Health services perspective of the nutrition of Mexican children. IV. Prevention of nutritional deficiencies and emerging nutritional problems during childhood

Una mirada desde los servicios de salud a la nutrición de la niñez mexicana. IV. Prevención de los problemas de nutrición de los niños, de rezago y emergentes

Samuel Flores-Huerta[1], Ricardo Pérez Cuevas[2], Hortensia Reyes-Morales[2], Juan Garduño-Espinosa,[2] Evelyne Rodríguez-Ortega[2], and Onofre Muñoz-Hernández[2]

Abstract

To demonstrate childhood nutritional problems, both those that are a consequence of underdevelopment (stunted and micronutrient deficiencies) and those emerging problems (overweight and obesity), we stress the importance of promoting breastfeeding along with appropriate complementary feeding. It is also recommended to measure body mass index to detect timely childhood growth deviations. To prevent low birth weight, high-quality antenatal care must be offered to mothers in accessible health facilities that are equipped to resolve pregnancy-related complications including newborn delivery by healthcare professionals. Several measures are helpful for preventing iron deficiency anemia such as increasing the iron reserves of pregnant women, retarding clamping of the umbilical cord that, in turn, increases the iron reserves of the newborn. We must eliminate risk factors for iron loss through the gastrointestinal tract and provide iron supplementation for at-risk infants. Folic acid also must be included in the supplement. Prevalence of stunting in poor communi-

Resumen

Para contender con los problemas de la nutrición de los niños, los de rezago y emergentes, se enfatiza la importancia de que los niños pequeños sean amamantados e ingieran mayor cantidad de alimentos complementarios de origen animal. Asimismo, se recomienda utilizar el índice de masa corporal para detectar oportunamente problemas nutricios de déficit o exceso. La prevención del peso bajo al nacer requiere otorgar a la madre una atención prenatal de calidad, favorecer el acceso a los servicios de salud y una atención profesional del nacimiento. Para prevenir la anemia carencial se destaca la importancia de una correcta orientación alimentaria, eliminar los factores que ocasionan microsangrado gastrointestinal, adicionar hierro a los alimentos de consumo popular, aumentar las reservas al nacimiento y dar a los niños suplementos con sales específicas de hierro y ácido fólico. Para disminuir el retardo de la talla para la edad, que se encuentra vinculado a la deficiencia de cinc, se considera que la forma más eficaz de aportar este micro nutrimento es con

[1]Departamento de Investigación en Salud Comunitaria, [2]Centro de Estudios Económicos y Sociales en Salud, Hospital Infantil de México Federico Gómez, Secretaría de Salud, México, D.F., México

Received for publication: 5-15-2008
Accepted for publication: 5-21-2008

ties is generally associated with zinc deficiency. Sufficient portions of animal and seafood products should be included in the daily diet, and supplements with this micronutrient should be provided in order to help prevent its deficiency. Regarding the emergent nutritional problems, we discuss the prevention of obesity due to its severe health consequences. Currently, there is no consensus about the most cost-effective interventions. In addition to the high proportion of therapeutic failures, several actions using as a model the energy balance equation from gestation to the child's age are proposed. We discuss the amount of food and food composition as risk factors for obesity, along with the need to disregard a sedentary lifestyle. Obesity is not strictly a medical or health system responsibility but a problem shared by parents, families, schools, food producers and mass media as well as public authorities who, as social leaders, do not realize that we all are living in an obesogenic environment.

Key words: nutrition, health services, child, prevention.

suplementos que lo contengan y con alimentos de origen animal, además de productos del mar. De los problemas emergentes se menciona sólo la prevención de la obesidad por sus graves repercusiones. Ante la dificultad actual para decidir qué medidas son costo-efectivas, y ante el elevado fracaso terapéutico, se destaca la prevención como estrategia para su contención. Se enfatiza que es un problema de salud que estrictamente no es una responsabilidad médica o de los sistemas de salud, pero se proponen acciones alrededor de la ecuación del balance energético, abarcando desde la gestación a la edad escolar, en la que deben participar los individuos, los padres de familia, escuelas, maestros, productores de alimentos, publicistas y funcionarios públicos para modificar factores de riesgo como la cantidad y composición de los alimentos, además de la necesidad de eliminar el sedentarismo como forma de bienestar.

Palabras clave: Nutrición, servicios de salud, niñez, prevención.

Nutrition is one of the key factors that determines individual health from early ages, both in the short and long term. This is a permanent process that begins with feeding and makes possible individual growth and full development. As intermediate events, we find physiological processes related with absorption, metabolism and incorporation of nutrients. Different aspects of health are determined by the lack, sufficiency or excess of those nutrients. It is worth mentioning that current health is influenced by previous nutrition and they both influence future health. It is important to consider that during acute shortage or abundance of nutriments, human body tends to balance each nutriment, including energy. During chronic nutritional shortages, the human body develops adaptation mechanisms to survive such as a slow weight gain, stunted growth or both, which are not identified as a disease but impact the health of affected children. At first, children with stunted development tend to have more infectious diseases, which determines higher mortality rates. In the mid-term, these stunted forms also affect their intellectual and emotional development as well as their future health. On the contrary, when there is an excess supply of food, other health problems appear such as overweight and obesity, which are associated with metabolic syndrome and cardiovascular diseases as well as insulin resistance in the mid- and long term. These are among the leading causes of death in adults in several countries including Mexico.[1]

It is interesting to note that in 1943, when Federico Gomez founded the Children's Hospital of Mexico, nutrition problems were related with the malnutrition-infection complex. Overweight and obesity were not considered public health problems at the time; 66 years later shortage diseases have changed, severe malnutrition syndromes such as marasmus and kwashiorkor have disappeared and growth stunting and micronutrient deficiencies have become evident. At the same time, obesity emerged in all ages in epidemic proportions. Currently, several countries including Mexico face both healthcare problems: stunted growth and emergent nutritional diseases. We analyze measures to prevent these nutritional problems that would save

time and resources to treat diseases regarded as irreversible.

