



The

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Editorial

CHILDHOOD OBESITY

If you had asked a group of medical doctors 40 years ago whether child health would steadily improve throughout the twenty-first century, the answer would most likely have been "yes". The vision of the link between health and environment was limited to achieving a number of well-defined goals, namely clean water, enough food, immunization, and education. One could be confident that this day would come soon since industrialized countries knew how to succeed. Time and money would solve the problem. However the reality was not entirely as predicted: a group of paediatricians met in Brussels in 1991 to react to the unexpected trend of overweight: the European Childhood Obesity Group (ECOG) was founded, almost at the same time as the International Association for the Study of Obesity (IASO) and the International Obesity Task Force (IOTF). It took several more years to convince the World Health Organization (WHO) to recognize the magnitude of the problem. Today major health actors are there to meet the needs of the 150 millions of school-aged children and about 22 million younger children which are concerned all around the world. These numbers are still steeply increasing.

A first difficult task was to understand when and how one's environment could become harmful. First of all, it became clear that humanity was not following a three-step way: under nutrition, good nutrition and eventually, obesity. Obesity is an aspect of malnutrition.

Was it a matter of threshold (too much fat, too much television, etc) or a synergistic combination? Was genetic makeup to blame? Was it a sociological matter: urbanization, women at work, family desegregation...? Was it necessary to address this issue in all children while only a minority of them were concerned?

The combination of an increasingly poor quality of manufactured diet (high in fat, sugar, salt) and soft drinks, and the decrease in consumption of fruit, vegetables and grains, is essential and explains part of the link between cancer, cardiovascular diseases, type 2 diabetes and obesity. Sedentary lifestyle decreases energy expenditure and reduces physical fitness. Exposure of children to unlimited advertising triggers at-risk behaviours. In addition to this, new facts need to be taken into consideration: pregnancy and infancy are the beginning of the high-risk period where a metabolic shift can lead to increased sensitivity to weight gain; most complications start during childhood although they remain silent until early adulthood. Childhood obesity is a cause of reduced life quality and life expectancy.

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Childhood obesity: evidences of an early metabolic process leading to atherosclerosis

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Atherosclerosis has its beginnings in early childhood

Atherosclerotic cardiovascular disease is the most common cause of death and disability in the industrialized world. Atherosclerosis has a long preclinical phase characterized by the progressive development of artery wall damage already in childhood and young adulthood well before the clinical manifestations of disease later in adulthood. Autopsy studies as well as intravascular ultrasound studies or coronary arteriography clearly demonstrated atherosclerotic changes in the coronary arteries of adolescents and young adults⁽¹⁾. Moreover, increased carotid intima-media thickness as well as arterial reduced distensibility is suggestive of early atherosclerotic process also in children⁽²⁾.

Obesity accelerates the risk of atherosclerosis through the Metabolic Syndrome

Some metabolic disturbances such as insulin resistance, hypertension and dyslipidemia have been clearly identified as cardiovascular risk factors and promoters of the atherosclerotic process⁽³⁾. Cardiovascular risk factors have a tendency to occur in clusters especially in obese individuals characterizing the so-called Metabolic Syndrome⁽⁴⁾. Obesity plays a central role in the development of the Metabolic Syndrome: excess of fat accumulation often precedes the development of insulin resistance, hypertension and dyslipidemia. Moreover, each of the components of the Metabolic Syndrome worsens with increasing adiposity.

Consistent evidence exists on the association between childhood obesity and the Metabolic Syndrome in adulthood, as well as between early onset obesity and mortality in adulthood, independently of body size at adult age⁽⁵⁾. Childhood obesity predicts the risk of developing a constellation of metabolic, hemodynamic and inflammatory disorders associated with cardiovascular disease. Moreover, a significant number of obese children are already affected by the Metabolic Syndrome⁽⁶⁾.

