Tec Empresarial
P-ISSN: 1659-2395; E-ISSN: 1659-3359

MINI REVIEW; THE ASSOCIATION OF MATERNAL NUTRITIONAL STATUS AND LIPID PROFILE WITH PERINATAL OUTCOME.

Hend Faleh Alreshidi
Teaching Assistant , Department of Family Medicine ,University of Ha'il, Saudi Arabia

Gamal eldin Mohamed Osman Elhussein
Pediatric Department, College of Medicine, University of Ha'il, Saudi

Somaia Ibrahim
Associate professor. Department of Pediatrics, College of Medicine ,University Of

Amany M. Khalifa
Professor, Department of Pathology, College of Medicine, University OF Ha'il , Saudi Arabia.

Awfa Yosef Alazzeh
Department Of Clinical Nutrition, College Of Applied Medical Science, University OF Hail, Kingdom of Saudi Arabia

Mona Madbouly Mohammad Shahin
Assistant professor. Department of Pediatrics, College of Medicine, University Of Ha'il

Abeer Hassan Elhaj
Assistant Professor Community Medicine, College of Medicine, University of Hail

IbrahimAhmed Mohsen Alrashidi
Alnakheel Medical Services, Senior Pharmacist, Saudi Arabia

Wafaa F. Abusudah
Clinical Nutrition Department, Faculty of Applied Medical Sciences, Umm Al-Qura University, P.O Box 715, Makkah 21955, Saudi Arabia

Hind Naif Alshammari
Department of Family and Community Medicine, College of Medicine, University of Ha'il, Saudi Arabia

Randa Abdeen Husien Abdalla

Lecturer,Clinical Chemistry , College of Applied Medical Sciences, Medical Laboratory Sciences, University of Hail

Omar Hafiz Haj Ali
Lecturer, Haematology and Immunohaematology ,College of Applied Medical Sciences, Medical Laboratory Sciences, University of Hail

Fahmida Khatoon*
Associate Professor, Department of Biochemistry, College OF Medicine, University OF Ha'il, Saudi Arabia, Email;drfahmida24@gmail.com, Orcid id; 0000-0002-1120-408X

Fehaid Muqbil Alshammari
Clinical Nutritionist ,Ministry Of Health , Hail General Hospital

Dalal Saad Alshammari
Medical Intern , University of Ha'il

Abstract
Background: Lipids such as cholesterol and triglycerides play an important role in both maternal and foetal energy metabolism. Little is known about maternal lipid levels in pregnancy and their effect on foetal growth. The aim of this study was to assess maternal lipid levels, foetal growth and the risk of small-for-gestational age (SGA) and large-for-gestational age (LGA
Conclusions: Our study suggests a novel association of early pregnancy triglyceride and remnant cholesterol levels with foetal growth, patterns of foetal growth and the risk of LGA. Future studies are warranted to explore clinical implication possibilities.
Keywords: Foetal programming; Foetal weight; Infant; Small-for-gestational age; Lipoproteins; Pregnancy.

BACKGROUND

The nutritional status of women during pregnancy is exceptionally critical. Nutrient inadequacies during pregnancy can impair fetal growth, which can in turn increase the risk for low birth weight (LBW), small-for-gestational-age (SGA) babies, preterm delivery, or alterations in infant body composition1. Infants born with LBW have a greater risk of developing hypertension, cardiovascular disease, and diabetes mellitus in middle age2. The deleterious effects of maternal malnutrition not only affect antenatal growth and development but also alter lifelong health from infancy to senescence3,4. Poor nutrition of the mother may put the fetus at risk for structural defects and even death5-7.

Many studies especially in developing countries have shown that maternal malnutrition seriously impairs fetal outcomes. Birthweight and gestational duration are adversely affected and pregnancy complications increase in maternal malnutrition8. Maternal nutrition in pregnancy, as the main determinant of fetal nutrition, may lead to permanent modifications in fetal growth trajectories, gene expression, and metabolic pathways and lead to a modified disease risk profile in postnatal life9. It is, therefore, probably crucial to improve maternal nutrition status to improve pregnancy outcomes.

