Early life 1000 days: opportunities for preventing adult diseases

Juan Juan, Huixia Yang

Department of Obstetrics and Gynecology, Peking University First Hospital, Beijing 100034, China.

With the rapid socioeconomic development, improvements in living standards, and changes in lifestyle, adult diseases, such as cardiovascular diseases, type 2 diabetes mellitus (T2DM), hypertension, obesity, and so on, are increasing dramatically over the past decades, which have caused a huge economic and health burden at both population and individual levels in China.[1] The increased burden of adult diseases has become the main public health issue, and prevention of adult diseases in China has become a formidable task during recent years. In 2016, China has put forward the concept of whole life-course health and efforts have been made on shifting the focus from treating diseases to prevention. In view of the poor effects of prevention of diseases in adulthood, it is suggested that prevention and management of adult diseases should be extended to early life, which is the critical window for physiological programming and has profound and enduring effects on the whole life-cycle health.[2-4] In 2018, an article named "To Prevent Cardiovascular Disease, Pay Attention to Pregnancy Complications" published in Journal of the American Medical Association (JAMA) also illustrated that pregnancy is a window to future health.[5]

As illustrated by the well-known Developmental Origins of Health and Disease (DOHaD) concept, factors in early life stages significantly affect the development of diseases in later life.[6-8] Susceptibility to adult diseases is strongly influenced by intrauterine environment exposure during early development. DOHaD theory provides a new conception and perspective for the prevention of diseases in adulthoods. Based on this theory, substantial evidence has demonstrated the vital role of early life 1000 days and its importance in later life. Early life 1000 days indicates the period from conception to the second postnatal year, which is crucial for the growth and development of offspring.[9] Early life 1000 days is a period where the foundations for optimum health, growth, and development are established and is a "window of opportunity" with high plasticity to efficaciously intervene and reduce the exposure of adverse factors as well as prevent adult diseases.[10] We emphasize and call for more widespread attention to early life 1000 days for the prevention of adult diseases epidemic in China.

The Lancet Series of 2018 acknowledged that maternal overnutrition and obesity, maternal undernutrition, related paternal factors, and the use of assisted reproductive treatment are the four major factors that contributed to the future health.[2-4] Apart from these, environmental factors also play an important role in the health of future life. As there are many factors involved, we mainly focus on the influence of lifestyle (including nutrition and exercise) during early life 1000 days on the long-term health as well as the importance of preconception care, prenatal care, and postnatal care for preventing adult diseases in this review.

Preconception care. As we all know, balanced diet and physical activity during pregnancy are crucial for maternal and child health. However, the importance of preconception period is always being overlooked. It is reported that nutrition status and lifestyle habits of couples with reproductive age before pregnancy also have a lasting impact on maternal and child health.[2-4] The preconception period presents a period of special opportunity for intervention. Identification of people contemplating pregnancy provides a window of opportunity to improve health before conception. A sharper focus on intervention before conception is needed to improve maternal and child health and reduce the growing burden of adult diseases. We call for heightened awareness of preconception healthcare. Health care, balanced diet, and healthy lifestyle should be guaranteed from preconception period and continued throughout the life cycle.[11] However, nowadays women of reproductive age usually overlook preconception period and they do not receive regular physical examination before pregnancy in China, especially in low-resourced rural area of China. According to a population-based cohort study among >6.4 million women aged 20 to 49 years in China, the awareness rate of blood glucose levels and diabetes mellitus status among reproductive-age women before pregnancy is extremely low, and the management of pregestational diabetes

Access this article online

Quick Response Code:

Website: www.cmj.org

DOI: 10.1097/CM9.0000000000001920

Correspondence to: Prof. Huixia Yang, Department of Obstetrics and Gynecology, Peking University First Hospital, Beijing 100034, China
E-Mail: yanghuixia@bjmu.edu.cn

Chinese Medical Journal 2022;135(5)

