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High Maternal Dietary Glycemic Index and Sugar Consumption and Their Association with Birth Defects and Pregnancy Complications

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Introduction

- Birth defects occur in 1 in every 33 babies in the United States, and 7.8 million babies worldwide (1).
- Having a child with a birth defect can be costly for the family not only in the money spent on medical bills, but also the emotional toll (2).
- In 2004, hospital costs for children with birth defects in the United States were $2.6 billion (3).
- There are many environmental and genetic factors that can lead to birth defects, including the mother's nutritional habits before and during pregnancy (1).
- Increased sugar intake (including glucose, fructose, or sucrose), or high dietary glycemic index (DGI), by the mother could be a risk factor for the formation of birth defects.
- Neural tube defects (NTD's) are a main outcome associated with a high DGI in the mothers (4).
- Over 300,000 babies worldwide are born with a NTD, which cause major problems with the brain and spine (5).
- Pregnancy complications, mainly preeclampsia, have also been linked to increased sugar consumption (6).

Methods

PubMed was the primary database used for this systematic review.

- The key terms used were "pregnant women" OR "pregnancy" AND "glycemic index" AND "congenital abnormalities".
- A MeSH search using these key terms resulted in 10 articles, five of which were chosen (**Figure 1**).
- Cases were excluded if there were no human subjects or the mother had pre-gestational diabetes.
- There had to be mention of an exposure of high DGI or sugar intake (including glucose, fructose or sucrose), and the risk for birth defects or pregnancy complications for a study to be included in this review.
- The other articles in this study were obtained by looking at the references of the five that were originally chosen (**Figure 1**).

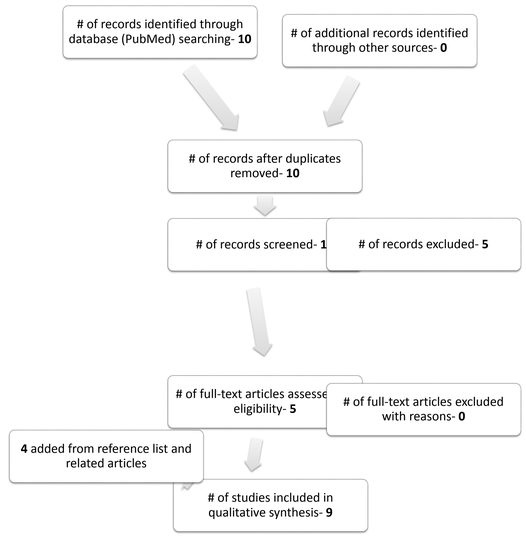
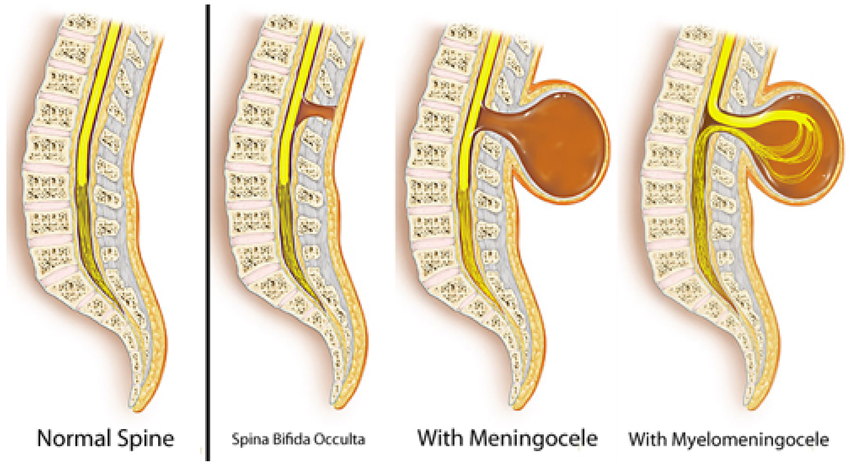


Figure 1. Flowchart reporting the selection process of the articles included in the review.



Types of neural tube defects
Source:
https://www.google.com/search?q=types+of+neural+tube+defects&source=lnms&tbm=isch&sa=X&ved=0ahUKEwiLoIeXybLaAhVB3IMKHZa1A3EQ_AUICigB&biw=1680&bih=995#imgrc=j09aphvYhgBJMM:&spf=1523461725725

Results

Eight out of nine studies showed an increased risk for pregnancy complications and birth defects.

Birth Defects

The six case-control studies looked at birth defects, mainly neural tube defects (NTD's), as the outcome for high DGI and/or sugar intake. Only one study did not find an increased risk (7).