Promotion of correct nutrition and growth surveillance in children

Feeding and growth are parts of one process that determines health in the short and long term. Correct nutrition and growth surveillance would avoid several growth stunting and emergent nutritional problems. Therefore, we begin by showing the need to stress promotion of breastfeeding, correct complementary feeding and growth surveillance of children in all medical units.

Breastfeeding

Breastfeeding was the basis for our species survival until the early 20th century and is regarded as the most important food because of its benefits for the health of children and mothers. Breast milk is still the worldwide reference for newborn nutrition because of its composition of macro- and micronutrients.[2] The World Health Organization (WHO) published in 2006 the first growth and development standard to evaluate children <5 years old.[3] Breastfed children show a better response to vaccines and reach a higher psychomotor and cognitive development;[4] they also receive active and passive protection against infectious diseases such as diarrhea, respiratory tract infections and others.[5] Children fed with mother's milk show a lower mortality rate from both infectious and non-infectious diseases such as sudden infant death syndrome.[6] The increased prevalence of breastfeeding has reduced malnutrition, underweight and stunted growth rates.[7] It is also important to highlight that breastfed children show a lower risk for developing overweight, obesity and arterial hypertension in the long term, as well as other chronic and degenerative diseases.[8,9] However, it is important to highlight that breastfeeding benefits are related with its exclusiveness and duration in the first year of age, especially during the first 6 months of life. In practice, breastfeeding is limited not by the ability of the mother to produce milk, but by social, cultural and labor factors. For instance, when mothers are discharged after delivery, they receive almost no information on the benefits of breastfeeding or how to start and maintain it.[10] The benefit of breastfeeding for a society having an epidemiological transition is directly related with the number of children that start and maintain breastfeeding through their first year of life. Unfortunately, exclusive breastfeeding rates are <40% in Mexico at 4 months of age; therefore, this calls for a promotion of breastfeeding to improve childrens health as a social strategy.[11] Proposed measures to improve breastfeeding prevalence include the following:

1. Modify obstetrics and pediatrics services to guarantee breastfeeding protection, promotion and support, carrying out the "Ten Steps to Successful Breastfeeding" statement from UNICEF in Baby-Friendly Hospitals.
2. Modify healthcare personnel attitude and inform the mother before being discharged about the numerous benefits of breastfeeding for herself, her child and society in general.
3. Incorporate breastfeeding permanently as a topic of educational programs on health promotion in primary care hospitals, emphasizing its importance on children and mothers health. The prevalence of exclusive breastfeeding should be indicative of the benefit received by children.
4. Reach agreements with companies that produce breast-milk substitutes to respect WHO's International Code of Marketing of Breast-milk Substitutes, dating from 1981.[12]

Complementary diet

The sixth month of life is a critical stage for childrens' health regarding their nutrition and growth.

The current paradigm suggests newborns should have an exclusive breast-milk diet during their first six months of life, allowing their adequate growth and development. After this point, children need to receive other foods without suspending breast-milk.[13] This guarantees sustained growth and acquisition of all their functions. However, two problems related with malnutrition and health care are found in 6-month-old children who live in impoverished communities: growth stunt and anemia from iron and folic acid deficiency.[14,15] Recent surveys report that feeding practices for children at this age are not adequate.[16] The child receives new foods without considering his nutritional needs, health problems and nutriment sources. In general, children who live in rural areas ingest higher amounts of vegetable-origin foods than animal-origin foods, accompanied by tea, coffee or soda. Urban children also receive few animal-origin foods and present an increasing intake of juices, sodas and other industrialized foods. Mothers from both populations should receive appropriate information about complementary diets for their children. According to WHO recommendations for children who are not breastfed, it is important to promote daily intake of animal-origin foods such as meat, poultry, fish or eggs and milk. This will allow children >6 months old to meet their requirements and maintain their growth.[17] In order to ensure an appropriate protein, vitamin and mineral supply, children who do not ingest animal-origin foods regularly should ingest a higher amount of milk (~300-500 mL/day) and include cereals, legumes, fruits and vegetables in an assorted diet. It is healthy to reduce intake of processed juices and avoid sweetened beverages from an early age.[18,19] The purpose is that children should acquire healthy habits during their first year of life.

