CHAPTER
157

The impact of maternal nutritional status on fetal weight and long-term repercussions: Systematic review

https://doi.org/10.56238/alookdevelopv1-157

Francini Viscondi Lopes e Moura
Lecturer in the medical course and doctoral student in Health Promotion at the University of Franca (UNIFRAN)
PhD student in the Health Promotion Program and lecturer at the University of Franca.

Ana Flavia Aggio Jamberci
Medical student at the University of Franca (UNIFRAN)
Incomplete university education
University of Franca

Biancca Bavelloni Mendes
Medical student at the University of Franca (UNIFRAN)
Incomplete university education
University of Franca

Sabrina Viscondi Lopes e Moura
Medical student at the José Rosário Vellano University (UNIFENAS)
Incomplete university education
University of Franca

Marisa Afonso Andrade Brunherotti
Coordinator of the UNIFRAN Health Promotion Program.
Post-doctorate in child and adolescent health and social medicine from USP Faculty of Medicine of Ribeirão Preto.
Professor and Researcher of the Health Promotion Program at the University of Franca.

ABSTRACT
Maternal nutritional status is an indicator of long-term health maintenance, both for the mother and for the child, and the great challenge during the pregnancy period is to maintain it adequate, with an effective supply of nutrients, that is, to provide enough energy supply to maintain a pregnant woman's body mass index within the parameters considered ideal and allow adequate growth of the fetus. Injuries during pregnancy, especially when related to maternal overweight or malnutrition, cause fetal metabolic reprogramming leading to cell hyperplasia or energy-saving fetus, respectively, causing a greater risk of metabolic and cardiovascular diseases. In addition, vitamin deficiencies such as folic acid and iron, among others, are harmful to the fetus, with a greater risk of defects in neural tube closure and anemia, and supplementation is recommended. In this way, monitoring during the prenatal period allows a follow-up of this pregnant woman so that she receives guidance and better control of her nutritional balance to prevent harm to the health of the binomial.

Keywords: High-risk pregnancy, Small for gestational age, Large for gestational age, Macrosomia, Maternal nutritional status.

1 INTRODUCTION

Maternal nutritional status is an indicator of long-term health maintenance, both for the mother and for the child, and the great challenge during the pregnancy period is to maintain it adequate, with an effective supply of nutrients, that is, to provide enough energy supply to maintain a pregnant woman's body mass index within the parameters considered ideal and allow adequate growth of the fetus. Injuries during pregnancy, especially when related to maternal overweight or malnutrition, cause fetal metabolic reprogramming leading to cell hyperplasia or energy-saving fetus, respectively, causing a greater risk of metabolic and cardiovascular diseases. In addition, vitamin deficiencies such as folic acid and iron, among others, are harmful to the fetus, with a greater risk of defects in neural tube closure and anemia, and supplementation is recommended. In this way, monitoring during the prenatal

period allows a follow-up of this pregnant woman so that she receives guidance and better control of her nutritional balance to prevent harm to the health of the binomial.

2 RESEARCH OBJECTIVE

To gather literary evidence regarding which diseases often negatively interact with maternal health, leading to preventable comorbidities that have a negative impact on the early and long-term health of the fetus.

3 METHODOLOGY

A systematic review was carried out whose guiding question for the research was: “What is the repercussion of maternal nutritional status on the newborn's birth weight and long-term results?". The selection of articles on gestational diseases and the repercussions on the health of the fetus was collected from LILACS, MEDLINE, PUBMED, SCIELO and SCOPUS databases. Inclusion criteria were scientific articles, in Portuguese, English and Spanish, published in the last 5 years and works directly related to the related theme. The exclusion criteria were articles related to maternal laboratory markers, articles aimed at regional populations to avoid a confounding factor with regard to eating habits, articles related to postnatal situations, breastfeeding, articles that deviate from the investigated theme and those written in languages different from the three defined.

4 RESULTS

It was observed that maternal nutritional deviations due to obesity, excess weight gain during pregnancy, malnutrition and hypovitaminosis lead to fetal epigenetic alterations, which are often permanent, contributing to the increase in non-communicable chronic diseases.

5 CONCLUSIONS

Through the information contained in this study, it is possible to identify scientific evidence that points to a close relationship between the injuries that occur during pregnancy due to maternal nutritional status and the repercussions of these on the fetus, in its childhood and adulthood.

