



SPECIAL ARTICLE

Taking a closer look at the early onset of childhood obesity risk

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Abstract Epidemiological studies and studies in animal models have demonstrated the importance of the early stages of life and their relationship with health and disease in adulthood. Intervening in the risk of adult diseases by acting early in life is possible due to the great plasticity of this period, when timely actions can have a great impact. These would be aimed at reducing risk factors which would help to break the intergenerational vicious circles of maternal and childhood obesity, diabetes and related cardiometabolic health consequences, with a potential impact on the next generation.

Obesity in children and adolescents is a global health problem whose prevalence is increasing. When it comes to the risk of developing childhood obesity, the periods from conception and pregnancy through the end of the first 2 years of life are particularly relevant. Despite the special relevance of this stage, it has not always received the attention it deserves, and the approach at this time not free of difficulties.

Due to their importance, each of these stages requires specific approaches. Education on the concept of the relevance of healthy lifestyles during this period should be delivered not only to health care personnel but also to the general population.

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PALABRAS CLAVE

Orígenes;
Riesgo;
Obesidad;
Infantil

Reflexiones sobre los orígenes del riesgo de obesidad infantil

Resumen Estudios epidemiológicos y en modelos animales han demostrado la importancia de las etapas precoces de la vida y su relación con la salud y la enfermedad en la edad adulta. La posibilidad de intervenir en el riesgo de enfermedades de la edad adulta actuando

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en etapas tempranas de la vida, es posible debido a la gran plasticidad de este periodo, en donde acciones oportunas pueden tener un gran impacto. Estas estarían orientadas a reducir los factores de riesgo lo que ayudaría a interrumpir los círculos viciosos intergeneracionales de obesidad materna e infantil, la diabetes y las consecuencias de salud cardiometabólicas relacionadas, con potencial impacto sobre la siguiente generación.

La obesidad en niños y adolescentes es un problema de salud mundial con una prevalencia creciente. En el riesgo de desarrollo de la obesidad infantil cobran especial relevancia los periodos que comprenden desde la concepción, el embarazo y hasta el final de los primeros 2 años de vida. Aunque esta etapa tiene una especial relevancia no siempre ha recibido la atención merecida y su abordaje no está exento de dificultades.

La importancia de cada una de las etapas requiere abordajes específicos. La formación sobre el concepto de la relevancia de los estilos de vida saludables durante este periodo debe transmitirse no solo al personal sanitario sino también a la población general.

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Introduction

Since Barker et al. found evidence of an association between the birth weight resulting from the course of intrauterine development and cardiovascular disease in adulthood (1989),¹ several epidemiological studies and animal models have proven the importance of the early stages of life in relation to adult health and disease.² Modifying the risk of adult diseases by acting during early stages of life is possible thanks to the great plasticity of that period, during which appropriate interventions can have a substantial impact. These interventions would seek to reduce risk factors in order to break intergenerational vicious cycles of maternal and childhood obesity and diabetes and their cardiometabolic repercussions, with a potential impact on the following generation. In this context, studies are needed to determine the optimal postnatal management of these children and the potential to correct for antenatal adverse conditions and events. While this paradigm is appealing, some of the challenges it poses include determining the magnitude and possibility of modifying the development of these risk factors. The theory of fetal programming also applies to childhood obesity (Fig. 1).

The aim of our study was to identify the early roots of childhood obesity, including the periods of preconception, gestation and the first two years of life. To this end, we chose to perform a narrative review including meta-analyses, systematic reviews, randomized controlled trials and the contents of clinical practice guidelines. We analyzed each of the periods of interest, exploring their relevance in the risk of childhood and adolescent obesity, existing barriers and difficulties and the measures that could be implemented to improve risk in each period.