Adipose tissue of obese children is involved in the inflammatory process

Obese children (as adults) often have low grade inflammation, as suggested by CRP, TNFalpha, IL-6 circulating levels, higher in obese than in non-obese individuals⁽⁷⁾. The causes of inflammation in obesity are not known although an early elementary lesion in the adipose tissue of obese children has been recently demonstrated, in which macrophage infiltration is the main feature⁽⁸⁾. Both macrophages and adipocytes secrete cytokines and inflammatory mediators which are potentially involved in the lipotoxic perturbations of liver, pancreas, and skeletal muscle

as well as in endothelial cell dysfunction⁽⁹⁾. For instance leptin, one of the most extensively studied adipokines, is directly involved in increasing angiogenic activity and oxidative stress as well as promoting vascular calcification and smooth muscle cell proliferation⁽¹⁰⁾.

Interestingly, the evidence that insulin resistance may explain most of the features of the Metabolic Syndrome – but not those of inflammation – justifies the hypothesis that insulin resistance may develop independently from inflammation though it is affected by inflammatory mediators secreted in the adipose tissue and therefore may share common antecedents of atherosclerosis.

Under- or over- nutrition in early life is an independent risk factor for obesity in adulthood

Intrauterine and early postnatal life are sensitive periods for the development of the metabolic self-regulation mechanism of the organism. Consistent evidence exists on the effect of early environmental factors on the long-term phenotype, so that individuals exposed to under- or over-nutrition in early life develop a thrifty phenotype that predisposes them to obesity and its consequences later in life⁽¹¹⁾. Infants born large or small for gestational age are at higher risk of obesity and its associated disorders than infants born appropriate for gestational age⁽¹²⁾. Moreover, a rapid weight gain in the first months of life, independently from risk co-factors, has been associated with a higher risk of obesity in young adulthood⁽¹³⁾. The mother's nutrition as well as infant feeding play an active role in all these processes.

Summary and conclusion

Cardiovascular disease is the most common cause of death in industrialized countries. Prevention of cardiovascular disease is done through prevention of atherosclerosis which is promoted by obesity and other disorders frequently associated with obesity, like diabetes, hypertension and dyslipidemia. Both obesity and atherosclerosis are associated with inflammation. An early elementary inflammatory lesion has been recently demonstrated in the adipose tissue of obese children, suggesting that the adipose tissue plays a central role in the development of the inflammatory process promoting atherosclerosis. Moreover, other factors such as fetal and early postnatal growth have been identified as independent risk factors for both obesity and metabolic disorders.

On the basis of this evidence, obesity prevention has to be started as soon as possible in life. Food intake in pregnancy as well as breast feeding and weaning procedures are potential sensitive targets to prevent obesity and metabolic disorders.

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Health impact of fruit and vegetable consumption in children

— María I. Mesana, Juan Fernández, Luis A. Moreno —

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The prevalence of obesity and chronic diseases is increasing in industrialized countries. The Mediterranean diet is one of the healthiest dietary models that currently exist, and those countries following this pattern benefit from low rates of chronic diseases morbidity and high life expectancy. It successfully combines pleasant taste and healthy dietary habits, including high consumption of vegetables and fresh fruits.

Characteristics of the Mediterranean diet

Traditional Mediterranean dietary patterns are characterised by high intakes of plant foods such as fruits and vegetables, bread, cereals (primarily whole-grain), pulses and nuts. These foods are consumed in season and, for the most part, in fresh form, having undergone little or no processing. This enhances the availability and utilisation of the micronutrients and antioxidants they contain.

There is no single Mediterranean diet but rather there are as many eating patterns as there are Mediterranean countries. Despite the fact that the Mediterranean diet concept has gained popularity, not all countries bordering the Mediterranean have preserved the distinctive dietary patterns that were defined in the 1950's. Children and adolescents are those with the most deteriorated Mediterranean diet profile. Changes in their diet include increased energy intake and increased consumption of foods with low nutrient density (soft drinks, candy, sweets, etc.). These changes have negatively impacted certain nutritional benefits characteristic of the diet: reduced antioxidant and vitamin intakes, increased proportions of saturated fatty acids, and decreased fibre consumption.

