

## PROMOTION OF CARDIOVASCULAR HEALTH AND PREVENTION FROM EARLY STAGES OF LIFE

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### Current state of knowledge

Cardiovascular disease is not a major cause of mortality among children and adolescents; however, currently, there is compelling evidence signaling that the onset of the atherosclerotic process begins at early ages, long before coronary or cerebrovascular symptoms manifest<sup>1,2</sup>.

Several studies support the association between the quality of the environment during early stages and the risk of future disease in adulthood. Additionally, the adoption of specific behaviors and habits from childhood become cardiovascular risk factors since early ages<sup>1,3-5,8</sup>.

Familial background is of utmost importance, since the presence of a family history of cardiovascular disease, especially with an early onset, is considered a non-modifiable but highly relevant risk factor in the detection of children and families with an increased risk of cardiovascular disease<sup>5-8</sup>.

During the lockdown period necessary to reduce the spread of COVID-19 pandemic, children and adolescents had to stay at home, leading to an increase in modifiable cardiovascular risk factors in the pediatric age group. This was evident by both weight gain and increased sedentary behaviors, as well as an increase in unhealthy eating habits<sup>9</sup>.

Regarding cardiovascular disease prevention in childhood, the focus is primarily on the primordial and primary levels of prevention. Primordial prevention aims to avoid the appearance of risk factors for atherosclerosis, while primary prevention, once these risk factors are present, aims to their reduction and the prevention of their progression towards disease<sup>4, 10-12</sup>.

### Disease onset in early life stages

Traditionally, chronic non-communicable diseases were considered the result of a specific genetic profile combined with lifestyle choices in adulthood.

There is a close interplay between genes and the environment, with current recognition of the significance of the early pre- and postnatal environment in determining

susceptibility to the development of non-communicable diseases throughout life<sup>13</sup>.

The concept of DOHaD, which stands for Developmental Origins of Health and Disease, refers to the critical period from conception to the first years of life. This paradigm links adult health status and disease risk to the environmental conditions an individual experienced during the early stages of development<sup>8</sup>.

Other fundamental concept is fetal programming or developmental programming, suggesting that certain adverse events occurring at critical moments of development (particularly during the prenatal stage) can lead to permanent and long-term effects. This concept is based on Barker's hypothesis, proposed in 1995, stating that fetal malnutrition, not only affects fetal growth, but also induces postnatal metabolic changes that predispose to chronic disease in adulthood<sup>8,14</sup>.

Epigenetic modifications involve changes in deoxyribonucleic acid (DNA) and histones, but not in the nucleotide sequence, that modify gene expression giving rise to different phenotypes. Modifications in the chromatin can favor or inhibit specific gene expression. Although these epigenetic signals can be inherited, the process is dynamic and reversible, and tend to stabilize with age<sup>14</sup>.

The first 1000 days of life, spanning from gestation to the first two years of age, constitute the most sensitive period for epigenetic modifications and alterations in developmental programming that will have effects throughout life. An example of this is the well demonstrated association between low birth weight, as a consequence of an adverse prenatal nutritional environment, and cardiovascular disease in adulthood<sup>13,14</sup>.

### Recommendations

Due to the early occurrence of the initial lesions leading to the development of cardiovascular disease, it is essential to initiate healthy lifestyles since early childhood to improve adult health status<sup>15-18</sup>.

To start early prevention strategies in families with high atherogenic risk, it is crucial to know and identify risk factors and family history of cardiovascular disease. Therefore, it is recommended that every medical consultation include targeted anamnesis to gather information about personal and family history of these factors<sup>5-7</sup>.

### **Recommendations on diet, overweight and obesity<sup>4-6</sup>**

- Promote breastfeeding for at least the first 12 months of life, if possible, for the first 24 months, with exclusive breastfeeding recommended ideally for the first 6 months.

- Recommend the introduction of complementary feeding gradually from 6 months of age, according to the infant's age and development.

- Encourage family meals in a relaxed environment, favorable to communication, without screens or other distractions.

- Suggest minimizing or eliminating the consumption of sodas, juices, or other sugary beverages.

- Promote the consumption of fruits and vegetables.

- Recommend four main meals per day, highlighting the importance of breakfast.

- Suggest the consumption of skimmed milk and its derivatives, starting at 2 years of age.

- Discourage daily consumption of high-calorie foods and off-schedule meals.

- Encourage a total caloric intake that does not exceed the necessary requirements to guarantee adequate growth.

- Suggest controlling portion sizes.

- Recommend maintaining a healthy body weight with a body mass index below the 85th percentile for age.

