How to Feed the Fetus

Ferdinand Haschke

Department of Pediatrics, PMU Salzburg, Salzburg, Austria

Many nutritional risks for maternal and child health begin during the adolescent and young adult years prior to first pregnancy. Because they affect fetal development before the initiation of antenatal care, the arguments for preventive actions in the field of nutrition during the adolescent and young adult years are compelling. Accelerating rates of female obesity have further complicated nutritional risks arising in females between 15 and 25 years so that in many emerging societies, obesity coexists with food insecurity and undernutrition. In 2017, the Nestlé Nutrition Institute provided an unrestricted educational grant to support a series of publications which summarize recent interventions and recommendations in the field of nutrition of young females before and during pregnancy [1, 2]. The supplement “How to Feed the Fetus” addresses short- and long-term consequences of nutrition and health issues before and during pregnancy.

One in 6 pregnancies worldwide is affected by the inability of the mother’s metabolism to maintain normoglycemia. Insulin resistance and insufficient insulin secretion result in gestational diabetes mellitus (GDM). Because of the increasing number of pregnant women with higher body mass index (BMI), the prevalence is likely to increase. In addition to short-term consequences of non- or poorly treated GDM, such as fetal overgrowth, exposure of the fetus to hyperglycemia will predispose the offspring to noncommunicable diseases later in life [3]: the effect of GDM on offspring overweight, obesity, impaired glucose tolerance, and resulting cardio-metabolic disease may be in part triggered by maternal obesity. Maternal

GDM may also be associated with offspring negative health outcomes, such as allergy, and neurocognitive conditions, such as ADHD and autism. GDM as a maternal intrauterine trigger could play a role in influencing offspring long-term outcomes through epigenetic modification of gene function [3]. Human studies indicate a causal relation between GDM and the epigenetic regulation of the leptin gene, which could explain offspring adiposity. Furthermore, GDM and altered methylation status has been reported of a gene associated with autism spectrum disorder (OR2L13 promoter) and of the serotonin transporter gene (SLC6A4), which is involved in depression, anxiety, and autism. A combined diet and exercise program before and during pregnancy can be useful in preventing GDM in high-risk women. In addition, there is some evidence that probiotic and myo-inositol supplementation can work [4]. Medical nutrition therapy provides the basis for the management of GDM. The conventional approach of limiting carbohydrates at the cost of increasing energy from fat source may not be the most optimal. Instead, allowing higher levels of complex, low to medium glycemic index carbohydrates and adequate fiber through higher consumption of vegetables and fruits seems more beneficial. For medical nutrition therapy to work it is vital that dietary advice and nutrition counseling is provided by a dietician, is easy to understand and use, and includes healthy food options, cooking methods, and practical guidance that empowers and motivates to make changes towards a healthy eating pattern.

The literature on omega-3 LCPUFA fats supplementation before and during pregnancy in higher income countries is also summarized in this issue [5]: the updated Cochrane review of marine oil supplementation includes 7 RCTs (19,927 pregnant women) with LCPUFA fats in any form or dose during the second half of pregnancy. Results show high-quality evidence that supplementation with omega-3 LCPUFA during pregnancy reduces the risk of having a premature baby <37 weeks' gestation by 11% and <34 weeks' gestation by 42% compared with no omega-3 supplementation. Prenatal omega-3 LCPUFA supplementation is safe because of no effect on bleeding or postpartum hemorrhage, and it significantly reduces the incidence of low birth weight but increases the incidence of pregnancies continuing beyond 42 weeks. The 2-day shift in mean gestation in the DOMInO trial (2,499 pregnant women) increases the number of post-term pregnancies and, thus, the need for more obstetric interventions to initiate birth by approximately 4% [5]. Studies on omega-3 LCPUFA supplementation during pregnancy and improved cognitive outcome in the offspring are still controversial. This supports the need for further research to investigate the effects of prenatal omega-3 supplementation before adopting a universal supplementation approach into routine antenatal care.

The WHO estimates that over 2 billion people are at risk for micronutrient deficiencies, mainly from developing countries in Asia and Africa. Of public health concern are iron, vitamin A, iodine, zinc, folate, and B vitamins deficiencies. Regional estimates of anemia and micronutrient deficiencies indicate a high prevalence among women of reproductive age [6]. Approximately 50% of anemia among non-pregnant and pregnant women is amenable to iron supplementation. However, the regional role of iron deficiency in anemia has been shown to be extremely variable from <1 to 75% and may be influ-

enced by many conditions, including malaria, infection, hemoglobinopathies, or other micronutrient deficiencies. Preconception anemia and maternal undernutrition are associated with an increased risk of low-birth-weight and small-for-gestational-age births, while anemia in the first trimester of pregnancy is associated with low birth weight, preterm birth, and neonatal mortality. Only a few trials report the outcomes of preconception nutritional interventions with supplements containing multiple micronutrients with or without energy from lipids [6]: birth weight and length are higher and the risk of stunting in the offspring is 12–13% lower at 2 years. There is strong evidence that during pregnancy multiple micronutrient supplements together with protein and energy reduce the risk of stillbirth by 40% and the risk of small-for-gestational age by 21%, increase birth weight, and are cost-effective. In addition, limited data from several developing countries indicate better cognitive outcome in children >6 years after multiple micronutrient supplementation before and during pregnancy and during the first 1,000 days of life.

In conclusion, metabolic imbalances during pregnancy, such as GDM, might result in epigenetic changes which affect the offspring and might predispose to noncommunicable diseases later in life. Preventive measures for GDM must be initiated during pre-pregnancy and early pregnancy, in particular in women with high BMI. In pregnant women who develop GDM, medical nutrition therapy has to be provided by health-care professionals. Omega-3 LCPUFA supplementation during the second half of pregnancy is effective to prevent premature birth and low birth weight. In developing societies, multiple micronutrient supplementation before and during pregnancy can contribute to better growth and cognitive development of the offspring.

References

- 1 Salam RA, Hooda M, Das JK, Arshad A, Lassi ZS, Middleton P, et al. Interventions to improve adolescent nutrition: a systematic review and meta-analysis. *J Adolesc Health*. 2016 Oct;59(4 Suppl):S29–S39.
- 2 Das JK, Salam RA, Thornburg KL, Prentice AM, Campisi S, Lassi ZS, et al. Nutrition in adolescents: physiology, metabolism, and nutritional needs. *Ann N Y Acad Sci*. 2017 Apr;1393(1):21–33.
- 3 Chu AHY, Godfrey KM. Gestational diabetes mellitus and developmental programming. *Ann Nutr Metab*. doi: 10.1159/000509902.
- 4 Kapur K, Kapur A, Hod M. Nutrition management of gestational diabetes mellitus. *Ann Nutr Metab*. doi: 10.1159/000509900.
- 5 Best KP, Goersall J, Makrides M. Prenatal nutritional strategies to reduce the risk of preterm birth. *Ann Nutr Metab*. doi: 10.1159/000509901.
- 6 Young MF, Ramakrishnan U. Maternal undernutrition before and during pregnancy and offspring health and development. *Ann Nutr Metab*. doi: 10.1159/000510595.