Epidemiology of obesity

Childhood and adolescent obesity is a global health problem whose prevalence is increasing. Childhood obesity is asso-

ciated with comorbidities that involve nearly every organ system, including, among others, the endocrine, gastrointestinal, respiratory, cardiovascular and musculoskeletal systems, in addition to medical and surgical interventions that may be required due to various clinical conditions.³ Childhood obesity is likely to extend into adulthood.⁴

Focusing on the population aged 5 to 19 years, in 2020 there were 158 million children with obesity, a figure that increased to 206 million in 2025 and is expected to increase to 254 million by 2030.⁵ The population under 5 years is also affected, as, indeed, 35 million children aged less than 5 years had excess weight, of varying severity, in 2024.⁶ In Spain, the Aladino study, conducted in children aged 6 to 9 years and published in 2023, found that 20% of children had excess weight and 16% obesity.⁷

The first 1000 days of life, encompassing conception, gestation and up to two years post birth, are particularly important for the risk of childhood obesity. Despite the importance of this critical window, it has not always received the attention it deserves and intervention during it can present several difficulties. It is divided in three periods: preconception, gestation and postnatal period, the relevance of which has not always been clear and during which there may be barriers to corrective interventions that are not yet well understood.

We proceed to analyze each of these periods, exploring their relevance for the risk of childhood and adolescent obesity, the barriers and difficulties they pose for intervention and the measures that could be implemented to reduce risk in each of them.

Preconception

Evidence on the impact on the risk of childhood obesity

Within the first 1000 days period, several studies have demonstrated the importance of maternal body mass index

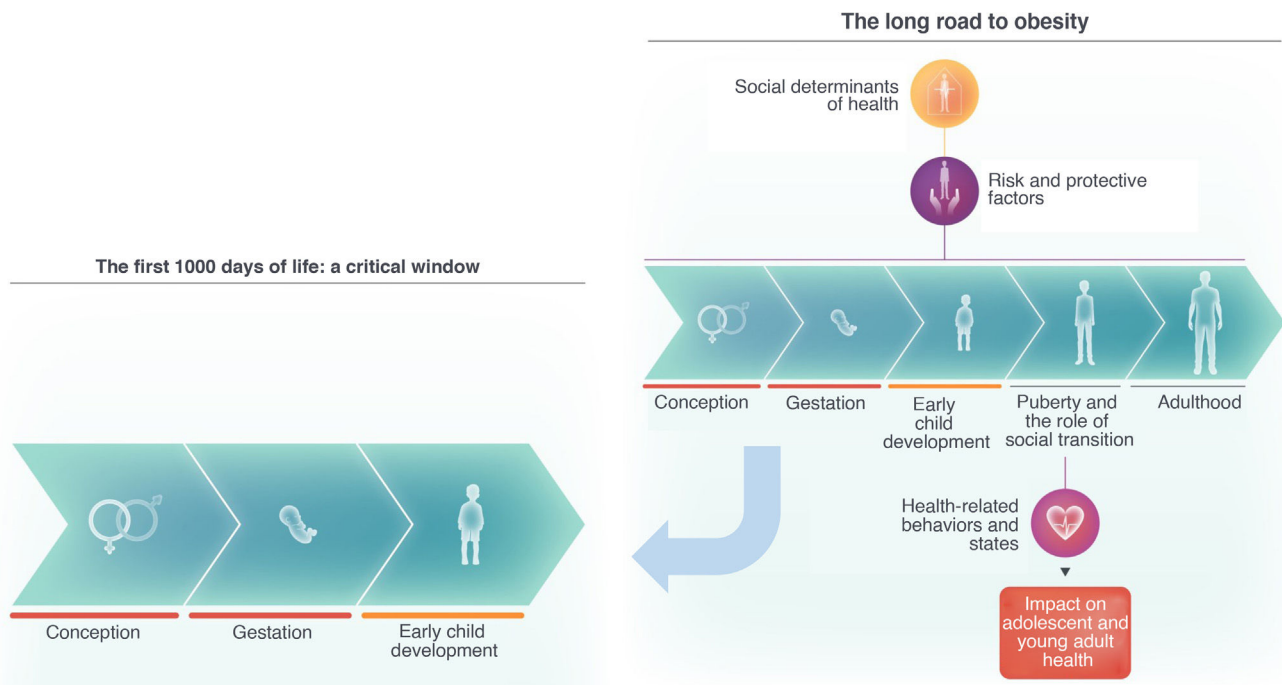


Fig. 1 The long road to obesity. The first 1000 days: a critical window.