REFERENCES

AL-BELTAGI, M., Bediwy, A. S., & Saeed, N. K. (2022). Insulin-resistance in paediatric age: Its magnitude and implications. World journal of diabetes, 13(4), 282–307. https://doi.org/10.4239/wjd.v13.i4.282

AY L, KRUITHOF CJ, BAKKER R, STEEGERS EA, WITTEMAN JC, MOLL HA, ET AL. MATERNAL ANTHROPOMETRICS ARE ASSOCIATED WITH FETAL SIZE IN DIFFERENT PERIODS OF PREGNANCY AND AT BIRTH. THE GENERATION R STUDY. BJOG. 2009;116(7):953-63

BODNAR LM, Wisner KL, Moses-Kolko E, Sit DK, Hanusa BH. Prepregnancy body mass index, gestational weight gain, and the likelihood of major depressive disorder during pregnancy. J Clin Psychiatry. 2009;70(9):1290-6.

BONAKDAR, S. A., Dorosty Motlagh, A. R., Bagherniya, M., Ranjbar, G., DaryabeygiKhotbehsara, R., Mohajeri, S., & Safarian, M. (2019). Pre-pregnancy Body Mass Index and Maternal Nutrition in Relation to Infant Birth Size. Clinical nutrition research, 8(2), 129–137. https://doi.org/10.7762/cnr.2019.8.2.129

BOUBRED F, Pauly V, Romain F, Fond G, Boyer L (2020). The role of neighbourhood socioeconomic status in large for gestational age. PLOS ONE, 2020, vol. 15, issue 6, 1-14 e0233416. https://doi.org/10.1371/journal.pone.0233416

BRAGA, CAMILA PEREIRA ET AL. RELAÇÃO DO GANHO DE PESO, ANTES E DURANTE A GRAVIDEZ, COM A MACROSSOMIA FETAL EM GESTAÇÕES COMPLICADAS PELO DIABETES GESTACIONAL E HIPERGLICEMIA LEVE. NUTRIRE, V. 36, N. 1, P. 85-98, 2011. DISPONÍVEL EM: <HTTP://HDL.HANDLE.NET/11449/141233>.

CAMBOIM J S, Lima M N F A, Leite, K N S. Sousa K M O.Patologias que mais acometem as gestantes: análise documental. Temas em saúde.Volume 17, Número 3 ISSN 2447-2131 João Pessoa, 2017. pág.247 a 260.

CETIN I, Mandò C, Calabrese S. Maternal predictors of intrauterine growth restriction. Curr Opin Clin Nutr Metab Care. 2013 May; 16(3):310–9.

CRANE JM, White J, Murphy P, Burrage L, Hutchens D. The effect of gestational weight gain by body mass index on maternal and neonatal outcomes. J Obstet Gynaecol Can. 2009;31(1):28-35

CÔRTES, M. H., Vasconcelos, I. A. L., & Coitinho, D. C. (2009). Prevalência de anemia ferropriva em gestantes brasileiras: uma revisão dos últimos 40 anos. Revista de Nutrição, 22, 409-418.

DELAGUILA M, Tavares A, Arinelli R, Padula A, Pepe C.Análise do impacto econômico da falta de suplementação multivitamínica em mulheres em idade reprodutiva e suas consequências em recém-nascidos.Jornal Brasileiro de Economia e Saúde 2020;12(2):135-41

DESAI M.; JELLYMAN J.K.; ROSS M.G., Epigenomics, gestacional programming and risk of metabolic syndrome. International Journal of Obesity: 2005, 39, 633-641.

DIOUF I, Charles MA, Thiebaugeorges O, Forhan A, Kaminski M, Heude B, et al. Maternal weight change before pregnancy in relation to birthweight and risks of adverse pregnancy outcomes. Eur J Epidemiol. 2011;26(10):789-96.

EMBLETON ND, Wood C. Metabolic outcomes in very low birthweight and preterm infants in later life. Journal of Pediatr (Rio J). 2019;95:260---3.

