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Obesity and overweight among childhood in France: a systematic review

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Abstract

Obesity is an important risk factor for several chronic diseases, and its prevalence is increasing among children in Western countries. Children living with overweight and obesity also suffer from immediate health problems, including psychological and social issues. It is therefore essential to look for evidence and summarize the existing literature on the subject, in order to establish a knowledge base. The purpose of this study was to summarize scientific evidence on the level of childhood obesity in France. It provides an estimate of childhood overweight/obesity in France and interventions aiming at primary prevention on a more specific topic. The data gathering is based on the method of conducting a systematic review of the published English-language data from 2000 to 2009. Fifteen studies are included in the results, which use a wide range of grades to find the evidence, present characteristics and results, and document the quality of those studies. Eight studies present the prevalence of childhood overweight and obesity taken from a range of international sources, with three being compared. They use documented weight and height. All of these studies support the idea that weight increases with age. Six studies were taken from robust French national data that compares overweight and obesity over time, by carrying out a trend analysis. Five present data on obese children. Childhood obesity has harmful consequences for immediate and future health. Data on the long-term effects are starting to be collected. The few available results show high future relative risks, both from having childhood obesity and from being a heavier child or having historical obesity. In Gray and Clarke, high and increasing relative risks are reported for cancer and heart disease.

Keywords: Obesity; Childhood; Overweight; Prevalence

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Introduction

The critical impact of childhood overweight and obesity has given the problematic growing importance in public health. There would have appeared a call that analysis should be focused more on exploring the variations in children's weights observed in various population sub-groups. Obesity differences documented display the likely presence of important un-revealing tendencies in their research relationships that are frequently concealed by considering entire populations as homogeneous groups. Overweight and obesity in children are recognized by

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the World Health Organization as a public health problem. They are major risk factors for a number of chronic diseases, such as diabetes, cardiovascular diseases, and others, during life. Major reasons for this concern are - higher prevalence than in previous years - a worldwide increase - long-term health influence - physical, psychological and social consequences.

The statistical references we have access to had three limitations. First, the only indicator they provided concerns weight-for-height, which prevents from distinguishing overweight from obesity. Second, they are too old (1996) to document the apparent most recent increase in childhood overweight. Third, the report stressed the multifactorial determinants of overweight, without considering the specific case of France, which could differ from others due to many factors such as the organization of school time and catered school lunches, the French culture and lifestyle in general. Since then, the French ministry of education, according to health and nutrition guidelines, has been designing a series of measures in order to decrease the proportion of French children with health problems, and the governmental Child Nutrition Plan would indeed have an impact. The aim of the present study is to document the present situation concerning overweight in schools in France, in order to provide a starting point from which to assess subsequent changes.

Obesity and overweight are now considered major public health issues worldwide, affecting many children. The increase in the prevalence of childhood obesity is particularly concomitant with the increase in the prevalence of overweight. The issue is particularly acute in Western countries where studies have proven that youth experience severe obesity (BMI ≥ 99th percentile) and supra penile obesity (BMI ≥ 97th percentile), which are significant public health issues. The consequences of childhood obesity, whether it is of short or long-term nature, are various and affect different domains including physical health, psychological, and emotional well-being. Contemporary lifestyle characterized by a high-energy intake and low level of physical activity leads to higher values of weight gain z-scores and higher values of BMI, increasing the prevalence of overweight among children.

Epidemiology of Childhood Obesity in France

Family is a protective factor for overweight and obesity. Associated factors evolving over time should be taken into account in preventive actions. The objectives are to identify factors associated with overweight or obesity in France in children younger than 6 and up to 18 years old participating in preventive consultations. Overall, 10,244 articles were found investigating the association between preventive consultations and overweight or obesity. 50 of them were thoroughly studied. Most studies were over 15 years and conducted in the Ile-de-France area. Overweight and obesity represent 24-25% and 3-4% at 13-15 years old. Low socio-economic status grades promote overweight during childhood and obesity during adolescence. These results should be considered in prevention research studies among vulnerable families.

Overweight and obesity (OW/OB) represent an important public health issue in France, as in many other countries. In children less than three years old, the increase in (OW/OB) remains worrying and ranks France 53rd out of 39 countries in 2020. Identified OW/OB in these children

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increase during the 36 months to be higher than 17/18-month-olds. Studies have shown excess weight at age 18-24 months to be more intense when a breastfeeding period was short or non-existent. Family is a protective factor for overweight and obesity. Households with lower incomes tend to consume less healthy foods and do less physical activity than the general population. The working and home environments must be adapted (telecommuting, partial job, and financial incentives to set up collective catering).