Growth surveillance

Anthropometry is a useful tool to measure increase of cell, tissue and body mass from birth until the end of puberty.[20] The most common and useful measurements are weight (body mass) and size (longitudinal growth),[21] followed by cranial and arm perimeters and, more recently, waist circumference.[22,23] By comparing these parameters with reference values and appropriate cut-points,[20] we can analyze children's nutritional condition. In order to timely identify stunted development or emergent nutritional problems, it is very important to monitor physical growth from birth. In practice, this means to measure children's weight and size every 2 months during their first year of life, twice a year until their third year of life and annually until adolescence. It is useful to evaluate a child's development through a graphic record that shows weight and size gains as well as body mass index (BMI, kg/m^2), using charts as those promoted by CDC[24] or Child's Growth Standard (WHO, 2006)[3] that allow pediatricians to compare children's growth and detect developmental problems (stunting or excessive growth). The use of BMI to monitor growth changes in children of any age should be promoted in healthcare facilities as well as in schools.

Stunted development prevention

Low birth weight

The term low birth weight (LBW) is applied to newborns weighing <2500 g at birth regardless of gestational age. This weight generally results from being born before the 37th gestation week or having intrauterine growth restriction.[25,26] LBW usually represents that care received by the mother before and during gestation were far from optimal.[27] LBW consequences are a higher morbidity and mortality from birth to preschool age and it represents a risk factor for the development of chronic degenerative diseases during adulthood.[25,27] Developing countries have a LBW prevalence of 23.8%, which increases 3-fold the percentage observed in developed countries (7%);[28] in Mexico, LBW prevalence is ~9%.[25] Factors that determine low birth weight are primarily social and economic, linked to poverty and lack of social care. Therefore, all investments oriented to

prevent this health problem are highly cost-effective. Policies should have an integral approach, incorporating infrastructural improvements to educate and assist pregnant women, affording them timely and appropriate care, although LBW is a physiological condition. Factors to be strengthened include the following.

Prenatal care

Two actions should be highlighted: 1) Provide appropriate medical care to pregnant woman, favoring opportune and sufficient patient visits; prevent and detect the most frequent problems in each gestation trimester with special attention on nutritional deficiencies and infectious and hypertensive diseases.[25,26] Lack of nutriments should be avoided by promoting proper feeding and dietary supplements such as iron and folic acid. These nutriments have demonstrated to reduce LBW incidence.[29] Weight gain should also be charted according to gestation evolution. 2) Eliminate unhealthy habits such as smoking or smoke inhalation during cooking, which is frequent among mothers of low socioeconomic status.

Access to health services

Prenatal, emergency and delivery care should be available at a maximum of 30 min from the mother's home in order to provide quality service.

Newborn care

LBW prevention reduces mortality especially during the perinatal stage where the newborn may require intensive care due to immature pulmonary function and infections acquired during the first days of life. Also, LBW prevention helps to stop the negative cycle where stunted growth results in unproductive adults who present chronic degenerative diseases.[30,31]

Prevention of iron-deficiency anemia

Anemia from nutritional origin is the most commonly spread micronutrient deficiency worldwide. It affects children <5 years old and women of childbearing age. This disease has different consequences according to presentation time. When a pregnant woman has anemia, this impacts fetal growth and neurological development. If it occurs during the first year of life, it affects the newborn's immune,[32] muscular[33] and neuronal[33,34] functions and increases morbidity from infections. When small children present anemia, this affects their neurological development, which does not improve even 10 years after anemia has been corrected, possibly implying that the damage is irreversible.[33,34]

The stages of anemia evolution are as follows,

Ferritin decrease

This protein, which carries reserve-iron, decreases <10 ìg/L.

Ineffective erythropoiesis

In this stage, erythrocyte protoporphyrin levels reaches >100 ìg/dL and transferrin saturation decreases to <16%. Hemoglobin levels decrease. During this stage, microcytic and hypochromic erythrocytes appear. Hemoglobin concentrations are lower than the following prospective values: children between 6 and 12 months old (³10.5 g/dL), children between 12 and 23 months of age (³10.7 g/dL), and children >24 months old (³g/dL). These data were adjusted for altitude.

Table 1 shows anemia prevalence during the first 5 years of life using different surveys.[1,35-38] The problem increases during the second year of life, however, with a different magnitude. The IMSS survey is the only one that shows total anemia prevalence; part of the survey corresponds to iron deficiency and the other part to folic-acid deficiency.

Programs aimed to prevent this disease should include the following measures:

1. Nutritional advice: Because iron is ingested with food, it is important that parents are aware of

appropriate nutritional patterns to prevent LBW. Newborns have a large iron reserve during their first months of life; however, reserves are depleted at ~2 months of life in premature newborns and ~4 months of life in full-term newborns. Breastfeeding should be promoted because iron absorption rate is ~50% (breastmilk iron concentration is between 0.2 and 0.4 mg/L). This represents a higher absorption rate than that obtained from bovine milk and formulas.[5,39,40] Non-breastfed children should receive an iron-added formula (12-15 mg/L) to cover this micronutrient requirement. Parents should receive continuous nutritional advice so their offspring receive heme iron as found in animal tissue (red meats, eggs, fish) with a bioavailability between 10% and 15%. Also, it is very important to teach parents that beverages such as tea and coffee are not healthy foods for children because they inhibit iron absorption. On the other hand, non-heme iron (from vegetable foods) have an absorption rate between 1% and 5%; nevertheless, this percentage increases when combined with heme-iron food because meat and fish amino acids and organic acids (for instance, ascorbic acid) favor iron absorption.[41]

