UNITED STATES DEPARTMENT OF AGRICULTURE

Beverage Consumption During Pregnancy and Birth Weight: A Systematic Review

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USDA and HHS implemented a process to identify topics and scientific questions to be examined by the 2020 Dietary Guidelines Advisory Committee. The Committee conducted its review of evidence in subcommittees for discussion by the full

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[i] Under contract with the Food and Nutrition Service, United States Department of Agriculture.

Committee during its public meetings. The role of the Committee members involved establishing all aspects of the protocol, which presented the plan for how they would examine the scientific evidence, including the inclusion and exclusion criteria; reviewing all studies that met the criteria they set; deliberating on the body of evidence for each question; and writing and grading the conclusion statements to be included in the scientific report the 2020 Committee submitted to USDA and HHS. The NESR team with assistance from Federal Liaisons and Project Leadership, supported the Committee by facilitating, executing, and documenting the work necessary to ensure the reviews were completed in accordance with NESR methodology. More information about the 2020 Dietary Guidelines Advisory Committee, including the process used to identify topics and questions, can be found at www.DietaryGuidelines.gov. More information about NESR can be found at NESR.usda.gov.

The Committee and NESR staff thank USDA's Agricultural Research Service for coordinating the peer review of this systematic review, and the Federal scientist peer reviewers for their time and expertise.

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INTRODUCTION

This document describes a systematic review conducted to answer the following question: What is the relationship between beverage consumption during pregnancy and birth weight standardized for gestational age and sex? This systematic review was conducted by the 2020 Dietary Guidelines Advisory Committee, supported by USDA's Nutrition Evidence Systematic Review (NESR).

More information about the 2020 Dietary Guidelines Advisory Committee is available at the following website: www.DietaryGuidelines.gov.

NESR specializes in conducting food- and nutrition-related systematic reviews using a rigorous, protocol-driven methodology. More information about NESR is available at the following website: NESR.usda.gov.

NESR's systematic review methodology involves developing a protocol, searching for and selecting studies, extracting data from and assessing the risk of bias of each included study, synthesizing the evidence, developing conclusion statements, grading the evidence underlying the conclusion statements, and recommending future research. A detailed description of the systematic reviews conducted for the 2020 Dietary Guidelines Advisory Committee, including information about methodology, is available on the NESR website: https://nesr.usda.gov/2020-dietary-guidelines-advisory-committee-systematic-reviews. In addition, starting on page 75, this document describes the final protocol as it was applied in the systematic review. A description of and rationale for modifications made to the protocol are described in the 2020 Dietary Guidelines Advisory Committee Report, Part D: Chapter 2. Food, Beverage, and Nutrient Consumption During Pregnancy.

List of abbreviations

Abbreviation	Full name
BMI	Body mass index
CNPP	Center for Nutrition Policy and Promotion
DPS	Division of Prevention Science
FNS	Food and Nutrition Service
GDM	Gestational diabetes mellitus
HBW	High birth weight
HHS	United States Department of Health and Human Services
IUGR	Intrauterine growth restriction
Kg/m^2	Kilograms per meters squared
LBW	Low birth weight
LGA	Large for gestational age
LNCSB	Low- or no-calorie sweetened beverages
NESR	Nutrition Evidence Systematic Review
OASH	Office of the Assistant Secretary for Health
ODPHP	Office of Disease Prevention and Health Promotion
ONGA	Office of Nutrition Guidance and Analysis
PCS	Prospective cohort study
RCT	Randomized controlled trial
SES	Socioeconomic status
SGA	Small for gestational age
SSB	Sugar-sweetened beverages
TEI	Total energy intake
USDA	United States Department of Agriculture

WHAT IS THE RELATIONSHIP BETWEEN BEVERAGE CONSUMPTION DURING PREGNANCY AND BIRTH WEIGHT STANDARDIZED FOR GESTATIONAL AGE AND SEX?

PLAIN LANGUAGE SUMMARY

What is the question?

- The question is: What is the relationship between beverage consumption during pregnancy and birth weight standardized for gestational age and sex?

What is the answer to the question?

- Insufficient evidence is available to determine the relationship between consumption of milk during pregnancy and birth weight outcomes.
- Insufficient evidence is available to determine the relationship between consumption of tea during pregnancy and birth weight outcomes.
- Insufficient evidence is available to determine the relationship between consumption of coffee during pregnancy and birth weight outcomes.
- Insufficient evidence is available to determine the relationship between consumption of sugar-sweetened beverages or low- or no-calorie sweetened beverages during pregnancy and birth weight outcomes.
- Insufficient evidence is available to determine the relationship between consumption of water during pregnancy and birth weight outcomes.