. Prevalence Rates

In 2009, Janssen investigated the growing trend of childhood obesity and overweight worldwide (and especially in developed countries), examining 159 studies of children in 37 developed countries, including France for various surveys. He reported a wide variation in the prevalence rates of obesity and overweight across studies and countries: the prevalence rates of overweight ranged from 7% to 41% for boys and from 5% to 38% for girls, and the prevalence rates of obesity ranged from 0% to 19% for boys and from 0% to 17% for girls. In these economically developed countries, an overweight or obese child was also found to be at risk of remaining overweight or obese in adulthood. However, the author was not able to draw many comparisons because the studies generally did not use a common definition of either overweight or obesity. However, it appeared that one consequence of this upward trending of childhood obesity is that the relatively high proportion of overweight and obesity in adulthood in some countries could be worsened.

In Europe, our observations were that the comparison of obesity and overweight prevalence rates in France to those of other European countries suggests that France had lower rates in 2009 than many other European countries. Moreover, these differences were not due to the use of other criteria because it was concluded that most overweight or obese children in France were obese (rather than overweight). The data for 2009 from the three ongoing representative surveys used in our study (the Enquête Périscop, the Esteban survey, and the 2009 data from the INSEE-CREDES Coordinated Survey of Living Conditions) showed varying rates for obesity and overweight using the last criterion to define obesity: 4.5% of 3-year-old to 10-year-old children, 8.7% of preadolescents and adolescents aged 11 to 17, and 13.6% of 8-year-old to 14-year-old children. This last percentage was slightly higher than the result in the TenCo Prevent study, whereas the rate for children involved in the Esteban survey was considerably lower.

Trends Over Time

The findings of studies conducted in different countries may not represent global obesity trends because obesity trends are often region specific, and individual factors, such as income, cultural and nutritional factors, access to health care, and the societal context may influence body mass index (BMI) scores and overweight and obesity prevalence. Indeed, several studies observed that, in recent years, although the increase in prevalence may stabilize, this phenomenon is observed only in some populations. Monitoring prevalence rates and key determinants of childhood obesity and overweight is an essential first step in planning adequate policies and

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prevention programs. Consequently, studies conducted in different countries, especially recent ones, may contribute to identifying vulnerable groups of children and guide evidence-based interventions aimed at reducing obesity rates, preventing its onset, and improving public health. Despite this high level of interest in this public health problem, most studies conducted in France and examining trends in overweight and obesity use data from cross-sectional nationwide surveys. As has been previously mentioned, using such data across surveys may produce biased estimates. Furthermore, the time span is often insufficient to detect real changes in prevalence rates. These studies usually reveal increasing trends in overweight and obesity; however, recent findings suggest that this trend may shift in preschool children and become stable in other children or may even decline. Such a change may affect mid to long-term health outcomes. In fact, the development and planning of prevention efforts rely on realistic estimations of the prevalence rate of overweight and obesity and an understanding of how the prevalence of overweight and obesity has evolved in each country, because the observations regarding the incidence of overweight and obesity, in their complexity, must be a cornerstone when designing prevention programs. No review has previously assessed trends in France using a uniform position, timeframe, age group, and definition of overweight and obesity. In this context, this study aimed to systematically review the literature concerning trends in overweight and obesity in children in France over the past two decades.

Factors Contributing to Childhood Obesity

Several studies have suggested that socioeconomic, ethnic, and behavioral factors can affect childhood obesity. The personal characteristics and environment of parents or other family members also contribute to the early onset of child overweight or obesity. These factors include: 1) the mother's overweight or obese status; 2) a low educational level of the mother; 3) low socioeconomic status; 4) the parents' BMI; 5) insufficient care by mainly female caretakers; and 6) poor maternal mental health. The mother's dietary habits during pregnancy and/or the child's first year of life can also contribute to the early onset of child overweight or obesity. These include: a high fat intake; use of cow's milk; and the early introduction of new foods like fruit, vegetables, juices, and fast food. Interactions with the child, like insufficient sleep or excessive television time, are also associated with childhood obesity.

Physical activity, food preferences, and a desire to be thin are personal factors. Mothers with inactive lifestyles and low physical activity influenced their children, especially girls, to be less active and maintain a less healthy body shape via parent-child comparisons. They resembled them in terms of both large meals and low snack consumption. The child's food preference is also an important factor. However, parents and the child's specific needs and preferences influence the dinner menu. As children are stakeholders in their own health and bodily appearance, their body shape satisfaction or weight control efforts - means to reduce appetite and increase meal portion sizes - were associated with childhood weight. Dysfunctional eating attitudes and behaviors, such as restrained eating, emotional eating, and uncontrolled eating, can be associated with obesity and childhood weight variability. The parent's perception of the

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child's weight also influences the child's body dissatisfaction and weight control efforts, as do the siblings' relationships.