FERREIRA LA, Piccinato CA, Cordioli E, Zlotnik E. Índice de massa corporal pré-gestacional, ganho de peso na gestação e resultado perinatal: estudo descritivo retrospectivo. einstein (São Paulo). 2020;18:eAO 4851. http://dx.doi.org/10.31744/einstein_journal/ 2020AO4851

FORTNER RT, Pekow P, Solomon CG, Markenson G, Chasan-Taber L. Prepregnancy body mass index, gestational weight gain, and risk of hypertensive pregnancy among Latina women. Am J Obstet Gynecol. 2009;200(2):167.e1-7.

GREEN, B B; Marsit, C J.Select Prenatal Environmental Exposures and Subsequent Alterations of Gene-Specific and Repetitive Element DNA Methylation in Fetal Tissues.Curr Environ Health Rep; 2(2): 126-36, 2015 Jun.ID: mdl-26231362

HERRING SJ, Oken E, Rifas-Shiman SL, Rich-Edwards JW, Stuebe AM, Kleinman KP, et al. Weight gain in pregnancy and risk of maternal hyperglycemia. Am J Obstet Gynecol. 2009;201(1):61.e1-7.
HOFMAN PL, Regan F, Jackson WE, Jefferies C, Knight DB, Robinson EM, et al. Premature birth and later insulin resistance. N Engl J Med. 2004;351:2179---86.

INSTITUTE OF MEDICINE (US) and National Research Council (US) Committee to Reexamine IOM Pregnancy Weight Guidelines; Rasmussen KM, Yaktine AL, editors. Weight Gain During Pregnancy: Reexamining the Guidelines. Washington (DC): National Academies Press (US); 2009.

KEATS, E. C., Haider, B. A., Tam, E., & Bhutta, Z. A. (2019). Multiple-micronutrient supplementation for women during pregnancy. The Cochrane database of systematic reviews, 3(3), CD004905. https://doi.org/10.1002/14651858.CD004905.pub6

KOLETZKO B, Bauer CP, Bung P, Cremer M, Flothkötter M, Hellmers C, et al. German national consensus recommendations on nutrition and lifestyle in pregnancy by the 'Healthy Start – Young Family Network'. Ann Nutr Metab. 2013;63(4):311–22.

LECORGUILLÉ, M., Teo, S., & Phillips, C. M. (2021). Maternal Dietary Quality and Dietary Inflammation Associations with Offspring Growth, Placental Development, and DNA Methylation. Nutrients, 13(9), 3130. https://doi.org/10.3390/nu13093130

LEWANDOWSKA M. (2021). Maternal Obesity and Risk of Low Birth Weight, Fetal Growth Restriction, and Macrosomia: Multiple Analyses. Nutrients, 13(4), 1213. https://doi.org/10.3390/nu13041213

LOPES, M N; Grassiolli, S; Rover, M M S; Paula, A C R; Favil, P T; Viera, C S. Perfil antropométrico e metabólico de adolescentes nascidos prematuros em município do Oeste do Paraná /Esc. Anna Nery Rev. Enferm; 24(4): e20200009, 2020

MARANGONI F, Cetin I, Verduci E, Canzone G, Giovannini M, Scollo P, et al. Maternal diet and nutrient requirements in pregnancy and breastfeeding. An Italian consensus document. Nutrients. 2016 Oct;8(10):E629.

MASZTALERZ-KOZUBEK, D., Zielinska-Pukos, M. A., & Hamulka, J. (2021). Maternal Diet, Nutritional Status, and Birth-Related Factors Influencing Offspring's Bone Mineral Density: A Narrative Review of Observational, Cohort, and Randomized Controlled Trials. Nutrients, 13(7), 2302. https://doi.org/10.3390/nu13072302

MOUSA, A., Naqash, A., & Lim, S. (2019). Macronutrient and Micronutrient Intake during Pregnancy: An Overview of Recent Evidence. Nutrients, 11(2), 443. https://doi.org/10.3390/nu11020443

NEHAB, S. R. G.; VILLELA L. D.; ABRANCHES, A. D.; ROCHA D. M.; SILVA L. M. L.; AMARAL Y. M. V.; et al. Influence of gestational and perinatal factors on body composition of full-term newborns Jornal de pediatria. Rio: 2020; 771-777.

OKEN E, Rifas-Shiman SL, Field AE, Frazier AL, Gillman MW. Maternal gestational weight gain and offspring weight in adolescence. Obstet Gynecol. 2008;112(5):999-1006.