(BMI) at the time of conception in relation to the development of obesity in the offspring.^{8–10}

The prevalence of maternal obesity at the start of pregnancy ranges between a minimum of 7% in Poland and a maximum of 25% in the United Kingdom, followed by Ireland and Spain.¹¹ The impact of the maternal BMI status before on the risk of developing obesity in the offspring was evaluated in a meta-analysis that included 79 studies.¹² This meta-analysis found that the risk of obesity increased with maternal BMI.

Another study assessed the impact of maternal BMI at different stages of child development, including the periods from 2 to 5 years, 5 to 10 years and 10 to 18 years. The impact of maternal BMI was found to increase with the child's age. The fact that the impact increases with the age of the offspring could reflect either manifestation of fetal programming mechanisms as the child grows or be explained by lifestyle factors throughout the years.¹³

Keeping in mind that the mother should not lose weight once she is pregnant, since there is an increased risk of excessive weight gain during gestation in mothers who are overweight or obese, the goal is to prevent excessive gestational weight gain.^{14,15}

Barriers to risk reduction

At this stage, the barriers encountered have to do with women not identifying themselves as members of a high-risk group or in a specific stage of life, when in fact it is a significant transitional period, with the establishment of close relationships and cohabitation, that may pose barriers to the maintenance of an adequate lifestyle.¹²

Potential interventions aimed at reducing risk

Interventions must focus on the establishment of a balanced diet and achieving a healthy weight. There is evidence that an active lifestyle during pregnancy is beneficial to fetal development and reduces the risk of excessive weight gain during pregnancy.

Gestation

Evidence on the impact on the risk of childhood obesity

Maternal obesity is an important risk factor during gestation, both on account of the adverse effects on the pregnancy and its association with deleterious effects on long-term health in both mother and offspring. Obesity during pregnancy is one of the most important health problems in women on account of its high prevalence, in addition to the increased risk of complications during pregnancy, such as gestational diabetes, preeclampsia, high blood pressure and large for gestational age status. The latter is particularly relevant, as infants born large for gestational age have an increased fat mass and increased risk of future obesity. It is estimated that children born to mothers with obesity, with or without gestational diabetes, have a 3.1-fold greater risk of developing obesity, perpetuating the intergenerational transmission of this metabolic disorder.¹⁶ There is also evidence that smoking during pregnancy increases the risk of excess weight in the offspring.¹⁷

However, maternal obesity is not the sole risk factor for the offspring, and excessive weight gain should also be considered in relation to potential risk.^{14,15} The analysis of differences in the BMI of offspring in relation to mater-

nal weight gain during pregnancy show that as weight gain increases, so does the offspring BMI.¹³ Maternal BMI at the time of conception and maternal weight gain during gestation are independent predictors of adverse events during pregnancy in both the mother and the child.^{18,19} Gestational weight gain is a determinant of fetal growth and can have an impact on the future metabolic health of the offspring. Outside of the existing epidemiological evidence, the molecular mechanisms leading to these deleterious effects on the health of the offspring remain unknown. However, there is growing evidence that genes, epigenetics and the intrauterine environment can affect the risk of obesity in the child.²⁰

Previous studies carried out by our group analyzed the results of metabolomic profiling of umbilical cord blood in newborn infants. These profiles reflect what has taken place during intrauterine life. The objective was to identify metabolites in the offspring related to gestational weight gain, revealing that lactate and leucine were the metabolites most strongly associated with maternal weight gain during pregnancy. Both of these metabolites have been associated with metabolic abnormalities in both the general and the obese populations.²¹

Another study assessed postnatal epigenetic alterations in the offspring in association to maternal metabolic status during gestation. These changes affect gene regulation and are involved in the development of multiple diseases with a substantial social impact, such as obesity. These changes involve genes and regulatory pathways of fatty acid metabolism, cardiovascular signaling or mitochondrial bioenergetics, crucial processes in obesity and diabetes. The fact that these alterations can be detected in peripheral blood supports the notion that maternal metabolism has a systemic impact on child development.²²

Barriers to risk reduction

Considering all of the above, it is essential to fight against stigma and promote an inclusive, respectful and nonjudgmental language in discussing with mothers the optimal gestational weight gain and the lifestyle habits that should be adopted, in addition to the strategy to achieve these goals.