Despite economic growth, improvements in maternal nutritional status in Indiia in the course of the most recent decade have been moderate. High rates of maternal undernutrition are measured by low Body Mass Index (BMI) which adversely affects the health and survival of mothers and newborns10-
13. While undernourishment remains a significant issue in nations undergoing rapid economic growth, a dynamic ascent of overnutrition, especially among women of reproductive age in Saudi Arabia, is a cause of concern10,14.

As per Barker's Hypothesis, early-life poor nutrition including prenatal as measured by birth weight, increase predisposition to metabolic syndrome which includes insulin insensitivity, diabetes mellitus, hyperlipidemia, obesity, hypertension, and other complications including coronary heart disease (CHD), and stroke15.

Physiologically, there is an increase in the concentration of serum lipids during the entire pregnancy because of essential adjustments in metabolic and physiologic functions16,17. During pregnancy, lipids are not only important for fetal development but for placental functions as well18. Lipids are fatty or oily compounds that are contributed by diet or through syntheses in the liver if the body's requirement is not met through food and nutrition. The main constituents of the lipid profile consist of lipoproteins [low-density lipoproteins (LDL), high-density lipoproteins (HDL), and very low-density lipoprotein (VLDL)], cholesterol (CH), and triglycerides (TG). Cholesterol is essential for the structural integrity of the cell19.

Lipid concentration changes are notable in the second trimester of pregnancy20. An increase in maternal lipid levels in Chinese and Iranian populations has been associated with adverse pregnancy outcomes16,17,21. Dyslipidemia is a well-known risk factor for metabolic syndrome, especially hypertriglyceridemia17,21. The most common forms of dyslipidemia are a higher level of LDL or bad cholesterol, higher levels of TG, higher level of CH, and lower levels of HDL or good cholesterol22,23. The incidence of fetal growth restriction (FGR), preterm birth, and SGA neonates is inversely related to a lower level of CH in maternal serum24,25 whereas, high TG and CH levels also show the same result26,27.

There are various factors (environmental, financial, social, religious, age, and activity level) that influence dietary choices and nutritional intake during pregnancy. Improving maternal nutrition practices during pregnancy can potentially save lives and improve outcomes for both mothers and babies. Nutrition education and counseling may be pertinent to improve the health of a pregnant woman. It is proposed to conduct this study keeping these changes in maternal nutrition in perspective.

AIM OF THE STUDY

The study aims to determine the association of maternal nutritional status and lipid profile with the perinatal outcome and evaluate the impact of nutrition education on the birthweight of the newborn.

LITERATURE REVIEW

According to the World Health Organization, a significant number of women are ignorant of the impact of their nutritional status on pregnancy and its outcome and do not get adequate micronutrients in their eating regimens not only throughout their reproductive life but during pregnancy as well 28-3

Nutrition Education, Nutritional Knowledge, and Practice during pregnancy

- Gezimu et al opined that knowledge and practice of nutrition during pregnancy in the researched area were found to be low. Similarly, parity and occupation were also associated with knowledge and were found to be a predictor of nutritional practice. Most of the participants were found to have poor dietary practices. Therefore, community-based nutritional education and antenatal nutritional counseling are required to be reinforced in the area to improve dietary practice31
- Teweldemedhin et al stated that nutritional counseling and education resulted in a significant improvement in the mean scores of the knowledge in pregnant women from pre-intervention to immediate post-intervention. Their study had shown that nutrition education during pregnancy has played a major role in enhancing the participant's knowledge and bringing in positive nutritional practices among them32.
- Abu-Baker et all concluded that the experimental group had shown significantly higher nutritional knowledge scores compared to the control group score after the educational intervention. Similarly, the dietary practice was found to be higher in the experimental group compared to their counterparts33.
- Singh et al concluded that 81.1% of those surveyed emphasized the importance of diet during pregnancy. Residence, education, and fertility were significantly associated with the knowledge of pregnant women to increase their diet during pregnancy. Painful labor and Cesarean section fear were the main reasons not to add extra food during pregnancy34.
- Tenaw et al stated that nutrition education for pregnant women has shown a significant effect in improving K&P about proper nutrition for pregnancy. The nutritional knowledge and practices of pregnant women should be emphasized, as they are poorly understood. Many studies show that women have a good understanding of nutrition, but they need improvement to practice effectively
35.