- Involve the whole family in lifestyle changes.

### **Recommendations on high blood pressure, dyslipidemia, and diabetes<sup>4-6</sup>**

- Monitor blood pressure at each pediatric routine visit from the age of 3 years or earlier (if the child has risk factors).

- Discourage foods with preservatives and excessive sodium content.

- Suggest removing the saltshaker from the table.

- Recommend the consumption of lean meats and healthy fats.

- Discourage the consumption of high-fat foods.

- Recommend the use of raw oils and discourage cooking methods with excessive fats.

- Determine blood glucose, post-load blood glucose, or glycosylated hemoglobin in children over 10 years old with a body mass index above the 85th percentile for sex and age associated with two risk factors (family history of type 2 diabetes mellitus, signs of insulin resistance, hypertension, dyslipidemia, polycystic ovary syndrome).

- Maintain appropriate blood glucose and glycosylated hemoglobin levels.

- Routine assessment of lipids and lipoproteins is suggested for children and adolescents at 2 moments: between 6-11 years and between 17-21 years.

- Lipids and lipoproteins assessment is recommended for children with family history and with risk factors or comorbidities at any age, other than those mentioned in the previous paragraph.

### **Recommendations on physical activity and sedentary lifestyle<sup>4-6, 17</sup>**

- Encourage parents to be role models for their children by leading physically active lives themselves.

- Recommend family activities that include appropriate physical activity for all family members.

- Promote active play in safe environments tailored to the age group.

- Advocate for limiting sedentary screen time to a maximum of 2 hours or less per day for children over 5 years old and less than 1 hour for children between 2 and 4 years old. For infants aged 0 to 2 years, screen time should be discouraged.

- Encourage participation in recreational and/or sports physical activities appropriate for the child's age and developmental stage.

### **Recommendations on tobacco and alcohol consumption<sup>4-6</sup>**

- Explain the meaning of passive smoking and its harmful health consequences.

- Encourage smoke-free environments at home and other places frequented by children.

- Discourage smoking near children and pregnant individuals.

- Provide parents assistance for smoking cessation.

- Discuss with children and adolescents the harmful consequences of smoking.

- Strongly discourage and demotivate the initiation of smoking and encourage quitting for current smokers.

- Talk to children and adolescents about the harmful consequences of alcohol consumption.

- Strongly discourage alcohol consumption at early ages.

## Recommendations related to maternal health and pregnancy control<sup>1, 5, 6, 17</sup>

- Conduct regular periodic prenatal check-ups with the aim of optimizing weight gain and early detection of gestational diabetes and high blood pressure.
- Recommend starting pregnancy with an adequate weight.
- Advise on a healthy diet with micronutrient supplementation according to medical indication.
- Recommend, when there are no contraindications, regular moderate-intensity physical activity, at least 150 minutes per week (including aerobic activity, muscle-strengthening exercises, and gentle stretching).
- Consider factors such as a history of diabetes, hypertension, or maternal obesity during pregnancy as contributors to an increased risk profile for cardiovascular disease in adulthood. Emphasize the importance of a healthy diet and lifestyle from birth for the child and their entire family.
- Implement interventions for smoking cessation as early as possible during pregnancy and maintain the cessation after birth.
- Inform about the risks associated with the consumption of alcohol, drugs, and tobacco; explicitly advise against the consumption of these substances during pregnancy and breastfeeding and highlight the negative effects of passive exposure to tobacco.
- Inform about the benefits of breastfeeding as a protective factor for the mother, contributing to reducing the development of risk factors for cardiovascular disease in later stages of life.

## Conclusion

Any effort made to reduce premature mortality and morbidity from cardiovascular disease should focus on primordial prevention, meaning preventing the development of risk factors, and primary prevention, reducing these risk factors when appear.

Considering that family medical history is an unmodifiable factor, its detection and recognition are essential with the goal of educating, raising awareness, and guiding the entire family group toward the prevention of modifiable risk factors. Healthy habits are established from childhood, and it is crucial to identify cardiovascular disease risk factors amenable to intervention in childhood and adolescence. Furthermore, children are more willing to learn and modify their habits, making childhood an ideal stage to address these issues, especially in individuals or families where multiple mentioned risk factors tend to cluster.

Due to the influence of early childhood experiences, including those occurring before conception, on health

and their association with the onset of non-communicable diseases, efforts in prevention and health promotion should focus on ensuring the adequate nutritional needs of pregnant women and young children, creating a favorable parenting environment, preventing exposure to environmental toxins, chronic stress, and an adverse environment.

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