Received: 11-10-2021; **Online:** 30-12-2021 **Edited by:** Yanjie Yin

mellitus (GDM) remains unsatisfactory, even in patients who are aware of their diabetes mellitus status, which may cause serious adverse maternal and perinatal outcomes.[12] Therefore, all women of reproductive age, especially for those with a history of pregnancy complications, should seek preconception counseling and be encouraged to adopt a balanced diet and lifestyle habits before pregnancy. For instance, women at high risk of overweight and obesity should keep their pre-pregnancy body mass index within a normal range before conception. Women with diabetes or a history of GDM should be educated on healthy lifestyle, balanced diet, and blood glucose monitoring in the preconception period to improve their blood glucose and maintain their blood glucose levels within an appropriate level. Healthcare providers should provide more effective preconception health support for women of reproductive age, so as to help them make adequate preparations for planned pregnancy and excellent pregnancy. In addition, the state and local governments should work together at different levels to carry out publicity activities on preconception care, so as to improve people understanding on the importance of preconception health, and better guide and support couples of reproductive ages through healthy lifestyle, balanced diet, and physical exercise, as well as avoid exposure to environmental harmful substances to ensure and improve the health of preconception.

Prenatal care. It is well established that a healthy lifestyle during pregnancy, including nutrition and exercise, is crucial for maternal and child health.[13,14] Early-life malnutrition, including both undernutrition and overnutrition, could significantly increase the risk of diseases in later life. Overnutrition refers to excessive energy intake, which usually leads to overweight, obesity, and excessive weight gain during pregnancy. Undernutrition is mainly due to insufficient amounts of macronutrient and/or micronutrient or unbalanced dietary intake, which may lead to fetal growth restriction, low birthweight, and so on. It is important to recognize that many nutrients exhibit a U-shaped risk curve, whereby inadequate or excessive amounts both place the individual at risk. Balanced nutrition during early life 1000 days is the guarantee for a good intrauterine environment and the health of infants. We must pay attention to it scientifically and reasonably and strengthen the nutrition education during early life 1000 days.

Studies have shown that a healthy lifestyle is of great significance to ensure appropriate weight gain during pregnancy and decrease the risk of pregnancy complications, including GDM and gestational hypertension, and so on, and further preventing the risk of diabetes and hypertension in later life.[15-18] Women who had gestational hypertension or preeclampsia in their first pregnancy were 2 to 3 times more likely to later develop chronic hypertension compared with women who had normal blood pressure in their first pregnancy. A meta-analysis showed that the overall relative risk for T2DM was almost ten times higher in women with previous GDM than in healthy controls.[19] Therefore, it is important to prevent and control for pregnancy complications by feasible prenatal care, such as effective and first-line preventive strategies including nutrition and exercise intervention to prevent adult diseases. In China, a GDM One-Day Care Program was launched in May 2011 at Peking University First Hospital to educate GDM patients on the basic knowledge of GDM, weight management, medical nutrition therapy, physical exercise advice, and blood glucose self-monitoring methods by professional physicians, nurses, as well as clinical nutritionists. This GDM One-Day Care Program sets a good model for group management of GDM and has been implemented throughout the country as part of the World Diabetes Foundation projects and many hospitals have followed and implemented this model.[20] All pregnant women are encouraged to keep a good lifestyle during pregnancy, and a focus on prenatal care is of great importance for preventing adult diseases.

Postnatal care. In addition to preconception care and prenatal care, we should further strengthen the health care in postnatal period. It is an important period to address intrapartum problems and initiate an intervention for both mothers and their offspring, who are at high risk of diseases in later life. Thus, more attention should also be paid to postnatal period to promote long-term health. It is recommended to conduct the first postnatal care at 6 weeks after childbirth. However, the postnatal care rate is relatively low in China currently, which might owe to multiple barriers, such as lack of self-efficacy and social support, as well as professional knowledge among health providers. Therefore, healthcare providers should cooperate to provide more support for postnatal care. Lifestyle intervention, including a balanced diet and physical activity, is also the most fundamental and effective strategy for postnatal care in preventing adult diseases in the future. Weight retention should be limited among overweight or obese women as postpartum weight retention is associated with lifetime obesity risk and adverse outcomes in the next pregnancy. In addition, glucose tolerance status should be improved. Lifelong screening for the development of T2DM or prediabetes should be performed every 1 to 3 years among women with a history of GDM as a history of GDM is associated with increased risk of T2DM for both mothers and their children.[21] For the infant, Early Essential Newborn Care (EENC), including delayed cord clamping, immediate and sustained skin-to-skin contact, and so on, has been proved to reduce preventable neonatal morbidity and mortality, as well as improve newborns' health. The World Health Organization and the United Nations International Children Emergency Fund (UNICEF) have jointly developed the Action Plan for Healthy Newborn Infants in the Western Pacific Region (2014–2020) to promote the implementation of EENC.[22] A study conducted in 18 counties in four provinces in Western China showed that the exclusive breastfeeding rate increased from 43% to 73% after the implementation of EENC. Therefore, we should further strengthen the health education of EENC and give more policy and technical support to the implementation of EENC, so as to maximize the important role of EENC for newborn health. Moreover, breastfeeding can also confer long-term metabolic benefits and reduce the risk of adult diseases.[23] The UNICEF recommended that breastfeeding should be continued until the second postnatal year, which is the end of early life 1000 days. A prospective cohort study showed