2. Iron loss reduction: Children who live in impoverished countries present parasitoses that may cause hidden melena, with an estimated contribution of 25% to anemia. Therefore, treatment with anti-parasitic drugs has been effective to prevent and reduce anemia prevalence. Another measure to reduce iron loss is to avoid intake of bovine milk in children <1 year old because it produces digestive tract microbleeding.
3. Iron-enriched foods: These have shown positive effects on iron hemoglobin concentration. Nowadays there are several iron-enriched processed foods for young children (cereals and fruits). Iron-enriched foods for general consumption include corn and wheat flours as well as reconstituted bovine milk. There are specific products for vulnerable groups such as those used in IMSS Oportunidades programs.[42]
4. Increase iron reserves at birth: This occurs after delaying umbilical cord clamping at least 2 min after birth. This allows the newborn to receive an additional iron supply (up to 75 mg), which is sufficient to prevent this micronutrient depletion before the 6th month of life.[43]
5. Prophylactic iron-salt supply: Populations with high and low anemia prevalence, as well as populations who do not have access to iron-enriched foods, should receive iron routinely in order to prevent its deficiency.[44,45] The US Institute of Medicine (IOM) recommends administration of iron drops between 4 and 6 months of age.[46] In Mexico, the IMSS provides iron supplements to all full-term newborns from the 4th month of life and to premature newborns from the 2nd month of life, with a 3-month standard treatment. Dosage is 10 mg/day to guarantee that 1 mg is assimilated.[38] A weekly supply to avoid iron depletion has shown to be efficient enough to incorporate it into other programs.[47]

Prevention of folic acid deficiency

It is recommended that mother ingests folic acid during gestation as a complementary nutriment

Table 1. Prevalence of anemia in children <5 years of age

Age (months)	ENN 1999[36]	IMSS 2004[37]	ENSANUT 2006[1]	PREVENIMSS 2006[38]
6-11	13.1	20.9 (7.5)*	——	——
12-23	48.9	22.7 (14.9)*	37.8	30.1
24-35	32.1	——	25.7	18.9
36-47	21.6	——	20.1	16.5
48-59	16.4	——	14.2	11.6
Average	27.2	21.8	23.7	19.2

All values are percentages.
*Values for iron deficiency.
ENN, National Nutrition Survey; IMSS, Mexican Insitute of Social Security; ENSANUT, National Health and Nutritrion Survey; PREVENIMSS, IMSS Integral Health Programs.

when prescribed by her physician. Premature and LBW children are more vulnerable to present this deficiency because they have low folate reserves at birth and a higher demand to gain weight rapidly. Although >50% of anemia cases originate from iron deficiency, this is very often accompained by folic acid and vitamin B_{12} deficiencies.[48] An IMSS survey revealed a prevalence of folic acid deficiency of 9.4% in children <1 year old.[14] Another national survey found a prevalence of folic acid deficiency of 8.8% in children <2 years old.[49] An appropriate diet during this stage is fundamental to prevent such deficiency. Folic acid is abundant in green leafy vegetables (steam-cooked for small children), germinated cereals, legumes, liver and milk. Anemia caused by iron + folic acid deficiency does not present alarming clinical manifestations, but it is a hidden disease that may affect an entire generation when not treated and prevented. Supplements to prevent anemia should include iron and folic acid.

Stunted development and zinc deficiency

Stunted development and zinc deficiency maintain a causal relationship. Zinc deficiency is the primary cause of lack of energy and proteins in severe malnutrition states. In stunted development, micronutrient deficiency is the primary cause, particularly from zinc. The relationship between these problems is so close that prevalence of stunted development has been considered the equivalent of zinc deficiency.[50] Stunted development is a severe health problem, particularly in underdeveloped countries. According to the National Health and Nutrition Survey (2006), in Mexico stunted development has a prevalence of 12.7% in children <5 years-old;[1] however, it shows contrasting figures according to different population groups. Children <2 years old who live in urban areas have a prevalence of 6.5% compared to 22.4% found in children who live in rural areas. The problem starts at the 6th month of life in these populations.[15] Zinc is an essential nutrient for health and has multiple essential functions as follows: improves appetite and taste sharpness, promotes fetal and childhood longitudinal growth, and insures neuromotor development and sexual maturity. Biochemically, zinc increases immunological functions and provides antioxidative protection to cellular membranes, participates in protein synthesis (>200 metalloenzymes), as well as in cellular membrane stabilization and gene expression.[50,51] It is recommended to ingest 10 mg of zinc daily during childhood either with foods or as supplement to maintain all functions where it participates and reduces the prevalence of stunted development. Zinc ingeston has demonstrated longitudinal growth benefits and reduces the incidence of some infectious diseases. One metaanalysis found that zinc supplement had a positive effect on size gain (0.35) and weight gain (0.3). These values are expressed as standard deviation units.[52] In Mexico, the program called Progress-Opportunities, which comprises nutritional, healthcare and economic support, promotes daily consumption of baby foods (44 g) with several nutriments including 10 mg iron and zinc, among others. This program evaluation shows that children <6 months old presented significant increases in longitudinal growth and reduction in anemia rates.[42] Other studies have shown zinc supplement reduces incidence of pneumonia (41%) and diarrhea (18%), as well as duration of diarrhea (24%). These benefits have a direct relationship with deficiency level of this micronutient.