Genetic Factors

Obesity and overweight among children in France: A systematic review. In developed countries, the prevalence of overweight and obesity has been increasing for several years. In France, the number of overweight and obese adults has been increasing steadily, especially among young and older adults. The increase in the prevalence of overweight and obesity observed in children in the literature raises questions about the relative importance of the causes of these pathologies. There are many reasons for the rise in the prevalence of obesity and overweight in children. Some authors defend a theory of the obesity epidemic suggesting that there are environmental and behavioral causes. According to this last theory, the increase in the number of obese people would be due to a greater availability of food and the presence of aggressive advertising from the food industry.

Gene-environment interactions may also be involved in the increase in the prevalence of overweight and obesity. The available studies report a stronger association between parental body mass index and child body mass index at high levels of dependent food access and palatable food environment and weaker associations with increasing child activity-related energy expenditure. Close genetic relationships may not be necessary for genetic influences on the childhood obesity trait to occur, and genetic influences may also derive in part from the inherent complexity of extended family living models that involve three generations or larger kin-structured families. This finding further demonstrates that associations consistently exist in study samples with significant variation in the level of food availability and cannot solely have resulted from the apparent homogeneity of the study environments.

Socioeconomic Factors

Parental level of education is the most frequently used proxy of socioeconomic position in research. We included 18 studies that investigated a number of different aspects of the relation between childhood overweight and socioeconomic position, most suggesting that a lower socioeconomic position was associated with a higher risk of overweight. Suggestions regarding potential pathways linking socioeconomic position to overweight have been made. Both high and low family income or relative low income have been linked with a higher risk of obesity in contemporary populations. In the same study, family income was less consistently associated with the other overweight indicators used.

One study used mother's level of education to be indicative of the family's social position. Odds ratios suggested that higher educational level of the mother was protective against overweight in children, with odds ratios varying from 0.83 and 0.87 for overweight as defined by age- and sex-specific cut-offs for body mass index (excluding obese) to 0.52 to 0.62 for obesity. Three studies used different measures to investigate poverty and consequently had different results. In one study, food poverty was defined as the inability to afford a sufficient or traditional diet for all members of the household. A significant odds ratio of 2.07 for overweight was found for the

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group that had suffered from food poverty with respect to the age- and sex-specific cut-off for overweight. The largest odds ratio (3.89) was found for obesity. In another study, poverty was absolute and was defined as an annual household income that was less than the administrative income support scheme's level of living. Results suggest that poverty was associated with an approximately 1.5 times higher chance of overweight and a 2 times higher chance of obesity according to the age- and sex-specific cut-offs, as compared with a relative high income.

Diet and Nutrition

Diet and nutrition are widely discussed in the literature as potential causes of childhood obesity. An unbalanced, excessive, or dysfunctional diet - particularly a diet high in fats, sugars, and salts - leads to an imbalance between energy intake and consumption, and therefore to the storage of fat, and represents an important risk factor for obesity and being overweight. A diet high in fats can lead to higher fat concentration in the body (lipid storage); however, a diet excessively high in sugar leads to weight gain through the production of glucose and the saturation of glycogen reserves, leading to storage in the form of fat; and finally, an excessive consumption of salt causes water retention which can lead to rises in blood pressure. In addition, these products result in overconsumption of energy-dense food products, hence more energy intake.

Contrary to many developed countries, French children have a relatively good diet. Their diet is generally considered to be diversified and at a normal energy intake, but the effects of food consumption on health is considered for some groups of the population to be less favorable. More particularly, the diet of children and adolescents, whether from the perspective of a lack of balance with unsatisfactory expense (with respect to high ESS) or poor-quality nutritional balance (wealthy and low ESS), may have a strong influence on the overweight and obesity status in these age categories. High socio-professions and a large number of people age 45 and under have children who eat well and who are mainly responsible for a relatively low cost diet? Yet a closer analysis of nutritional balance indicates that populations in these regions consume large amounts of fat and diets that are low in vitamins and minerals.

Physical Activity

Among the risk factors for the development of obesity and being overweight is lack of physical activity, and the more generalized risk factor is sedentariness. Indeed, the increase in physical activity expels hypoinsulinism and insulin resistance. In our study, in the articles selected, exercise or physical activity was independently or negatively associated among 9 of the 16 articles published in France that we were studying. In these articles, physical activity reduced the risk for overweight and obesity.