that higher lactation intensity and longer duration were independently associated with lower 2-year incidences of T2DM after GDM pregnancy, which indicates that breastfeeding may prevent T2DM after GDM delivery.[24] Another large cohort study reported that breastfeeding ≥6 months was associated with a decreased risk of childhood overweight at age 2 years.[25] Therefore, breastfeeding should be encouraged through postnatal care.

In conclusion, the early life 1000 days should never be overlooked and it plays a crucial role in the prevention of adult diseases. We should fully recognize the importance of early life and pay more attention to the early life 1000 days, establish healthy intrauterine environment, and reduce the exposure of adverse factors. At the same time, we should further formulate relevant public health strategies and measures to reduce the incidence of overweight and obesity, improve the status of overnutrition and undernutrition, improve life cycle health, and prevent the occurrence of adult diseases by providing more appropriate preconception, prenatal, and postnatal care for women of reproductive age. We believe that, through unremitting efforts, more women and their offspring will be benefited from adequate health care education and healthy lifestyle during early life 1000 days.

Funding

This study was supported by a grant from the Youth Program of National Natural Science Foundation of China (No. 82003528).

Conflicts of interest

None.

References

1. GBD 2017 DALYs and HALE Collaborators. Global, regional, and national disability-adjusted life-years (DALYs) for 359 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet 2018;392:1859–1922. doi: 10.1016/S0140-6736(18)32335-3.
2. Stephenson J, Heslehurst N, Hall J, Schoenaker DAJM, Hutchinson J, Cade JE, *et al*. Before the beginning: nutrition and lifestyle in the preconception period and its importance for future health. Lancet 2018;391:1830–1841. doi: 10.1016/S0140-6736(18)30311-8.
3. Fleming TP, Watkins AJ, Velazquez MA, Mathers JC, Prentice AM, Stephenson J, *et al*. Origins of lifetime health around the time of conception: causes and consequences. Lancet 2018;391:1842–1852. doi: 10.1016/S0140-6736(18)30312-X.
4. Barker M, Dombrowski SU, Colbourn T, Fall CHD, Kriznik NM, Lawrence WT, *et al*. Intervention strategies to improve nutrition and health behaviours before conception. Lancet 2018;391:1853–1864. doi: 10.1016/S0140-6736(18)30313-1.
5. Abbasi J. To prevent cardiovascular disease, pay attention to pregnancy complications. JAMA 2018;320:1741–1743. doi: 10.1001/jama.2018.14645.
6. Barker DJ, Osmond C. Infant mortality, childhood nutrition, and ischaemic heart disease in England and Wales. Lancet 1986;1:1077–1081. doi: 10.1016/s0140-6736(86)91340-1.
7. Barker DJ, Osmond C, Golding J, Kuh D, Wadsworth ME. Growth in utero, blood pressure in childhood and adult life, and mortality from cardiovascular disease. BMJ 1989;298:564–567. doi: 10.1136/bmj.298.6673.564.
8. Barker DJ. Developmental origins of adult health and disease. J Epidemiol Community Health 2004;58:114–115. doi: 10.1136/jech.58.2.114.
9. Schwarzenberg SJ, Georgieff MK. Committee on Nutrition. Advocacy for improving nutrition in the first 1000 days to support childhood development and adult health. Pediatrics 2018;141:e20173716. doi: 10.1542/peds.2017-3716.
10. Bateson P, Barker D, Clutton-Brock T, Deb D, D'Udine B, Foley RA, *et al*. Developmental plasticity and human health. Nature 2004;430:419–421. doi: 10.1038/nature02725.
11. Hanson MA, Bardsley A, De-Regil LM, Moore SE, Oken E, Poston L, *et al*. The International Federation of Gynecology and Obstetrics (FIGO) recommendations on adolescent, preconception, and maternal nutrition: "Think Nutrition First". Int J Gynaecol Obstet 2015;131 (Suppl 4):S213–S253. doi: 10.1016/S0020-7292(15)30034-5.