- Kumar et al opined that in-depth interviews revealed that the participants had poor practice despite having good nutritional knowledge and knowledge about increased nutrient intake in pregnancy36.

Recommended weight gain during pregnancy based on Pre-Pregnancy BMI for singleton pregnancy37:

Pre-pregnancy BMI (kg/m^2) (WHO)	**Category**	**Recommended Gestational Weight Gain Singleton**
<18.5	Underweight	12.5 - 18 kg
18.5-24.9	Normal weight	11.5 - 16 kg
25-29.9	Overweight	7-11.5 kg
30 -34.9	Obese- Class I	5 - 9 kg

It is well known now that the health status both before and after conception holds great significance for both mother and child. Weight gain and birth weight are indisputably related to each other. Several studies have shown a higher occurrence of LBW with inadequate maternal weight gain. It is suggested that a low weight gain after 20 weeks of gestation may result in preterm birth and low weight gain throughout pregnancy in LBW babies. A weight gain of 7-11 kg appears to be a measure of adequate fetal growth although preferably it should be closer to 10 kg rather than 7kg 12. Adequate nutrition before and during pregnancy has a greater long-term impact on health than it does at any other time.

Maternal Lipid Profile and Fetal Growth

- Gootjes et al concluded that there is a significant linear trend was noticed of a larger crown-rump length (CRL) in women with higher TG concentrations. A significant positive association was also observed between the analysis of CRL and remnant cholesterol. CRL was not associated with TC, LDLc, HDLc concentration, and TG/HDLc ratio in early pregnancy. When the analyses were split for 10–12 weeks and 12–14 weeks of gestational age. Relation between TG, remnant CH, and attenuated embryonic size demonstrated were no longer significant on sensitivity analysis38.
- Adank et al stated an association between increased fetal head circumference (HC) and abdominal circumference (AC) growth rates with maternal TG levels and remnant cholesterol levels. Their research shows a novel relationship between fetal development, patterns of fetal growth, and the risk of LGA and early pregnancy TG and residual cholesterol levels39.

REFERENCES

1. Blumfield, M. L., Hure, A. J., MacDonald-Wicks, L. K., Smith, R., Simpson, S. J., Giles, W. B., Raubenheimer, D., & Collins, C. E. (2012). Dietary balance during pregnancy is associated with fetal adiposity and fat distribution. The American journal of clinical nutrition, 96(5), 1032–1041.

