Ferrero, financing half of the costs of the program. EPODE now extends to nearly 1.8 million inhabitants in 167 French cities, 20 cities in Spain, and eight cities in Belgium. The project aims to reduce BMI in overweight or obese children promoting physical activity and a healthy diet through three major steps: (1) informing community and families about the obesity problem, using meetings and brochures; (2) Training participants (teachers and professionals); (3) starting the action in schools, distributing educational materials, improving school catering, and hosting food workshop [27].

4.7 Germany

Understanding the importance of obesity as a health issue, and recognizing the worrying increase of overweight adolescences, a range of federal policies were established in Germany to face the issue since, public health services in Germany have played a great role in putting obesity on the political agenda, and they focused on dealing with obesity from child and adolescent health services perspective. The Robert Koch Institute has launched the German Health Interview and Examination Survey for Children and Adolescents (KiGGS-Study), with a baseline study in 2003–2006 and a follow-up study in 2014–2017. The results of the second study were published in March 2018. They pointed to a strong social gradient, with the prevalence of overweight reaching 27.0% and 24.2% in girls and boys respectively, aged 3–17 years with low socioeconomic status compared to 6.5% in girls and 8.9% in boys with high socioeconomic status.

Some of the other vital initiatives in response to the Survey are the National Cycling Plan 2020, which promotes cycling, walking, and the use of public transport and the two programs of the Federal Centre for Health Education (FCHE): Gut Drauf (Feeling Well), which aims to improve the health of children and adolescents

aged 12–18 years, and Tutmirgut (Good For Me), aimed at children aged 5-11 years. In 2007, there were 708 programs for overweight or obese children and adolescents in Germany, reaching approximately 44,000 persons [24]. In Germany, policies are implementing a salt reduction in bread and many consumer awareness initiatives regarding a healthy lifestyle, promoted in schools, and via media and Internet [28].

4.8 Denmark

The Danish National Action Plan against Obesity was written to improve awareness in the Danish population and generally reduce high BMI. Children and adolescents are one of their main targets. Concerning nutrition, the aim concerning children's diet is to reduce the number of subjects who consume more energy from fat and sugar and, at the same time, pay attention to the correct fiber intake. Also, life outside the home was provided with healthy food, and parents were supported in taking proper diet choices. Of course, also physical activity is considered, and new guidelines were established, increasing the hours to it dedicated to schools and strengthening the competences of teachers. Suitable playground and outdoor areas were provided, as well as car-free areas near schools and safe foot and cycle paths [29].

5. Conclusion

Handling childhood obesity is undoubtedly challenging despite the substantial progress made concerning healthy nutrition, early life, and increased physical activity. It has also been essential to restrict advertising on TV actively. Still, it should also be taken into consideration to control video games, mobile phones, tablets, and social media since, nowadays, there is no more efficient way to address kids than getting in touch with them through the Internet. Monitoring childhood obesity is, for sure, more rewarding if compared to adults but, initially, for the complexity of relating to young subjects, it can be very onerous.

Consequently and taking into account the role played by multinational food industries in supporting French policies should be considered to further involve in obesity control plans, food, and sports industries. Doing so will make it possible to boost the research resources and, at the same time, allow the markets' sectors, that would possibly be affected by the latest policies and guidelines, to adapt their selling to the new consumer type. It should also be mentioned that some European countries are still not facing the childhood obesity problem, primarily due to inadequate resources and a lack of interface between the health institutions and industries.

In Malta, for example, the requirement of precise definitions for food procurement that tenders on how to set a healthy meal plan in schools was given by the Advisory Council with the support from the EU Joint Research Centre, a proper example of a strategy controlling balance and micronutrient intake of at least one meal per day of all school kids. This strategy, together with the Healthy Weight for Life strategy for 2012–2020 and the Food and Nutrition Policy and Action Plan for Malta 2015–2020, makes Malta one of the most committed European countries in the battle against childhood obesity. The Maltese case is one of the first to be taken into consideration when evaluating the situation.

Conflict of interest

The authors declare no conflict of interest.

DOI: http://dx.doi.org/10.5772/intechopen.93604

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