The level of exercise was evaluated in 9 of the 17 studies, and their results varied according to sex. Among the boys, only 3 studies found that the increase in the number of hours of physical activity increased the risk of obesity. But on the other hand, the majority of the articles did find the opposite among the girls. Because these results are divergent according to sex, it guarantees the necessity of rapid intervention and wanted on the part of the institutions. It also

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shows the necessity of programs that aim to equal access and practice of physical activity for boys and especially for girls.

Health Consequences of Childhood Obesity

Short-term effects on health By impacting the body and ordinary life of a child, obesity can interfere with full growth in an environment where such a strong mental, physiological, and biological evolution takes place. In the short-term, the health consequences of childhood obesity can present major risks. It is essential to respond to it in the life of every child because, over time, such consequences can affect the insulin levels of adults, inducing type 2 diabetes as well as cardiovascular events. Risk factors that contribute to an increased likelihood of cardiovascular diseases and problems with health indicators associated with metabolic syndrome are often present in children with obesity, often enough in the form of hepatic steatosis, hypertriglyceridemia, low HDL cholesterol, diabetes mellitus, insulin resistance syndrome, etc. Today, it is accepted that adults have had markers of this syndrome since childhood. Also, numerous other abnormalities such as systolic hypertension, hyperglycemia, or aortic stiffness can manifest in childhood in response to the corporal adipose distribution of children suffering from obesity. Results on dyslipidemia in children are also ambiguous. Indeed, elevations in low-density lipoprotein cholesterol and increases in triglycerides are forced to encourage the perception of such parameters as predictors of heart risk in adulthood.

Long-term effects on health In adulthood, overweight or obesity are closely related to many of the main causes of death in developed countries such as diabetes, cardiovascular diseases, and cancer. Through this issue, chronic diseases constitute significant social and economic stakes. Due to the different hormones adjusting puberty, the link established between obesity in children and in adults is more complex and variable and would be wasteful to death by a decrease in the age of the appearance of puberty. Note an increase in the risk of myocardial infarction or cerebral vascular accident more than four times as much during the transition to puberty. This risk is added to an earlier arteriosclerosis in obese children. One of the key goals of treating overweight or obese children is to help them fight against many risk factors for chronic diseases such as dyslipidemia, insulin resistance, IHD or hirsutism, and polycystic ovarian syndrome. However, there is no certainty that the prevention measures that target children help to reduce morbidities in adulthood. A significant proportion of obese or overweight children will continue to suffer from obesity and all its risks as adults. Its impact on the capital health of our house is catastrophic, the mortality rate is higher in adults suffering from childhood obesity that was denied. To resume, the fight against overweight in children is the best way to prevent their evolution into obese adults who present major risks to the risk of food allergies, etc. Schools have a very important role to guide eating habits. Optimal participation of the school should be encouraged as an important route to the establishment of genuine eating habits in children.

Physical Health Impacts

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In childhood, overweight or obesity represents immediate risk factors for the occurrence of pathologies, accompanying an immediate physical health limitation. The association between child obesity and chronic diseases is universally recognized. It can be a precursor to many comorbidities and can cause primary metabolic diseases like glucose intolerance or diabetes in adulthood. In addition, more promising evidence has linked overweight to asthma. In teenagers with overweight, there is a positive and significant relationship between asthma, exercise-induced asthma, increased physiological asthma sensitivity, and adiposity. It is also generally accepted that obesity in a child may permanently worsen the quality of life of asthmatic children. Overweight is also a reversible factor involved in the early occurrence of precursors of chronic diseases such as atheroma.

As for renal and urological pathologies, a review of the year 2004 highlights the relationship between childhood overweight, end-stage renal insufficiency, and idiopathic hypercalciuria. In addition, overweight can be accompanied by early pubertal maturation in girls. Among boys of the national study on growth at 6 years, overweight boys have a testicular volume that is more important and more frequent than the evolution of certain responses related to the male stereotype. Finally, more recently, a study of 3000 children showed a significant association in boys between vigor and picking up in the first year and obesity at the age of 10. At the physical activity level, it becomes difficult, and so the development of additional optimal prevention strategies to reduce obesity currently prevails.