2. Lee, Y. Q., Lumbers, E. R., Schumacher, T. L., Collins, C. E., Rae, K. M., Pringle, K. G., & Gomeroi Gaaynggal Advisory Committee (2021). Maternal Diet Influences Fetal Growth but Not Fetal Kidney Volume in an Australian Indigenous Pregnancy Cohort. Nutrients, 13(2), 569.
3. Sinha, S., Patro, N., & Patro, I. K. (2018). Maternal protein malnutrition: Current and future perspectives of spirulina supplementation in neuroprotection. Frontiers in neuroscience, 12.
4. Cetin, I., & Laoreti, A. (2015). The importance of maternal nutrition for health. In From the womb to the adult: International Workshop on Neonatology and Satellite Meetings, October 26th-31st (Vol. 4, No. 2, pp. 1-11). Hygeia Press.
5. Mayneris-Perxachs, J., & Swann, J. R. (2019). Metabolic phenotyping of malnutrition during the first 1000 days of life. European journal of nutrition, 58(3), 909-930.
6. Morrison, J. L., & Regnault, T. R. (2016). Nutrition in Pregnancy: Optimising Maternal Diet and Fetal Adaptations to Altered Nutrient Supply. Nutrients, 8(6), 342.
7. Kominiarek, M. A., & Rajan, P. (2016). Nutrition recommendations in pregnancy and lactation. Medical Clinics, 100(6), 1199-1215.
8. Khan, M. N., Rahman, M. M., Shariff, A. A., Rahman, M. M., Rahman, M. S., & Rahman, M.
A. (2017). Maternal undernutrition and excessive body weight and risk of birth and health outcomes. Archives of Public Health, 75(1), 12.
9. Parisi, F., Savasi, V. M., di Bartolo, I., Mandia, L., & Cetin, I. (2020). Associations between First Trimester Maternal Nutritional Score, Early Markers of Placental Function, and Pregnancy Outcome. Nutrients, 12(6), 1799.
10. Sesikeran, B. (2018). Child Malnutrition in Low-Income and Middle-Income Countries: Insights from India. EC Paediatrics, 7, 255-272.
11. Kader, M., & Perera, N. K. P. (2014). Socio-economic and nutritional determinants of low birth weight in India. North American journal of medical sciences, 6(7), 302.
12. Muthayya, S. (2009). Maternal nutrition & low birth weight-what is really important. Indian J Med Res, 130(5), 600-8.
13. Sahu, M. T., Agarwal, A., Das, V., & Pandey, A. (2007). Impact of maternal body mass index on obstetric outcome. Journal of Obstetrics and Gynaecology Research, 33(5), 655-659.
14. Misra, A., Singhal, N., Sivakumar, B., Bhagat, N., Jaiswal, A., & Khurana, L. (2011). Nutrition transition in India: Secular trends in dietary intake and their relationship to diet-related non- communicable diseases. Journal of diabetes, 3(4), 278-292.
15. Edwards M. (2017) The Barker Hypothesis. In: Preedy V., Patel V. (eds) Handbook of Famine, Starvation, and Nutrient Deprivation. Springer, Cham. https://doi.org/10.1007/978-3-319- 40007-5_71-1
16. Yue, S., Pei, L., Chen, W., Li, Z., & Xiao, H. (2021). Dyslipidemia in Pregnancy and the Proper Reference Values: A Retrospective Study in South China. Obstetrics and Gynecology Research, 4(1), 43-51.
17. Sharami, S. H., Gholipour, M., Milani, F., Kazemnejad, E., Heirati, S. F., & Ranjbar, Z. A. (2020). The Association between Dyslipidemia and Preterm Birth: A Prospective Cohort Study in

The North of Iran. Endocrine, Metabolic & Immune Disorders-Drug Targets (Formerly Current Drug Targets-Immune, Endocrine & Metabolic Disorders), 20(2), 227-233.
18. Herrera, E. & Desoye, G. (2016). Maternal and fetal lipid metabolism under normal and gestational diabetic conditions. Hormone Molecular Biology and Clinical Investigation, 26(2), 109-127.
19. Craig M, Yarrarapu SNS, Dimri M. Biochemistry, Cholesterol. [Updated 2022 Aug 15]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022
20. Aguilar Cordero MJ, Baena García L, Sánchez López AM, et al. Nivel De Triglicéridos Como Factor De Riesgo Durante El Embarazo; Modelado Biológico; Revisión Sistemática [Triglyceride Levels As A Risk Factor During Pregnancy; Biological Modeling; Systematic Review]. Nutr Hosp 32 (2015): 517-527.
21. Shen, H., Liu, X., Chen, Y., He, B., & Cheng, W. (2016). Associations of lipid levels during gestation with hypertensive disorders of pregnancy and gestational diabetes mellitus: a prospective longitudinal cohort study. BMJ open, 6(12), e013509.
22. Lee Y, Siddiqui WJ. Cholesterol Levels. [Updated 2022 Jul 25]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK542294/
23. Zhu, S. M., Zhang, H. Q., Li, C., Zhang, C., Yu, J. L., Wu, Y. T., & Huang, H. F. (2022). Maternal lipid profile during early pregnancy and birth weight: A retrospective study. Frontiers in endocrinology, 13, 951871.
24. Oluwole, A. A., Adegbesan-Omilabu, M. A., & Okunade, K. S. (2014). Preterm delivery and low maternal serum cholesterol level: Any correlation?. Nigerian medical journal : journal of the Nigeria Medical Association, 55(5), 406–410. https://doi.org/10.4103/0300-1652.140381
25. Pecks, U., Brieger, M., Schiessl, B., Bauerschlag, D. O., Piroth, D., Bruno, B., Fitzner, C., Orlikowsky, T., Maass, N., & Rath, W. (2012). Maternal and fetal cord blood lipids in intrauterine growth restriction. Journal of perinatal medicine, 40(3), 287–296.
26. Adank, M. C., Benschop, L., Kors, A. W., Peterbroers, K. R., Smak Gregoor, A. M., Mulder, M. T., Schalekamp-Timmermans, S., Roeters Van Lennep, J. E., & Steegers, E. (2020). Maternal lipid profile in early pregnancy is associated with foetal growth and the risk of a child born large- for-gestational age: a population-based prospective cohort study : Maternal lipid profile in early pregnancy and foetal growth. BMC medicine, 18(1), 276.
27. Vrijkotte, T. G., Krukziener, N., Hutten, B. A., Vollebregt, K. C., van Eijsden, M., & Twickler,
M. B. (2012). Maternal lipid profile during early pregnancy and pregnancy complications and outcomes: the ABCD study. The Journal of clinical endocrinology and metabolism, 97(11), 3917–3925.
28. Fasola, O., Abosede, O., & Fasola, F. A. (2018). Knowledge, attitude and practice of good nutrition among women of childbearing age in Somolu Local Government, Lagos State. Journal of public health in Africa, 9(1), 793.