12. Wei Y, Xu Q, Yang H, Yang Y, Wang L, Chen H, *et al*. Preconception diabetes mellitus and adverse pregnancy outcomes in over 6.4 million women: a population-based cohort study in China. PLoS Med 2019;16:e1002926. doi: 10.1371/journal.pmed.1002926.
13. Zhou LY, Deng MQ, Zhang Q, Xiao XH. Early-life nutrition and metabolic disorders in later life: a new perspective on energy metabolism. Chin Med J (Engl) 2020;133:1961–1970. doi: 10.1097/CM9.0000000000000976.
14. Zheng J, Zhou LY, Xiao XH. Maternal exercise and its beneficial effects on glucose metabolism in offspring. Chin Med J (Engl) 2020;133:863–867. doi: 10.1097/CM9.0000000000000731.
15. International Weight Management in Pregnancy (i-WIP) Collaborative Group. Effect of diet and physical activity based interventions in pregnancy on gestational weight gain and pregnancy outcomes: meta-analysis of individual participant data from randomised trials. BMJ 2017;358:j3119. doi: 10.1136/bmj.j3119.
16. Simmons D, Devlieger R, van Assche A, Jans G, Galjaard S, Corcoy R, *et al*. Effect of physical activity and/or healthy eating on GDM risk: the DALI lifestyle study. J Clin Endocrinol Metab 2017;102:903–913. doi: 10.1210/jc.2016-3455.
17. Wang C, Wei Y, Zhang X, Zhang Y, Xu Q, Sun Y, *et al*. A randomized clinical trial of exercise during pregnancy to prevent gestational diabetes mellitus and improve pregnancy outcome in overweight and obese pregnant women. Am J Obstet Gynecol 2017;216:340–351. doi: 10.1016/j.ajog.2017.01.037.
18. Koivusalo SB, Rönö K, Klemetti MM, Roine RP, Lindström J, Erkkola M, *et al*. Gestational diabetes mellitus can be prevented by lifestyle intervention: the Finnish gestational diabetes prevention study (RADIEL): A randomized controlled trial. Diabetes Care 2016;39:24–30. doi: 10.2337/dc15-0511.
19. Vounzoulaki E, Khunti K, Abner SC, Tan BK, Davies MJ, Gillies CL. Progression to type 2 diabetes in women with a known history of gestational diabetes: systematic review and meta-analysis. BMJ 2020;369:m1361. doi: 10.1136/bmj.m1361.
20. Juan J, Yang H. Prevalence, prevention, and lifestyle intervention of gestational diabetes mellitus in China. Int J Environ Res Public Health 2020;17:9517. doi: 10.3390/ijerph17249517.
21. American Diabetes Association. 14. Management of diabetes in pregnancy: standards of medical care in diabetes-2021. Diabetes Care 2021;44 (Suppl 1):S200–S210. doi: 10.2337/dc21-S014.
22. Obara H, Sobel H. Quality maternal and newborn care to ensure a healthy start for every newborn in the World Health Organization Western Pacific Region. BJOG 2014;121 (Suppl 4):154–159. doi: 10.1111/1471-0528.12943.
23. Stuebe AM, Rich-Edwards JW, Willett WC, Manson JE, Michels KB. Duration of lactation and incidence of type 2 diabetes. JAMA 2005;294:2601–2610. doi: 10.1001/jama.294.20.2601.
24. Gunderson EP, Hurston SR, Ning X, Lo JC, Crites Y, Walton D, *et al*. Study of women, infant feeding and type 2 diabetes after GDM pregnancy investigators. Lactation and progression to type 2 diabetes mellitus after gestational diabetes mellitus: a Prospective Cohort Study. Ann Intern Med 2015;163:889–898. doi: 10.7326/M15-0807.
25. Bider-Canfield Z, Martinez MP, Wang X, Yu W, Bautista MP, Brookey J, *et al*. Maternal obesity, gestational diabetes, breastfeeding and childhood overweight at age 2 years. Pediatr Obes 2017;12:171–178. doi: 10.1111/ijpo.12125.

How to cite this article: Juan J, Yang H. Early life 1000 days: opportunities for preventing adult diseases. Chin Med J 2022;135:516–518. doi: 10.1097/CM9.0000000000001920