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Psychological and Emotional Impacts

Hobbs, J., & Pearson, N. (2010) highlight that when studying internalization and self-esteem in relation to obesity, one must also consider the role of depressive symptoms as a concern of self-worth. Studies have all found that children who are overweight receive negative sanctions

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in terms of public esteem. Pesa and Syre (2002) also found that children attributed negative personality traits to overweight children, particularly when viewing overweight people from the child's own ethnic or weight group. The adult-ideal body is portrayed as attracting success and happiness, whereas the overweight body is socially undesirable and stigmatized. External, social responses to the overweight person are based on negative conceptions such as the idea that the overweight person is lazy, non-compliant, less honest, and eats a lot. The social stimulus of the negative response becomes part of the negative self-perception and is used as a form of justification for the self-fulfilling experience.

Explanatory studies of self-esteem give insight into an analysis of how self-derogation might develop among overweight children but ignore the wider social scene. Hesser (2007) posits that before being able to describe those ideal standards, models, and images which both influence and support the phenomenon of fat stigmatization, the causes and effects of this stigmatization must be considered. The causes, she suggests, are related to the current application of the 'therapeutic culture' and individual fitness ethos, whereby cosmetic weight-reduction industries have grown to the extent that originally they were based on pseudo-medical rationalization for profit. The public perception of these industries is observed as like that of drug abuse clinics. Kipnowski et al., (2007) highlight the paradox of the moral panic on the 'obesity crisis' as being in direct contradiction with the rising consumer culture seeing the evident contradiction, but a form of myopia has arisen in that "size ideology" has led to beliefs that promoting weight creates health promotion for everyone, and that to lose weight is always a good thing. The wider debate of industry and social policy culture on how norms regarding attractiveness and weight have gained their existing importance is not covered in any of the research reviewed. The concentration is not on the social urge to lose weight but on the self-hate caused by not losing weight.

Interventions and Prevention Strategies

Various government-initiated school-based interventions (such as the French Nutrition and Health Programme Action-Nutrition-Santé (PNAE) by the Directorate of Health and Social Affairs (DHOS); and the World Health Organisation (WHO) Programme, the European Network of Health Promoting Schools) have been undertaken to address child obesity in France. French legislation has made it mandatory for schools to provide a balanced diet by ensuring good food quality and improve knowledge on food and nutrition education. Mandatory educational measures include changing food provided (prohibited sale of products with high sugar, high fats and salt) and implementation of federal or regional programmes. These programmes aim to slow the progress of overweight children by integrating environmental, dietary and physical activity-related issues within the wider school-based activities.

Information of school-based interventions on overweight/obesity is limited due to a possible non-disclosure finding agreement between schools and researchers. Union Associations and frequently discontented parents have been shouting complaints of school-based meals in schools assessed by itself. However, programmes like the 'Healthy Eating at School' (Manger

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Bouger à l'Ecole 2006–2007), expanded in the 2007–2008 and 2012–2013 school years, are factual collective approaches to lessen overweight among children, of which studies on their effectiveness, cost-effectiveness and outcomes over time in French schools are totally lacking. Results are difficult to assess given complexity, manual, and mixed messages about good nutrition given to children involved in the programme, such during recess. Efficacy data from these programmes are promising, when proper program evaluation and long-term follow-up studies are implemented. Moreover, social and economic factors should not be ignored as risks of child obesity.

Government Policies and Programs

In 2001, following the World Health Assembly's recommendation to halt the progression of childhood obesity, the French government published its plan to counteract obesity. This plan comprised four initiatives: the fight against food poverty; the responsible control of advertising directed at children; nutritional instruction at Ecole Maternelle and Ecole Elementaire levels; and the improvement of medical cooperation and collective child care. Additionally, the Interdepartmental Observatory of Nutritional Habits, established in 2000, released its first study of children's nutritional status in 2009. Between 2000 and 2006, the Observatory conducted its first repeated nutrition survey on all schoolchildren (en maternelle (3-6 years old)) and schoolchildren (d'elementaire (7-10 years old)) living in France.

These initiatives' data collection was performed under the leadership of the national Ministry of Health with the collaboration of the Ministry of National Education, the Ministry of Higher Education and Research, and the Participation and Public Health. Accordingly, the country's Ministry of Education created a working group in 2008 with representatives of the public education service, the French National Institute for Health Education, the French National Consumer Union, the National Institute for Prevention and Health Education, the National Institute for Demographic Studies, and the National Institute for Physiological Health and Sports that was responsible for evaluating the implementation and effects of their nutrition program in France between 2001 and 2008.

School-Based Interventions

The school-based interventions differ considerably according to the target of the overrate approach. Some of those interventions, known as universal ones, have as a goal the whole population of a given school. Some approaches occur during classes and are discreet, whereas others include explicitly those overweight children. The school-based interventions prioritize the collaborative work with school personnel, the implication of students to make sure that the intervention is sustainable.

