

Obesity and lung disease in city children

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RESUMEN

La obesidad infantil es considerada como problema mundial de salud y uno de los países más afectados es México. Considerando la importancia de esta enfermedad en la población escolar de la ciudad de México, la presente revisión busca dar a conocer la posible relación entre obesidad, las enfermedades respiratorias comunes y el ozono; así como algunas estrategias generales usadas clínicamente para el control de peso y la reducción de la obesidad.

Palabras clave: Obesidad, niños en edad escolar, pérdida de peso, complicaciones respiratorias, ozono.

ABSTRACT

Childhood obesity is considered a world health epidemic, and one of the countries mostly affected by it is Mexico. Considering the importance of these issues in school-age children, this paper reviews the updated knowledge of possible relation between obesity, common respiratory complications and ozone, as well as some general strategies that are clinically used in controlling weight and obesity.

Key words: Obesity, school-aged children, weight loss, respiratory complications, ozone.

Obesity could be described as the New World Syndrome. Its prevalence is continuously increasing among people from a number of countries, irrespective of age or gender ¹.

A possible mechanism through which obesity could be originated is when early (intrauterine and neonatal) life environment plays an important role in programming the susceptibility to obesity in later life. Some experimental studies have shown that there are associations between fetal and neonatal nutritional environment and the amount and distribution of adipose tissue in adult life ². Among

other hormones, leptin (adipocyte-derived hormone), plays a major role in the regulation of the overall metabolism and has multiple neuroendocrine (adeno- and neurohypophysis axes and the hypothalamus-pituitary-adrenal axis) and immune functions. Leptine exerts its actions beginning early in life, regulating intrauterine and early extrauterine life growth and development, as well as the adaptation to extrauterine life, neonatal thermogenesis and response to stress ³; it may also increase the risk for developing chronic diseases in later life.

Obesity is characterised by excess of body fat that most of the time, but not always, is accompanied by an increase in body weight; it occurs when the body mass index (BMI) is ≥ 30 units in adults ⁴. Because of the high median BMI compared with that of the United States and World Health Organization standards (WHOS), some authors have been cautious in establishing an upper normal cutoff for clinical normality, not merely selecting the 85th and 95th percentiles as equivalents of overweight and obesity, respectively. Therefore, some studies have proposed percentiles 74.5 in boys and 72.5 in girls as the action points of overweight as they are the percentiles corresponding to BMI 25 kg/m² at 18 years of age ⁵.

The prevalence of overweight has significantly increased in Mexico and the survey in this country (ENSANUT, 2006) showed that 26.8% of school-age children are obese

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⁶. It is well known that treatment of obesity is difficult and it requires the joint action of a multidisciplinary team of professionals and that the key for prevention of obesity is a change of sedentary lifestyle and reduction of energy intake ⁷. Some studies suggest that there is a relationship between fast food and overweight and food consumption in school-age children of Mexico City: students with food insecurity had greater consumption of fatty cereals, salty foods and high energy density sweets ⁸.

Current levels of beverage intakes in Mexico are the highest recorded in a nationally representative survey, respect the last survey and present major challenges for public health authorities ⁹. Beverages contribute a fifth of all calories consumed by Mexicans, and extensive research has found that caloric beverages increase the risk of obesity ¹⁰. However, school policies allowed food and drink vendors to benefit financially by marketing some products within the schools, which enhances the current epidemic of obesity ¹¹.

The Secretary of Health of Mexico believes that the best way for children to lose weight is cutting down intake of calories, especially in the form of fat or high carbohydrate content, and ordered to prohibit soda beverages and to reduce the portions of crisps, soft drinks and other items with high energy density in schools.

Childhood obesity is not merely a risk factor for disease in adulthood; obese children may experience more illness and health related problems already in childhood ¹². Obesity may play a significant role in the pathogenesis of pulmonary diseases through mechanisms that may involve proinflammatory mediators produced in adipose tissue, as the hormone leptin, which is elevated in obese animals, and promotes airway inflammation ¹³.

The last Pandemic influenza H1N1 2009 which began in Mexico ¹⁴, caused more severe problems in children and young adults than seasonal influenza. The typical manifestation of a severe disease was diffuse viral pneumonia complicated with acute respiratory distress syndrome, and over half of the severe cases had underlying conditions, including morbid obesity all of which were regarded as major risk factors ¹⁵. Secondary bacterial infection is more common in children. *Staphylococcus aureus*, including methicillin-resistant strains, is an important cause of secondary bacterial pneumonia with a high mortality rate. Treatment of pneumonia should include clinical experience for this pathogen ¹⁶.

Urban environments and urbanized lifestyles have a strong influence on health and well-being, including infant and childhood populations in developed and underdeveloped countries, as well as among societies in developmental and environmental transition around the world. Urbanization will inevitably have a significant impact on the health of future generations caused by different kinds of pollution. Notably, health consequences of urbanized lifestyles are not confined to residents of cities and large towns but are becoming manifest in rapidly changing, previously traditional societies in rural and remote areas because globalization is altering infant feeding practices, dietary habits and lifestyle patterns of children ¹⁷.