The barriers encountered at this time point are the potential lack of prenatal care and controversies regarding appropriate management,¹¹ in addition to the diffusion of myths on several aspects, such as having to "eat for two" to ensure the fetus gets enough calories or that exercise may be harmful during pregnancy.^{23,24}

Potential interventions aimed at reducing risk:

Interventions should focus on diet, physical activity, adequate sleep and avoiding stress.²⁵⁻²⁷

Diet: structured diet with healthy foods, avoiding alcohol, tobacco and other toxic substances.

Exercise: safe and recommended during pregnancy (walking, swimming, prenatal yoga).

Sleep: aim for 7 to 9 hours of sleep per night.

All of these strategies should be implemented under the guidance of health care professionals with expertise on the particular area.

Social and family support are also necessary, especially from the partner, to change lifestyle habits.

Postnatal period up to age 2 years

Evidence of the impact on the risk of childhood obesity

The postnatal period up to the end of the second year of life is the third window to consider. A prospective study analyzed the probability of overweight at age 3 years according to four modifiable risk factors, two of them maternal and the other two related to the child in the first year of life.²⁸ The maternal factors were smoking during pregnancy and excessive gestational weight gain and the child-related factors were whether the child had breastfed for at least 12 months or less and slept a mean of at least 12 hours a day or less. The authors calculated the probabilities of overweight at age 3 years in relation to the 16 possible combinations of the four factors, which ranged from 6% in children exposed to favorable levels of all four factors to 29% in children with adverse levels of all four.

The broad range of the risk of overweight suggests that interventions aimed at modifying these factors could have a substantial impact in the prevention of childhood obesity and its consequences. More so if we consider that, in this prospective study, 9.8% of mothers smoked during pregnancy and 50% had excessive weight gain. Seventy-three percent of infants breastfed for less than 12 months and 31% slept less than 12 hours a day on average. The study demonstrated the degree to which adverse levels of each of the four risk factors were independently associated with overweight at age 3 years.²⁸

Barriers to risk reduction

The barriers involve the lack of follow-up or checkups in the postnatal period.

Potential interventions aimed at reducing risk

Infant nutrition: exclusive breastfeeding for a minimum of six months.²⁹ From age six months, progressive introduction of complementary feeding. If possible, continue breastfeeding through age 2 years or for as long as the mother desires.³⁰

The child should be active a minimum of 30 minutes a day. Parents should promote a variety of physical activities, including interactive play, tummy time when the infant is awake to strengthen muscles and exploration of the environment in the first year of life. Prolonged sedentary behavior and any exposure to screens should be avoided.³¹ The infant should sleep a minimum of 12 hours a day in the first year of life.

Conclusion

Several factors in the early stages of life can increase the risk of childhood obesity, even during preconception, gestation and through the end of the second year of life. Pregnancy is a critical period in human life that has direct repercussions in the predisposition to the future development of cardiometabolic diseases. Disorders such as maternal obesity can affect the health of the offspring from childhood to adulthood, increasing the risk of obesity and its comorbidities.

ties, which in turn reduce quality of life and life expectancy. An adequate maternal weight before conception and avoiding excessive weight gain and smoking during pregnancy, in addition to achieving adequate weight gain in the infant and adherence to current childhood lifestyle recommendations, could help prevent childhood obesity.

The importance of each of these stages calls for specific approaches. Pregnancy and the first two years of life are generally supervised by health care professionals, although the outcomes achieved to date need to improve. Education on the relevance of healthy lifestyle habits during this critical window should be provided not only to health care professionals but also to the general population.

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Conflicts of interest

The authors have no conflicts of interest to declare.

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