The causes of zinc deficiency range from insufficient ingestion to inappropriate usage; however, we will focus on the primary cause related with foods ingested by young children. After the 6th month of life, nutriment requirements are met by foods complementary to breast milk. Animal-origin foods are rich in zinc as well as their lack of phytates. Beef, pork, poultry and organ foods are good sources of zinc as well as seafood and fish. Milk and eggs are also an excellent source of zinc. Some vegetables, such as seeds, nuts,

cereals, legumes and tubers, have a reasonable zinc concentration, but they also contain phytates that interfere with its absorption. Therefore, zinc contribution as part of a healthy diet should include daily consumption of animal-origin foods. Unfortunately, surveys on feeding practices of young children reveal that after the 6th month of life, these foods are not included in their diet;[16] therefore, healthcare professionals should advise mothers to incorporate them in children's diet from that age.

Emergent nutritional problems

Obesity prevention

An increased prevalence of obesity in children has been observed worldwide. One of the environmental factors contributing to this increment is that children ingest more calories than they require for their health and growth. Simultaneously, children play less and time devoted to sedentary activities has increased, generally involving television or video games. This means that children are living in obesogenic environments that favor consumption but do not favor energy expenditure. Obesity evolves naturally into chronic degenerative diseases that represent the first cause of death in adults in many countries.[30]

Prevention is the only feasible solution to a growing number of obese children who may develop type 2 diabetes and cardiovascular diseases because these diseases have a frequent therapeutic failure and an associated high cost of care.[27] However, there is insufficient evidence about which strategies should be implemented to deal with this health problem.[53] Certainly, because of the causal model presented here, it is appropriate to design an integral strategy (starting with the government), implementing useful preventive measures at the individual and community levels. Children's growth should be monitored using data in nominal systems in order to detect those who may present changes involving risk.

In our review we will follow changes that occur with age, starting with conception and following their first years of life towards school admission. We have not included metabolic and genetic factors because some are still under analysis and knowledge of genetic alterations was regarded as secondary to the purpose of this analysis. We analyze actions and those who carry these out and attempt to point out where the responsibility lies - individuals, healthcare systems or society as a whole. We will try to discriminate the role of groups who produce goods and services, as well as responsible government leaders and private employees who are the decision makers.

Gestation

It is pertinent to highlight that current and future health of children begins during gestation.[30,31]

Nutrition of the pregnant women has to be healthful in quantity and contents. The mother has to increase food intake because the nutrients are allocated both for her and her child. This does not mean she has to eat double portions. If nutritional condition is not optimal, it has to be improved and, when obesity is present, it has to be modified. In both scenarios, weight gain surveillance is essential. Composition in this period follows current paradigms, on one hand to increase intake of fruits and vegetables, grains, cereals and legumes, and on the other hand to limit or discontinue ingestion of refined carbohydrates and saturated fats. When the mother's nutrition is not optimal, the risk for low birth weight of the newborn is increased. If the mother presents overweight or obesity, the risk of having a newborn weighin 34 kg increases. In both cases there is higher perinatal mortality risk as well as risk of developing overweight and obesity in the future. The newborn's diet should be planned, making the mother aware of benefits from breastfeeding.

Exercise is advisable during pregnancy because it improves body shape, reduces stress and promotes sleep, and improves muscle tone, strength

and resistance, which will have a positive effect during labor. At this stage, exercise has little importance as an expense factor in the energy equation balance. Most of these actions are the responsibility of institutions and healthcare providers, and pregnant women have a shared responsibility during this stage.

Birth

Results from studies on the role of breastfeeding against overweight and obesity are controversial; however, there is increasing evidence on its protective role especially related to an exclusive breastfeeding diet and its duration.[54-56] Although the mechanisms are not well defined, two have been identified: the first is related to breast-milk composition and the second with the amount ingested. Protein quantity in breast milk is less than in other mammals and much lower than that contained in formulas. In equal amounts of carbohydrates, the higher protein quantity induces higher insulin production, which favors fat deposits.[8] The second mechanism corresponds to the fact that breast-fed children self-regulate the amount of food; in consequence if free demand is respected, newborns will maintain a balance, ingesting only what is necessary for their growth and development without being forced to finish a quantity determined by an adult.

Although breastfeeding is a private matter between mother and child, its promotion is the responsibility of healthcare institutions and professionals. In public as well as private institutions, there is little information about the benefits related to breastfeeding and, in contrast, formulas are highly promoted.

The first years of life

Feeding habits are acquired during the first years of life. Parents are the responsible players (especially the mother) and the child is exposed to appropriate or deficient practices. The epidemic of diseases from food inadequacy as well as emergent nutritional diseases reveals that feeding practices are not appropriate.[16] The purpose is that, by the end of the first years, children acquire the habit of consuming healthy food during the day, teaching them the benefits of games and exercise for their health. Next we highlight the importance of acquiring good feeding habits to maintain a balance between intake and energy expenditure, which allows growth, and at least 1 h exercise or vigorous activity. Considering recommendations from the American Heart Association and the American Academy of Pediatrics,[57,58] we present the following recommendations: encourage daily consumption of fresh fruits and vegetables at every meal, prepare meals with low-saturated fat vegetable oils and margarines instead of butter and lard, replace products made with refined flours with bread made from integral cereal or nixtamal tortilla, and include fish at least three times a week (either roasted or baked instead of fried or battered). A healthy diet should exclude simple carbohydrate drinks such as sodas and reduce the sugar included in at-home prepared beverages. Consumption of natural juices should be limited to one portion.[19] To prevent problems related with fat, it is recommended that the child consume skimmed or reduced-fat milk daily. Reduce salt added to meals and avoid placing the salt shaker on the table. Large portions are not considered healthy. Finally, teach children that foods should be enjoyed in a socially comfortable atmosphere where dialogue and sharing are integral part of meals, and that this cannot be achieved while watching television, playing video games or using the computer.