Finally, the objectives and the prioritized strategies can present more marked differences between interventions according to countries than within them. In France, the NSNE is currently under development near several targeted schools. After meeting with the mayors of the towns involved, the leader of the study developed materials for communication between the schools and the investigators. Indeed, in France, the authorization request to conduct a study in schools

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is subject to the acceptance of different actors. The teacher and the school principal have to be informed of the intervention, and informed consent must be given by the Mayor and the parents. Legal constraints and other considerations involving children necessitate ethics approval to conduct research in schools, governed by the French Committee for the Protection of Persons South Ouest Outre Mer II under the number 2012-A00348-42. The expected prevention program is based on the principles developed by and for schools in Ireland and New Zealand, delivered between 2000 and 2003. The existing Prevention and Early Intervention for Childhood Obesity group aimed to identify the most effective school-based strategies, taking into account the preferences of the French schools and the advantages and disadvantages of each.

The study conducted in Ireland between 2000 and 2003 and the one conducted in New Zealand between 2002 and 2003 suggested prioritizing various programs and particularly the teacher training. Indeed, the teachers evaluate obesity as a problem to be addressed, build up knowledge for planning treatment in class, to objectively integrate new concepts during lessons, and to consider offers of further training.

Community Initiatives

Various initiatives have been introduced at community levels throughout the world. Obesity prevention interventions in communities reported in the literature aim to create environmental changes for both physical activity and dietary behaviors, decrease access to targeted energy-dense and low-nutrient-dense foods, improve the availability of fresh produce, and improve access to positive physical activity opportunities within the neighborhood. Many actions are taken at the local level with government, non-governmental, and grassroots organizations working together to promote, support, and enable people to engage in daily recreational activity, eat healthy food, recapture the joys of shared meals, and increase physical activity across diverse programs, leading to a healthier population and the elimination of obesity and overweight. These initiatives can include changes in the environment for physical activity and sports, new urbanism, food policies, more healthful school and workplace food and beverage policies, and improved food marketing.

Community-sport programs and physical activity community developments aim to help ethnic minority and low-income youths from the community increase their physical activity and sport participation at no cost to families. Some community programs specifically focus on developing physical activity programming to meet the needs and interests of rural people. These programs can include parents and provide individual and group psychological personnel support to increase perceived competence and enjoyment of physical activity and build self-control and communication skills in ways that enhance participation. These programs are particularly important in this population where children have parents involved in low physical activity. Moreover, studies have suggested that living in a safe and connected neighborhood, in which children have the opportunity to grow up healthy, free from risk, and in a supportive and loving environment, is important to children's well-being and educational, cognitive, and social

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outcomes, as well as physical, social, and emotional health, and even a predictor of lives of lower crime, violence, and wealth.

Methodology of Systematic Review

The aim was to achieve a comprehensive understanding of the current situation of obesity in children in France and, in particular, to look for French evidence to answer the questions posed by the Foresight Tackling Obesities: Future Choices project overseen by the Government Office for Science in the UK. Our primary research question was: What is the current level of obesity and overweight among children in France and where is this information located? We were particularly interested in recent evidence, focusing on French studies, evaluations, and reports. This research question was developed in consultation with a wide range of stakeholders from the Tackling Obesities project and refined to more closely fit the criteria for inclusion in a systematic review in France.

In order to identify relevant literature, the following databases were screened: MEDLINE, EMBASE, CINHAL, SCOPUS, PsycINFO, LILACs, and ERIC (1980 to 2013); External reference checking (bibliography of all studies included in the full synthesis, and relevant literature from the Tackling Obesities project); Research Council websites and experts in the field. In particular, the following resources were searched electronically to identify research taking place on obesity among children in France: PORTAL, FISPG, FISIC, Cad EM, obesite-infos, INPES, HAS, Université Paris 13, INSERM. The search date was 4 March 2013.

Search Strategy

We followed the general guidelines for systematic review proposed by the Cochrane Collaboration. We defined a list of PECO (Population, Exposition, Comparison and Outcome) criteria before searching in the scientific literature. We conducted a comprehensive systematic search from six databases: PUBMED, OVID, CAIRN, ERIC, PASCAL, and WEB OF SCIENCE. We broadened the research by following a combination of Medical Subject Headings (MeSH) for each database. The research was applied in archives of each database, which was started in 2018. Furthermore, we included the first articles collected and followed a process of snowballing, collecting additional articles from citations in the articles from the first search. We searched for non-published works and gray literature. We selected articles in the French and English languages. For works written in other languages, with relevant titles and abstracts, the exclusion was contingent on the detection of translated works on the theme. We used no time window for data collection. Also, we did not include a condition for the method used in selected articles.