OLIVEIRA, C. M. O, Pereira L. A., Ferreira R. C., Clemente A. P. G. Estado Nutricional Materno e a sua associação com o peso ao nascer em gestações de alto risco.Cien Saude Colet ; 23(7): 2373- 2382, 2018 Jul. https://doi.org/10.1590/1413-81232018237.12042016

PARISI F, Laoreti A, Cetin I. Multiple micronutrient needs in pregnancy in industrialized countries. Ann Nutr Metab. 2014;65(1):13–21.

PARRETTINI, S, CAROLI, A, TORLONE E. Nutrition and Metabolic Adaptations in Physiological and Complicated Pregnancy: Focus on Obesity and Gestational Diabetes. Front Endocrinol (Lausanne)..2020; 11: 611929.

PRADO EL, Sebayang SK, Apriatni M, Adawiyah SR, Hidayati N, Islamiyah A, et al. Maternal multiple micronutrient supplementation and other biomedical and socioenvironmental influences on children's cognition at age 9-12 years in Indonesia: follow-up of the SUMMIT randomised trial. Lancet Glob Health. 2017 Feb; 5(2):e217–28.

RASMUSSEN KM, Yaktine AL, editors. Committee to Reexamine IOM Pregnancy Weight Guidelines, Food and Nutrition Board and Board on Children, Youth, and Families. Weight gain during pregnancy: reexamining the guidelines. Washington (DC): The National Academies Press; 2009.

ROSENTHAL J, Casas J, Taren D, Alverson CJ, Flores A, Frias J. Neural tube defects in Latin America and the impact of fortification: a literature review. Public Health Nutr. 2014;17(3):537-50.

SEBASTIANI, G., Herranz Barbero, A., Borrás-Novell, C., Alsina Casanova, M., Aldecoa-Bilbao, V., Andreu-Fernández, V., Pascual Tutusaus, M., Ferrero Martínez, S., Gómez Roig, M. D., & García-Algar, O. (2019). The Effects of Vegetarian and Vegan Diet during Pregnancy on the Health of Mothers and Offspring. Nutrients, 11(3), 557. https://doi.org/10.3390/nu11030557

SEBASTIANI, G., Andreu-Fernández, V., Herranz Barbero, A., Aldecoa-Bilbao, V., Miracle, X., Meler Barrabes, E., Balada Ibañez, A., Astals-Vizcaino, M., Ferrero-Martínez, S., Gómez-Roig, M. D., & García-Algar, O. (2020). Eating Disorders During Gestation: Implications for Mother's Health, Fetal Outcomes, and Epigenetic Changes. Frontiers in pediatrics, 8, 587. https://doi.org/10.3389/fped.2020.00587

SEBERT S, Sharkey D, Budge H, Symonds ME. The early programming of metabolic health: is epigenetic setting the missing link? Am J Clin Nutr. 2011 Dec;94(6 Suppl):1953S–8S.

SEYMOUR, J. V.; BECK K. L.; COLON C. A. Nutrition in pregnancy. Obstetrics, Gynecology and reproductive medicine. Elsevier: 2019. 29:8

SHANKAR AH, Jahari AB, Sebayang SK, Aditiawarman, Apriatni M, Harefa B, et al.; Supplementation with Multiple Micronutrients Intervention Trial (SUMMIT) Study Group. Effect of maternal multiple micronutrient supplementation on fetal loss and infant death in Indonesia: a double-blind cluster-randomised trial. Lancet. 2008 Jan; 371(9608): 215–27.

Sociedade Brasileira de Pediatria. [homepage on the internet]. Guia Prático de Aleitamento Materno. [cited 2020 nov.]. Disponível em: https://www.sbp.com.br/fileadmin/user_upload/22800f-GUIAPRATICO-GuiaPratico_de_AM.pdf

SOUTH, A. M. et al. Renal function and blood pressure are altered in adolescents born preterm. Pediatric nephrology. Berlin: 2019: 137-144.

SOUZA, M. T.; SILVA M. D., CARVALHO R. Revisão integrativa: o que é e como fazer. Einstein. 2010; p.102-6

STOTLAND NE, Hopkins LM, Caughey AB. Gestational weight gain, macrosomia, and risk of cesarean birth in nondiabetic nulliparas. Obstet Gynecol. 2004;104(4):671-7.