The key role played by healthcare professionals should be highlighted so that parents are aware of the importance of their children acquiring good eatibg and exercise habits, which will constitute a lifestyle that favors good health.

Healthy diet during school years

All of the previously mentioned concepts apply during school years. During this stage the child's world

has extended from home into the school environment where teachers and community participate. From a curricular perspective, empowering of children to learn the basis of a healthy diet is very limited because during elementary education the books students use have limited information on the subject. There are some positive exceptions in Latin America such as Elementary Education in Feeding and Nutrition that the Chilean government has established in their schools where children learn interactively the theory and practice of a healthy diet and exercise.[59] On the other hand, it can be observed that there is no equality between teachers and parents about the importance of a healthy breakfast at home and bringing a healthy lunch to school with foods already described. Children frequently buy potentially harmful food inside or outside the school. The school has to take advantage of this opportunity and offer healthy foods instead of foods that can be harmful. As for food sold in the street, the school has to teach the child the difference between a healthy and a non-healthy food as well as to make decisions to avoid acquiring everything offered inside or outside the school. Collaboration of municipal authorities is required to prevent street vendors from selling foods near schools.

Exercise

There are very limited activities to promote exercise because children spend a short time at school. Fortunately, there are programs that increase this stay and there is more opportunity for children to exercise, either as part of their games or during sports activities.

However, school achievements regarding this matter have no effect in advertising and mass media. Up to now, mass-media goal is that the consumer acquires products, independent of their nutritional value. Regulatory actions are also required so that products are labeled with nutrient contents and specifies the actual contents per portion. Also, advertisers should fulfill their responsibilities with an ethical code that clearly indicates children should not be exposed to food that may represent a health risk. Mass media are partially responsible for the current obesity epidemic evident in our society.

A simple measure with great impact to prevent this problem is a mandatory, annual, BMI and waist circumference measurement, which are indicators of general and central obesity. This should be reported to parents with its proper interpretation as a measurement of the health status of their children. The purpose is to maintain these anthropometric parameters within healthy limits and work together, both in school and at home to eliminate obesity-related risks in the short and long term.

It is important to mention that nutritional deficiency diseases as well as emergent nutritional diseases have as a common factor that they can be prevented if the practice of medicine is aligned with health problems and lifestyles are modified. It is clear that the obesity epidemic is a health problem, but it is not a medical responsibility. Parents and families participate as well as food producers and advertisers. Government employees also have some responsibility because, as social leaders, they are not realizing that we live in obesogenic environments. We urgently need national strategies, technically well done, that involve all the societal players with the purpose of improving lifestyles and gradually reducing harmful environments. Eating practices will have to adapt, as much as possible, to our population genetics, using healthy foods and eliminating sedentarism as a lifestyle in order to promote well-being.

Correspondence to: Samuel Flores Huerta
Departamento de Investigación en Salud Comunitaria
Hospital Infantil de México Federico Gómez, SSa
México, D.F., México
E-mail: floreshuertamd@yahoo.com