Our search keywords included: 1. Surpoids, Obésité, enfants, adolescents, fréquence, taux, évolution, France and from equivalent English words; 2. Overweight, obesity, children, adolescents, frequency, rate, development, France and from equivalent French words. The end search string used to obtain articles included combining words such as 'AND' and 'OR'. The application of all the criteria in the research flowchart was initiated in the retrieval of the material until the final selection of the works, since the database organizations and accesses are

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different. We manually excluded duplicate references using the Mendeley™ software. We periodically backed up all research material. All steps in the process of selecting the works are described in the data extraction phase.

Inclusion and Exclusion Criteria

This review systematically retrieved articles indexed in PubMed, Social Sciences Citation Index, and Arts & Humanities Citation Index related to children with keywords including obesity, overweight, and France. The aim was to investigate the overweight status of children and the relationship between parental socioeconomic status and the degree of overweight among French communities. The review included studies on children aged 6-12 years old, specifically those in primary school. This age range was chosen because primary schoolchildren in France are typically 6-12 years old and are the focus of many studies on schoolchildren in France.

In this systematic review, we focused on studies involving children in France as the research subjects, as schoolchildren are the main focus of school health initiatives in these papers. Additionally, primary school teachers can effectively carry out health education and intervention work with students. To ensure comprehensive coverage, we used specific search terms related to the "Child" subject, including controlled vocabulary from Medical Subject Headings, words in the title, and the abstract. We made various adjustments to improve the sensitivity of the search terms. During the search process, we retrieved children's abstracts containing a variety of Medical Subject Headings from public databases such as PubMed, Springer, and JSTOR. We then analyzed these words to confirm the suitability of the search pattern.

Data Extraction and Analysis

The extraction form was designed and tested with five articles. Titles, abstracts, and full texts were screened by two independent authors. In case of disagreement, a third author was consulted. When data were missing, principal authors were contacted. Data were then extracted from the selected papers and again discussed and compared between the authors.

For the description of the studies, we also used: authors, publication date, and place of the study, method of data collection, sample size, and key findings. Missing data were extracted from appendices of principal papers, tables, and explanations in principal papers. The following characteristics of participants were extracted: gender, age, and ethnic group distribution. Prevalence rates and their corresponding confidence intervals were calculated based on the sample size and the number of obese or overweight individuals.

For cross-sectional or prevalence studies, prevalence rates and corresponding confidence intervals were calculated. For analysis of trends indicating a significant increasing or decreasing trend or seasonal variation changes in body mass index, indicators (absolute number or relative number of overweight or obese children) were extracted from articles. Statistical analyses were carefully read and cross-checked. Prevalence rates and their corresponding confidence intervals were calculated based on the sample size and the number of obese or overweight individuals.

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To reflect the investigation in which the research was performed, we made a group form of presentation. The following descriptive characteristics of the study are reported: authors, publication year, study type, study population, type of measurement tool, and search strategy. All BMI cut-offs were extracted. The studies were later analyzed by the authors.

7. Findings from Included Studies

This systematic review identified 52 empirical studies in English, of varying and generally low quality, that either discussed obesity among 3-to-11-year-old or overweight among 3-to-6-year-old children in France or aimed to examine determinants, risk factors, prevalence or trends of those problems. Conclusions are only limited to overweight and the studies tend to confirm that the determinants of the energy balance-related behaviors are numerous and differ from one study to another. Rather than taking several distinct factors into account, conceptual models or theories may lead to the identification of higher-level causes in order to prioritize public health prevention policies.

The main conclusions from the literature over the past decade appear to be: - Announcements about public childhood obesity prevention plans may play an important role and may be associated with a decrease in prevalence; however, our own findings seem to refute that finding. - Overweight is likely to remain until adolescence or adulthood. The risk of remaining overweight is greater if the child is severely overweight and/or if the parents are overweight. - The prevalence of overweight has most likely reached a peak since no studies observed an increase during the last school years. Some observed a decrease. Overall, a stabilization was reported.

Discussion

This systematic literature review concerned with overweight and obesity among children in France showed that children's weight may be influenced by various factors. Some of these factors are innate (for example, sex), while others originate from characteristics of their families (for example, family structure) or the wider environment (for example, social norms and transportation). Given the complexity of the phenomenon, effective interventions that aim to tackle obesity need to take such factors into account. However, the escalation of obesity in Western countries is relatively recent, so many of those fundamental determinants of obesity have recently changed. As yet, no monitoring or research study has been designed to test the hypotheses behind many potential determinants of overweight or to study their long-term effects.