STOTLAND NE, Cheng YW, Hopkins LM, Caughey AB. Gestational weight gain and adverse neonatal outcome among term infants. Obstet Gynecol. 2006;108(3 Pt 1):635-43.

WHO Library Cataloguing-in-Publication Data World health statistics 2016: monitoring health for the SDGs, sustainable development goals. 1.Health Status Indicators. 2.Global Health. 3.Health Priorities. 4.Mortality. 5.Universal Coverage. 6.Life Expectancy. 7.Statistics. I.World Health ISBN 978 92 4 156526 4 (NLM classification: WA 900.1) E-ISBN 978 92 4 069569 6 (PDF). Disponível em https://www.who.int/publications/i/item/9789241565264

YISAHAK, S. F., Hinkle, S. N., Mumford, S. L., Li, M., Andriessen, V. C., Grantz, K. L., Zhang, C., & Grewal, J. (2021). Vegetarian diets during pregnancy, and maternal and neonatal outcomes. International journal of epidemiology, 50(1), 165–178. https://doi.org/10.1093/ije/dyaa200

MINISTÉRIO DA SAÚDE. Secretaria de Vigilância em Saúde. Departamento de Análise em Saúde e Vigilância de Doenças Não Transmissíveis. Vigitel Brasil 2021: vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico: estimativas sobre frequência e distribuição sociodemográfica de fatores de risco e proteção para doenças crônicas nas capitais dos 26 estados brasileiros e no Distrito Federal em 2021 / Ministério da Saúde, Secretaria de Vigilância em Saúde, Departamento de Análise em Saúde e Vigilância de Doenças não Transmissíveis. – Brasília: Ministério da Saúde, 2021.

NOMURA, R. Y.; PAIVA, L. V.; COSTA, V. N. et al. Influence of maternal nutritional status, weight gain and energy intake on fetal growth in high-risk pregnancies. Revista Brasileira de Ginecologia e Obstetrícia, v. 34, n. 3, p. 107-112, 2012.

MEŠTROVIĆ, Z.; ROJE, D.; RELJA, A. et al. Maternal body mass index change as a new optimal gestational weight gain predictor in overweight women. Croatian Medical Journal, v. 60, n. 6, p. 508–514, 2019.

HEDDERSON, M. M.; WEISS, N. S.; SACKS, D. A. et al. Pregnancy weight gain and risk of neonatal complications: macrosomia, hypoglycemia, and hyperbilirubinemia. Obstetrics and Gynecology, v. 108, n. 5, p.1153-61, 2006.

FEDERAÇÃO BRASILEIRA DAS ASSOCIAÇÕES DE GINECOLOGIA E OBSTETRÍCIA. Préeclâmpsia nos seus diversos aspectos. São Paulo: FEBRASGO, 2017. (Série Orientações e Recomendações FEBRASGO. n. 8, 2017). Disponível em: Acesso em: 10 maio 2022.

LEAL, M. C.; ESTEVES-PEREIRA, A. P.; NAKAMURA-PEREIRA, M. et al. Prevalence and risk factors related to preterm birth in Brazil. Reproductive Health, v. 17, n. 3 (supl.):127, 2016. LEAL, M.C.; PEREIRA, A. P. E.; VIELLAS, E. F. et al. Assistência pré-natal na rede pública do Brasil. Revista de Saúde Pública, n. 54: 8, 2020.

DESAI, M.; JELLYMAN, J. K.; ROSS, M. G. Epigenomics, gestational programming and risk of metabolic syndrome. International Journal of Obesity. v. 39, n. 4, p. 633- 41, 2015.

HAIDER, B. A.; BHUTTA, Z. A. Multiple-micronutrient supplementation for women during pregnancy. The Cochrane Database of Systematic Reviews, v. 4, n. 4, p. CD004905., 2017.

MOHER D.; LIBERATI, A.; TETZLAFF, J. et al. PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med, v. 6, n. 7. 2009.

RAVELLI, G. P.; STEIN, Z. A.; SUSSER, M. W. Obesity in young men after famine exposure in utero and early infancy. The New England Journal of Medicine, n. 295, p. 349-53, 1976.