Fruit and vegetable intake in children

Epidemiologic evidence suggests that a high consumption of fruit and vegetables is related to a low risk of certain types of cancer, certain digestive diseases and cardiovascular diseases, among others. As a result, public health agencies recommend that people over the age of 2 years should consume at least 5 servings of fruits and vegetables per day. Nutrition education efforts should be directed towards children to establish healthy eating habits that will have beneficial effects in adulthood. This is because chronic diseases have been detected at early ages, and childhood may be the easiest time to learn healthy lifestyle behaviours.

Although consumption of fruits and vegetables among Europeans of all ages is lower than recommended, it is especially low for children and adolescents. There is a



need for European children to achieve healthful eating habits to attain optimal growth and development and reduce the risk of chronic diseases. However, modern society has produced certain sociological changes, such as less time for food preparation, new products and new habits. The diets of most children do not meet the recommendations of the Food Guide Pyramid, especially for fruits and vegetables. This is important due to their content in minerals, vitamins, phytochemicals and dietary fibre. Choosing a variety of foods is thought to improve eating patterns by increasing exposure to a wider range of essential nutrients and other dietary components, including fibre and phytochemicals.

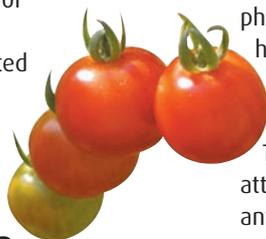
The consumption of fruit for breakfast, at least in some countries, is not very usual, and is even less in children and adolescents. For instance, a typical breakfast for Spanish children consist of milk with cocoa powder or soluble chocolate and sugar, a choice of either breakfast cereals, biscuits, bread, buns, croissants, etc. Only a few have orange juice or some kind of fruit. Regarding fruit preference, bananas and apples seem to be the fruit items preferred by Spanish children and young people, followed by oranges, strawberries and melon. Within the vegetable group, tomato sauce and salads, particularly lettuce and tomato salad, are the most commonly consumed items, followed by carrots.

Bioactive compounds in fruits and vegetables

Bioactive compounds are components of foods that influence physiological or cellular activities resulting in a beneficial health effect. It is important to note that bioactive compounds are not nutrients, and typically they occur in small amounts.

The presumed protective effect of fruits and vegetables is attributed to their high concentration of antioxidants. An antioxidant is a chemical substance that delays or prevents oxidation of a substrate. The production of oxidants (free radicals) is an event associated with aerobic metabolism. Inadequate antioxidant defences lead to oxidant-mediated diseases. Antioxidants inhibit oxidant formation, intercept oxidants and repair oxidant-induced injury Major dietary antioxidants are vitamin C, vitamin E, selenium, carotenoids, flavonoids, and other phenolic compounds. Antioxidants may counteract the adverse effects of oxidative stress and lead to improved immune function. The balance between free radicals and antioxidants is important for maintaining healthy body systems.

In conclusion, the diets of children and adolescents are undergoing important changes, which make them a priority target for nutrition interventions. Governments should take steps to prioritise cultivating, raising, producing, transporting and commercialising healthy foods, like fruits and vegetables.



EARLY INFANCY AS A KEY STAGE FOR OBESITY PREVENTION

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Childhood obesity

Overweight and obesity levels are rising in both children and adults^(e.g. 1). Identifying key periods of the lifespan during which overweight and obesity are likely to develop is thus essential to optimize prevention strategies. The period following birth is a crucial time for obesity development⁽²⁾ and could be a target for prevention since there is a clear opportunity to modify feeding practices, influence appetite regulation and shape early eating behaviours.

Rapid infant weight gain

Weight gain velocity is a risk factor in the development of overweight and obesity in later life⁽³⁻⁶⁾. Children who gain weight rapidly in the first months of life are more likely to be obese in childhood than those who gain weight along the predicted trajectory⁽⁶⁾. In a study of 90 Icelandic infants until age 6, weight gain from birth to 12 months as a ratio of birth weight was positively and highly correlated to BMI at age 6⁽⁷⁾. Many variables could contribute to the pattern of rapid growth in infancy, including “catch-up” growth in response to undernutrition during gestation⁽⁸⁾.