29. Marangoni, F., Cetin, I., Verduci, E., Canzone, G., Giovannini, M., Scollo, P., ... & Poli, A. (2016). Maternal diet and nutrient requirements in pregnancy and breastfeeding. An Italian consensus document. Nutrients, 8(10), 629.

30. WHO (2016) WHO recommendations on antenatal care for a positive pregnancy experience. World Health Organization, Geneva

31. Gezimu, W., Bekele, F., & Habte, G. (2022). Pregnant mothers' knowledge, attitude, practice and its predictors towards nutrition in public hospitals of Southern Ethiopia: A multicenter cross- sectional study. SAGE open medicine, 10, 20503121221085843.

32. Teweldemedhin, L. G., Amanuel, H. G., Berhe, S. A., Gebreyohans, G., Tsige, Z., & Habte, E. (2021). Effect of nutrition education by health professionals on pregnancy-specific nutrition knowledge and healthy dietary practice among pregnant women in Asmara, Eritrea: a quasi-experimental study. BMJ Nutrition, Prevention & Health, 4(1), 181.

33. Abu-Baker, N. N., Abusbaitan, H. A., Al-Ashram, S. A., & Alshraifeen, A. (2021). The Effect of Health Education on Dietary Knowledge and Practices of Pregnant Women in Jordan: A Quasi-Experimental Study. International Journal of Women's Health, 13, 433.

34. Singh, T., & Deepti, S. S. (2019). Knowledge, attitude, practice and determining factors regarding nutrition during pregnancy among females of rural Punjab.

35. Tenaw, Z., Arega, M., & Tachbele, E. (2018). Nutritional knowledge, attitude and practices among pregnant women who attend antenatal care at public hospitals of Addis Ababa, Ethiopia. International Journal of Nursing and Midwifery, 10(7), 81-89.

36. Kumar, R., Aslesh, O. P., Kapoor, A., Sanan, D., Wadhwa, E., & Agarwal, N. (2013). Urban poor women do not increase their diet during pregnancy: a study from an urban resettlement colony in Delhi, India. International Journal of Medicine and Public Health, 3(3).

37. Arora, P., & Tamber Aeri, B. (2019). Gestational weight gain among healthy pregnant women from Asia in comparison with Institute of Medicine (IOM) guidelines-2009: A systematic review. Journal of Pregnancy, 2019.

38. Gootjes, D. V., Posthumus, A. G., Wols, D. F., de Rijke, Y. B., Roeters Van Lennep, J. E., & Steegers, E. (2022). Maternal lipid profile in pregnancy and embryonic size: a population-based prospective cohort study. BMC pregnancy and childbirth, 22(1), 333.

39. Adank, M. C., Benschop, L., Peterbroers, K. R., Smak Gregoor, A. M., Kors, A. W., Mulder, M. T., Schalekamp-Timmermans, S., Roeters Van Lennep, J. E., & Steegers, E. A. P. (2019). Is maternal lipid profile in early pregnancy associated with pregnancy complications and blood pressure in pregnancy and long term postpartum?. American journal of obstetrics and gynecology, 221(2), 150.e1–150.e13.