Enhanced pulmonary inflammation associated with environmental exposures, as to ozone (O₃), due to an increased adipose tissue mass may also influence susceptibility to pulmonary infections ¹⁸. The reaction of O₃ with polyunsaturated fatty acids from the surfactant factor and pulmonary epithelial cells produces different products which can cross the alveolar-capillary barrier and reach distant structures. Its molecule induces fatigue, lethargy, headache, as well as significant disarrangements in the sleep pattern related to biochemical changes in the brain ¹⁹. Other results suggest that in animal models the neutrophilic inflammation induced by prolonged low level ozone exposure was attenuated in obese mice and appeared to result from an absence of IL-6-dependent neutrophil recruitment in them ²⁰. IL-6 plays a complex role in pulmonary responses to O₃, which differs between wild-type and ob/ob mice. New experiments might improve our understanding of the mechanisms by which obesity and ambient ozone influence pulmonary inflammation and may facilitate the development of novel therapeutic interventions for the treatment of lung disease.

Another indicator for a number of health problems in obese children is habitual snoring, a prominent symptom of sleep-disorder breathing. It comprises a spectrum of upper airway obstruction during sleep from simple snoring, estimated to affect 10% of preschool children, to the syndrome of obstructive sleep apnea (OSAS). This seems to play a role in the increased adherence of neutrophils to endothelial cells as well as in the resulting migration of the former to the inflamed area. Intercellular adhesion molecule 1 (ICAM-1) and interleukin (IL)-8 are markers widely used in OSA studies to investigate inflammation ²¹; the authors confirm the occurrence of an ICAM- and IL-8-

mediated neutrophilic airway inflammation in both OSA and obese patients. Children with OSAS do not maintain airflow of upper-airway inspiratory-pressure reduction during REM (Rapid Eye Movement) sleep, indicating a more collapsible upper airway, compared with that of control subjects during REM sleep. However, compensatory mechanisms exist to maintain ventilation²². These authors suggest that local reflexes, central control mechanisms, or both, reflexes and control mechanisms, need to be further explored to better understand the pathophysiology of this abnormality and the compensation mechanism.

Emerging evidence has challenged previous assumptions that primary snoring is benign and a recent report identified higher levels of social problems and anxiety/depressive symptoms in snoring children²³. The prevalence of asthma and obesity, two often associated conditions, is influenced not only by age and gender but also by lifestyle factors. Although an increase in the prevalence of overweight/obesity was not detected in asthmatic children and adolescents, some authors recommend a preventive surveillance of calorie intake and a promotion of physical activity in children requiring long-term treatment with inhaled glucocorticosteroids²⁴.

Common respiratory viruses, especially rhinoviruses, cause the majority of exacerbations in children. Infection of airway epithelial cells with rhinovirus causes the release of pro-inflammatory cytokines and chemokines, as well as recruitment of inflammatory cells, particularly neutrophils, lymphocytes, and eosinophils. The host response to viral infection is likely to influence susceptibility to asthma exacerbation. Having had at least one exacerbation is an important risk factor for recurrent exacerbations suggesting an 'exacerbation-prone' subset of asthmatic children. Factors underlying the 'exacerbation-prone' phenotype are incompletely understood but include some extrinsic factors such as obesity and intolerance to anti-inflammatory medications²⁵. However, new studies on these extrinsic factors are necessary.

SOME RECOMMENDATIONS TO CONTROL OBESITY

Populations with high fruit and vegetable (FV) consumption have a lower risk for childhood obesity and cardiovascular diseases. Home and school environments are decisive for the children to increase FV consumption. Creative ways to encourage FV consumption should be ex-

plored. These factors should be considered when designing programs aimed at increasing consumption of fruits and vegetables in children²⁶. Likewise, the Expert Committee in charge of establishing the Beverage Consumption Recommendations for the Mexican Population was convened by the Secretary of Health with the purpose of developing evidence-based guidelines for consumers, health professionals, and government officials. This committee recommends the consumption of water as a first choice, followed by no or low-calorie drinks, and skim milk. These beverages should be favored over beverages with high caloric value or sweetened beverages, including those containing artificial sweeteners¹⁰. Finally, a simple physical activity program can modify several cardiovascular risk markers in school children range of age (performing a 20-minute routine exercise every school day)²⁷. However, it is not possible to provide an evidence-based answer to the question of whether regular exercise is essential for normal growth. It is also unclear whether very low levels of exercise result in growth deficits. Regular practice of exercise is characterized by heterogeneity in responsiveness, with most individuals experiencing improvements in fitness traits while a significant proportion showing only very minor gains²⁸.

Indeed, childhood obesity has become a serious public health problem and nutritional therapy plays an important role in its prevention and treatment. The strategies consist in changing eating habits and performing some physical activity in a clean environment: this reduces body weight, improves lipid profile and decreases cardiovascular risks in children and adolescents with obesity, but always under medical supervision.

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