- Of the five studies that found and increased risk for NTD's:
  - three looked at DGI as the exposure (4,8,9)
  - one looked at sugar consumption (10)
  - one looked at both (11)
- The studies that looked at high DGI found an increased risk for NTD's; one study also found that the risk for gastrointestinal and musculoskeletal defects increased (9).
- One case found that NTD mothers had a 45% higher consumption of sugar (primarily sucrose) than the control group mothers ($p < 0.05$) (10).

Complications

Three cohort studies looked at increased sugar intake as a risk factor for pregnancy complications (6, 12, 13).

- Two studies found preeclampsia to be an outcome associated with the risk factor (6, 12).
- One study found that an increased glucose concentration resulted in early birth by 1.8 days ($p < 0.05$) and 4.8 days ($p < 0.01$) (13).
- Mothers who consumed more natural sugars were at a lower risk for preeclampsia, but added sugars resulted in a higher risk ($p < 0.009$)(12).

Public Health Implications and Recommendations

- Mothers with a higher DGI and/or sugar intake are at an increased risk for pregnancy complications and having children with birth defects.
- Mothers should be conscious of dietary intakes before and during pregnancy in order to avoid birth defects and pregnancy complications.
- Further research should be done on the causes of preeclampsia, and a larger variation of study types should be performed on the entire topic discussed in this review.

References

1 Facts about birth defects. (2016, October 11). Retrieved February 23, 2017, from Center for Disease Control and Prevention website: https://www.cdc.gov/ncbddd/birthdefects/facts.html

2 The global toll of birth defects. (n.d.). Retrieved February 23, 2017, from http://www.marchofdimes.org/mission/the-global-toll-of-birth-defects.aspx

3 Birth defects are costly. (2014, January 20). Retrieved February 23, 2017, from Centers for Disease Control and Prevention website: https://www.cdc.gov/features/birthdefectscostly/

4 Yazdy, M. M., Liu, S., Mitchell, A. A., & Werler, M. M. (2010). Maternal Dietary Glycemic Intake and the Risk of Neural Tube Defects. *American Journal of Epidemiology*, *171*(4), 407–414. http://doi.org/10.1093/aje/kwp395

5 *Neural tube defects*. (2012). Retrieved February 23, 2017, from https://www.cdc.gov/ncbddd/aboutus/annualreport2012/documents/ar2012-folicacid-printversion.pdf

6 Clausen, T., Slott, M., Solvoll, K., Drevon, C., Vollset, S., & Henriksen, T. (2001). High intake of energy, sucrose, and polyunsaturated fatty acids is associated with increased risk of preeclampsia. *American Journal of Obstetrics and Gynecology*, *185*(2), 451-458. http://dx.doi.org/10.1067/mob.2001.116687

7 Shaw, G. M., Carmichael, S. L., Laurent, C., & Siega-Riz, A. M. (2008). Periconceptional glycemic load and intake of sugars and their association with neural tube defects in offspring. *Paediatric and Perinatal Epidemiology*, *22*(6), 514-519. https://doi.org/10.1111/j.1365-3016.2008.00964.x

8 Yazdy, M. M., Mitchell, A. A., Liu, S., & Werler, M. M. (2011). Maternal dietary glycemic intake during pregnancy and the risk of birth defects. *Paediatric and Perinatal Epidemiology*, *25*(4), 340–346. http://doi.org/10.1111/j.1365-3016.2011.01198.x

9 Parker, S. E., Werler, M. M., Shaw, G. M., Anderka, M., Yazdy, M. M., & the National Birth Defects Prevention Study. (2012). Dietary Glycemic Index and the Risk of Birth Defects. *American Journal of Epidemiology*, *176*(12), 1110–1120. http://doi.org/10.1093/aje/kws201

10 Friel, J. K., Frecker, M., & Fraser, F. C. (1995). Nutritional patterns of mothers of children with neural tube defects in newfoundland. *American Journal of Medical Genetics*, *55*(2), 195-199.

11 Shaw, G. M., Quach, T., Nelson, V., Carmichael, S. L., Schaffer, D. M., Selvin, S., & Yang, W. (2003). Neural tube defects associated with maternal periconceptional dietary intake of simple sugars and glycemic index. *The American Journal of Clinical Nutrition*, *78*(5), 972-978. Retrieved from PubMed database.

12 Borgen, I., Aamodt, G., Harsem, N., Haugen, M., Meltzer, H., & Brantsaeter, A. (2012). Maternal sugar consumption and risk of preeclampsia in nulliparous norwegian women. *European Journal of Clinical Nutrition*, 920-925. https://doi.org/doi:10.1038/ejcn.2012.61

13 Scholl, T., Sowers, M., Chen, X., & Landers, C. (2001). Maternal glucose concentration influences fetal growth, gestation, and pregnancy complications. *American Journal of Epidemiology*, *154*(6), 514-520. https://doi.org/10.1093/aje/154.6.514

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