References

1. Olaíz-Fernández G, Rivera-Dommarco J, Shama-Levy T, Rojas R, Villalpando-Hernández S, Hernández-Ávila M, et al. Encuesta Nacional de Salud y Nutrición. Cuernavaca, México: Instituto Nacional de Salud Pública; 2006.
2. Schack-Nielsen L, Michaelsen KF. Advances in our understanding of the biology of human milk and its effects on the offspring. J Nutr 2007;137:503S-510S.
3. WHO. Child Growth Standards. www.who.int/childgrowth (accessed 2006).
4. Caspi A, Williams B, Kim-Cohen J, Craig IW, Milne BJ, Poulton R, et al. Moderation of breastfeeding effects on the IQ by genetic variation in fatty acid metabolism. www.pnas.org/cgi/content/full/0704292104/DC1 (accessed: 2007.
5. American Academy of Pediatrics. Policy Statement. Breastfeeding and the use of human milk. Pediatrics 2005;115:496-506.
6. Flores-Huerta S, Ramos-Hernández RI, Flores-Hernández S, Villa-Contreras S, Martínez-Salgado H. Síndrome de muerte súbita del lactante. Prevención en la práctica hospitalaria. Rev Med Inst Mex Seguro Soc 2006;44:511-518.
7. Heird WC. Progress in promoting breast-feeding, combating malnutrition, and composition and use of infant formula 1981-2006. J Nutr 2007;137:499S-502S.
8. Dewey KG. Is breastfeeding protective against child obesity? J Hum Lact 2003;19:9-18.
9. Martin RM, Ness AR, Gunnell D, Emmett P, George Davey Smith for the ALSPAC Study Team. Does breast-feeding in infancy lower blood pressure in childhood? The Avon longitudinal study of parents and children (ALSPAC). Circulation 2004;109:1259-1266.
10. Navarro-Estrella M, Duque-López MX, Pérez JAT. Factores que influyen en el abandono temprano de la lactancia por mujeres trabajadoras. Salud Pública Mex 2003;45:276-284.
11. González-Cossío T, Moreno-Macías H, Rivera JA, Villalpando S, Shamah-Levy T, Monterrubio EA, et al. Prácticas de lactancia materna en México: resultados de la Segunda Encuesta Nacional de Nutrición 1999. Salud Pública Mex 2003;45(suppl 4):S477-S489.
12. World Health Organization. International code of marketing of breast-milk substitutes. Geneva: WHO; 1981.
13. Flores-Huerta S, Martínez-Andrade G, Toussaint G, Adell-Gras A, Copto-García A. Alimentación complementaria en los niños mayores de seis meses de edad. Bases técnicas. Bol Med Hosp Infant Mex 2006;63: 129-144.
14. Duque X, Flores-Hernández S, Flores-Huerta S, Méndez-Ramírez I, Muñoz S, Turnbull B, et al. Prevalence of anemia and deficiency of iron, folic acid, and zinc in children under 2 years of age and beneficiaries of the Mexican Social Security Institute. BMC Public Health 2007;7:345.
15. Flores-Huerta S, Martínez-Salgado H. Prácticas de alimentación, estado de nutrición y cuidados a la salud en niños menores de 2 años en México. México: IMSS; 2004.
16. Flores-Huerta S, Acosta-Cázares B, Rendón-Macías ME, Klünder-Klünder M, Gutiérrez-Trujillo G. ENCOPREVENIMSS 2003, 2004 y 2005. 5. Consumo de alimentos saludables, o con riesgo para la salud, 2004. Rev Med Inst Mex Seguro Soc 2006;(44 Suppl 1):S63-S78.
17. WHO. Guiding principles for feeding non-breastfed children 6-24 months of age. Geneva: World Health Organization; 2005.
18. American Academy of Pediatrics. Pediatric Nutrition. Handbook Village, IL: American Academy of Pediatrics; 2004.
19. Rivera JA, Muñoz-Hernández O, Rosas-Peralta M, Aguilar-Salinas CA, Popkin BM, Willett WC. Consumo de bebidas para una vida saludable: recomendaciones para la población mexicana. Salud Pública Mex 2008;50:173-195.
20. WHO Expert Committee. Physical status: The use and interpretation of anthropometry. Geneva: World Health Organization; 1995.
21. De Onis M, Wijnhoven TMA, Onyango AW. Worldwide practices in child growth monitoring. J Pediatr 2004;144:461-465.
22. Fernández JR, Redden DT, Pietrobelli A, Allison DB. Waist circumference percentiles in nationally representative samples of African American, European American, and Mexican American children and adolescents. J Pediatr 2004;145:439-444.
23. Janssen I, Katzmarzyk PT, Ross R. Waist circumference and not body mass index explains obesity related health risk. Am J Clin Nutr 2004;79:379-384.
24. Kuczmarski RJ, Ogden CL, Guo SS, Grummer-Strawn LM, Flegal KM, Mei Z, et al. 2000 CDC growth charts for the United States: methods and development. National Center for Health Statistics. Vital Health Stat 11. 2002; 246.
25. United Nations Children's Fund, World Health Organization. Low birth weight: country, regional and global estimates. New York: UNICEF; 2004.
26. World Health Organization. Geneva: World Health Statistics; 2007.
27. ACC/SCN. Low birth weight: Report of a meeting in Dhaka, Bangladesh on 14-17 June 1999. In: Pojda J, Kelley L, eds. Geneva, Switzerland: WHO Sub-Committee on Nutrition; 2000.
28. WHO. Feto-maternal nutrition and low birth weight. Denmark: WHO; 2001.
29. Bhutta ZqA, Ahmed T, Black RE, Cousens S, Dewey K, Giugliani E, et al. Maternal and child under nutrition 3. What works? Interventions for maternal and child under nutrition and survival. www.thelancet.com (published online January 17; 2008. DOI:10.1016/S0140-6736(07)61693-6).
30. Barker DJP. Fetal origins of coronary heart disease. BMJ 1995;311:171-174.