Breastfeeding may protect against rapid weight gain and lower the risk of developing overweight and obesity later in life. A comprehensive review of 61 studies concluded that initial breastfeeding protects against obesity⁽⁹⁾. The protection mechanism is as yet unclear, but there is likely to be a better match between varying energy requirements of the growing infant and breast milk than formula. Breastfeeding on demand allows the infant to determine meal frequency and pattern which may entrain the development of the early appetite system to internal cues (hunger and satiety) rather than the mother determining meal pattern and size⁽¹⁰⁾. Mothers’ attitudes, beliefs and concerns influence feeding patterns: in one study high maternal concern about overfeeding (significantly higher in obese mothers) was associated with a higher fat mass in 5-year-old children compared to low concern⁽¹¹⁾. Thus, maternal weight status confers both a biological endowment and shapes behaviour towards the infant including method and pattern of feeding.

Early weaning increases risk of overweight and obesity

Infants who are weaned early (at or before 4 months) appear to have a higher risk of overweight and obesity later in childhood. Ong et al (2006) examined the relationship between dietary intake at age 4 months and weight gain in the first 5 years as well as body weight at age 5. They found significantly higher total energy intakes in those weaned at 1 – 2 months compared to those weaned at 4 months and later with an associated greater weight gain. No such effects were found for breastfed infants⁽³⁾.

What influences the timing and introduction of solid foods? Evidence from interviews with mothers^(12, 13)

suggests that early introduction of solid foods was associated with social deprivation, mothers’ perceptions of infant needs (including having a “hungry” baby), free samples of solids by manufacturers and lack of support to extend the period of breast or bottle feeding. It is interesting to speculate on how mothers identify “hungry” babies. These infants may have a strong drive to feed, as part of their “catch-up” growth if they are small. A prospective study of 923 infants found that the median age for introducing solids was 3.5 months and the greatest independent predictors of early weaning included rapid weight gain to age 6 weeks, lower socioeconomic status (SES), parental perception of a hungry baby, and feeding mode⁽¹⁴⁾. Thus, rapid infant weight gain is associated with early weaning, perhaps because infants are perceived as “hungry”, and that solid foods are required to meet infant need. The causal direction of this relationship is not yet clear. Is it that mothers respond to hungry babies who need to “catch-up” by feeding them more and weaning them early or do mothers perceive distress or discomfort as “hunger” and respond by feeding to comfort them?

Mothers’ perceptions of need can be associated with body size. Research on African American mothers found that perception of babies as small increased early introduction of non-milk solid foods⁽¹⁵⁾. Social groups vary in their perceptions of acceptable body size for babies, thus, African American mothers report a greater acceptance of large body size in their babies and few see this as a potential health risk (16). Similarly, some mothers believe that a “chubby baby is a healthy baby”. Preference for varying body size was examined in 50 mothers: older, breast-feeding mothers from higher SES backgrounds preferred leaner infants (17). The mother’s perception that her baby is small, the belief that a bigger baby is better and concerns about having a “hungry” baby are all likely to contribute to feeding practice, including decisions about breast or bottle feeding, early weaning and potentially to overfeeding.

Preventing childhood obesity

Infant feeding practices play an important role in determining risk for overweight and obesity later in life. However, as children grow there are many different issues which converge to amplify that risk, such as physical activity, television viewing, energy and nutrient intake. Six key strategies have been identified to prevent overweight in children, namely: breastfeeding, increasing physical activity, reducing TV viewing, increasing fruit and vegetable intake, reducing sugar-sweetened drink intake and decreasing portion sizes⁽¹⁸⁾. However, a stronger evidence base is needed to understand the converging factors which increase risk of overweight and obesity and the appropriate interventions (e.g. individual or population-based) which tackle weight gain. Ideally, given the current pandemic of overweight and obesity among children, it will be through both personalised nutrition and activity interventions together with effective public health policies that childhood obesity will be prevented.



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