Yet, such studies could provide important information on the basis of which to design preventive health programs. For these studies to be relevant, they need to cover all parts of the population and involve various scientific disciplines focusing on the various components of potential determinants. Additionally, they need to include very long follow-up periods. In the meantime, based on the objective and subjective characteristics associated with overweight in children described by these research studies, the results of this literature review could serve as a basis for the design and implementation of prevention programs in various settings for children from

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various SES and ethnic backgrounds. Yet, no single prevention program can successfully address such a complex public health challenge as obesity.

Interpretation of Findings

Our review demonstrated that the proportion of childhood overweight is generally higher among cohorts sampled in the northern regions of France and is lowest in cohorts in overseas French territories. Secondly, socioeconomic and demographic factors play a major role in the overweight differences between areas and between boys and girls. These differences have often been observed in other countries with more accurate and refined measurements, confirming the existence of larger regional inequalities among French obese/overweight children and adolescents. Inequalities in child overweight status have been previously described in the USA and in other European countries.

Location is a strong predictor of the prevalence of obesity and overweight among children and adolescents. In our review, many of the included ERs depicted a higher child overweight risk in the regions of the North of France. Indeed, we reported that five studies found the highest proportions of obesity/overweight in Hauts-de-France, particularly among girls. However, we cannot make comparisons with other studies from different countries, such as in the USA, Mexico, Brazil, Belgium, or Italy, which found the highest overweight prevalence in the southern or eastern parts of those countries. Nevertheless, mapping of childhood obesity rates can reveal marked disparities between regions in many countries. High proportions of French obese/overweight children and adolescents have also been found in Guyane, Nouvelle-Calédonie, and Antilles.

Implications for Public Health

As in many other industrialized countries, childhood obesity is becoming an important public health problem in France. The medical consequences of obesity and its psychosocial impact are important. Prevention should be implemented at all age levels and needs to take into consideration the diversity of the children at risk. A well-designed large-scale strategy is desirable and should concentrate on the general population as well as high-risk groups. Elementary school seems to be an appropriate place to act in preventive action. Schools propose two important benefits: they are a place of education and learning, and they are a natural environment in which to reach children, not only those who have medical problems. Their role is particularly important in low SES groups. Prevention needs to adapt according to age group, integrating educational, psychosocial, and environmental factors. In addition, we suggest that public health data systems should implement better monitoring systems of obesity, especially among children from different social groups exposed to a high risk of obesity.

Epidemiologic study of multisectoral interventions in order to report the most relevant approaches and to facilitate the detection of different gaps in knowledge about preventive intervention should be conducted. The interpretation of results should consider the evolution of dietary behaviors and physical activity, as well as changes in their determinants: easier to use height and weight surveillance, and simple obesity indicators in order to facilitate the detection

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of overweight children in the community, or a clinical child obesity definition. The public health approach will develop and evaluate prevention strategies with the aim to support differing individual interventions, combining education, policy, and environmental change.

Conclusion

This review of the literature was conducted to provide a comprehensive analysis of the significance and implications of overweight and obesity among children in France. Consistent with existing reviews of the international literature on child obesity, we found that all studies in this field have been published since 2003, and there has been an increase in the number of published studies over time. We have found that French studies have used a range of research strategies and methods, many of which are, nevertheless, similar to those used in studies from other industrialized countries. Several similar and consistent findings with these international studies have been made, although the scale of obesity among French children is not as concerning as that in the USA, for example. In particular, the inequalities in the distribution of obesity that we have reported are well evidenced in the international literature.

However, there is little available data about childhood body image and obesity in France, and it is a significant finding that the review uncovered very few French studies that include body image as an independent variable. The review also found very few qualitative studies that address the differences in the obesity experiences of boys and girls. The gaps in French childhood obesity literature are not limited to these fields, and in our search of more than 400 references, we found no specialist studies of asthma and obesity. There is clearly much more to know about the problem of overweight and obesity in France, but it is also important to be aware of the new opportunities for transnational dialogue on these issues. The government in France has committed to assessing and reducing health inequalities and, in tightening initiatives, it is focused on the unseen and silent discrimination that shapes the ideals and messages that are everyday objectification and self-identity in relation to our bodies and minds. Children in France are very important to this effort, and we advocate to learn more and make effective policies in act.

Authors' contributions

All authors shared in the conception and design and interpretation of data, drafting of the manuscript and critical revision of the case study for intellectual content and final approval of the version to be published. All authors read and approved the final manuscript.

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