31. Barker DJP. The fetal origins of type 2 diabetes mellitus. Ann Intern Med 1999;130:322-324.
32. Strauss R. Iron deficiency, infections, and immune function: a reassessment. Am J Clin Nutr 1978;31:660-666.
33. Beard J. Iron biology in immune function, muscle metabolism and neuronal functioning. J Nutr 2001;131:565S-580S.
34. Walter T. Infancy: mental and motor development. Am J Clin Nutr 1989;50:655-666.
35. Duque-López X, Flores-Hernández S, García-Morales RA, Mendoza-Ortiz ME, Méndez-Ramírez I, Flores-Huerta S, et al. Prevalencia de anemia, deficiencia de hierro, ácido fólico y cinc. México: IMSS; 2004. p. 185-200.
36. Rivera-Dommarco J, Shama-Levy T, Villalpando-Hernández S, González-de Cossio T, Hernández-Prado B, Sepúlveda J. Encuesta Nacional de Nutrición 1999. Estado Nutricio de Niños y Mujeres en México. Cuernavaca, Morelos, México: Instituto Nacional de Salud Pública; 2001.
37. Ximena-Duque X, Flores S, Flores-Huerta S, Méndez-Ramírez I, Muñoz S, Turnbull B, et al. Prevalence of anemia and deficiency of iron, folic acid, and zinc in children under 2 years of age and beneficiaries of the Mexican Social Security Institute. BMC Public Health 2007;7:345.
38. Gutiérrez G, Acosta B, Pérez L, Aranda J, Medina I, Turrubiarte N, et al. Programas Integrados de Salud. Encuesta Nacional de Coberturas 2003, 2004, 2005, 2006. México: Instituto Mexicano del Seguro Social; 2006.
39. American Academy of Pediatrics, Committee on Nutrition. Iron fortification of infant formulas. Pediatrics 1999;104:119-123.
40. Saarinen UM, Siimes MA, Dallman PR. Iron absorption in infants: high bioavailability of breast milk as indicated by extrinsic tag method of iron absorption and by the concentration of serum ferritin. J Pediatr 1977;91:36-39.
41. National Institute of Health. Dietary supplement fact sheet: Iron. Office of dietary supplements: NIH Clinical Center; 2004.
42. Rivera JA, Sotre-Alvarez D, Habitcht JP, Shama T, Villalpando S. Impact of the Mexican program for education, health and nutrition (Progresa) on rates of growth and anemia in infants and young children. A randomized effectiveness study JAMA 2004;291:2563-2570.
43. Chaparro C, Neufeld L, Tena G, Eguía R, Dewey K. Effect of timing of umbilical cord clamping on iron status in Mexican infants: a randomized controlled trial. Lancet 2006;367:1997-2004.
44. Mannar MV. Successful food-based programmes, supplementation and fortification. J Pediatr Gastroenterol Nutr 2006;43(suppl 3):S47-53.
45. Olivares MG. Suplementación con hierro. Rev Chil Nutr 2004;31:272-275.
46. Medicine Io. Iron deficiency anemia: recommended guidelines for the prevention, detection and management among U.S. children and women of childbearing age. Washington: National Academy Press; 1993.
47. Tee ES, Kandiah M, Awin N, Chong SM, Satgunasingam N, Kamarudin L, et al. School-administered weekly iron-folate supplements improve hemoglobin and ferritin concentrations in Malaysian adolescent girls. Am J Clin Nutr 1999;69:1249-1256.
48. Viteri FE. A new concept in the control of iron deficiency: community-based preventive supplementation of at risk groups by the weekly intake of iron supplements. Bio Env Sci 1998;11:46-60.
49. Villalpando S, Montalvo-Velarde I, Zambrano N, García-Guerra A, Ramírez-Silva CI. Vitamins A, and C, and folate status in Mexican children under 12 years and women 12-49 years: a probabilistic national survey. Salud Pública Mex 2003;45(suppl 4):S508-S519.
50. International zinc nutrition consultative group (IZiNCG). Assessment of the risk of zinc deficiency in populations and options for its control. Food and Nutrition Bulletin; 2004. pp. S141-S204.
51. Singh M. Role of micronutrient for physical growth and mental development. Indian J Pediatr 2004;71: 59-62.
52. Brown KH, Peerson JM, Rivera J, Allen LH. Effect of supplemental zinc on the growth and serum zinc concentrations of prepubertal children: a meta-analysis of randomized controlled trials. Am J Clin Nutr 2002;75:1062-1071.
53. Merialdi GCM, Villar J, Abalos E, Metin GA, Rkamdo I. Nutritional interventions during pregnancy for the prevention or treatment of impaired fetal growth: an overview of randomized controlled Trials. J Nutr 2003;133:1626S-1631S.
54. Gillman MW, Rifas-Shiman SL, Camargo CA Jr, Berkey CS, Frazier AL, Rockett HR, et al. Risk of overweight among adolescents who were breastfed as infants. JAMA 2001;285:2461-2467.
55. Toschke AM, Martin RM, von Kries R, Wells J, Smith GD. Infant feeding method and obesity: body mass index and dual-energy X-ray absorptiometry measurements at 9-10 y of age from the Avon Longitudinal Study of Parents and Children (ALSPAC). Am J Clin Nutr 2007;85:1578-1585.
56. Weyermann M, Rothenbacher DHB. Duration of breastfeeding and risk of overweight in childhood: a prospective birth cohort study from Germany. Int J Obes 2006;30:1281-1287.
57. American Heart Association, Gidding SS, Dennison BA, Birch L, Daniels SR, Gilman MW, et al. Dietary Recommendations for Children and Adolescents: A Guide for Practitioners. Pediatrics 2006;117:544-559.
58. Gidding SS, Dennison BA, Birch LL, Daniels SR, Gilman MW, Lichtenstein AH, et al. Dietary Recommendations for Children and Adolescents. A guide for practitioners. Circulation 2005;112:2061-2075.
59. FAO, Gobierno de Chile, Universidad de Chile, INTA. Educación en alimentación y nutrición para la enseñanza básica. Santiago: Universidad de Chile; 2003.