Why was this question asked?

- This important public health question was identified by the U.S. Departments of Agriculture (USDA) and Health and Human Services (HHS) to be examined by the 2020 Dietary Guidelines Advisory Committee.

How was this question answered?

- The 2020 Dietary Guidelines Advisory Committee, Beverages and Added Sugars Subcommittee conducted a systematic review to answer this question with support from the Nutrition Evidence Systematic Review (NESR) team.

What is the population of interest?

- This review examines beverage consumption in women before and during pregnancy and birth weight in their children.

What evidence was found?

- This review includes 19 articles.
- These articles did not provide enough evidence to answer the question. They presented inconsistent findings from studies with many limitations.

How up-to-date is this systematic review?

- This review searched for studies from January 2000 to June 2019.

TECHNICAL ABSTRACT

Background

- This important public health question was identified by the U.S. Departments of Agriculture (USDA) and Health and Human Services (HHS) to be examined by the 2020 Dietary Guidelines Advisory Committee.
- The 2020 Dietary Guidelines Advisory Committee, Beverages and Added Sugars Subcommittee conducted a systematic review to answer this question with support from the Nutrition Evidence Systematic Review (NESR) team.
- The goal of this systematic review was to examine the following question: What is the relationship between beverage consumption during pregnancy and birth weight standardized for gestational age and sex?

Conclusion statements and grades

- Insufficient evidence is available to determine the relationship between consumption of milk during pregnancy and birth weight outcomes. (Grade: Grade not assignable)
- Insufficient evidence is available to determine the relationship between consumption of tea during pregnancy and birth weight outcomes. (Grade: Grade not assignable)
- Insufficient evidence is available to determine the relationship between consumption of coffee during pregnancy and birth weight outcomes. (Grade: Grade not assignable)
- Insufficient evidence is available to determine the relationship between consumption of sugar-sweetened beverages or low- or no-calorie sweetened beverages during pregnancy and birth weight outcomes. (Grade: Grade not assignable)
- Insufficient evidence is available to determine the relationship between consumption of water during pregnancy and birth weight outcomes. (Grade: Grade not assignable)

Methods

- A literature search was conducted using four databases (PubMed, Embase, Cochrane, and CINAHL) to identify articles that evaluated the intervention or exposure of beverage consumption during pregnancy and the outcome of birth weight standardized for gestational age and sex. A manual search was conducted to identify articles that may not have been included in the electronic databases searched. Articles were screened by two NESR analysts independently for inclusion based on pre-determined criteria.
- Data extraction and risk of bias assessment were conducted for each included study, and both were checked for accuracy. The Committee qualitatively synthesized the body of evidence to inform development of a conclusion statements, and graded the strength of evidence using pre-established criteria for risk of bias, consistency, directness, precision, and generalizability.

Summary of the evidence

- Nineteen studies published between January 2000 and June 2019 met the criteria for inclusion in this systematic review, including 1 randomized controlled trial (RCT) and 18 prospective cohort studies (PCS).
- Many studies examined intake of multiple beverages.

- Evidence is summarized below by beverage type.

Dairy milk

- Six studies examined the relationship between dairy milk consumption and birth weight outcomes. The body of evidence included 1 RCT and 5 PCS.
- The search strategy focused on dairy milk, which included commercially available cow's milk and soy beverages with varying fat and sweetener content. However, no studies examining soy beverages met the inclusion criteria.
- The body of evidence showed little consistency in the timing of exposure assessment (ranging from first through third trimesters) and the period of intake it represented (ranging from the previous 24 hours to average intake for the first half of pregnancy), which limited comparability across studies.
- Both continuous and categorical birth weight outcomes were examined, and some studies examined both:
    - Five studies assessed continuous birth weight.
    - Three studies assessed categorical birth weight outcomes.
- The 5 studies examining continuous birth weight found significant associations with milk intake, but in different directions. Four studies suggested greater milk intake was related to higher birth weight, but 1 study found the opposite.
- The 3 studies examining categorical birth weight outcomes had limited consistency in the outcomes measured and in findings:
    - Two of the 3 studies examined risk of SGA; 1 found greater milk intake was associated with lower risk, while the other did not find a significant relationship. One of those studies also evaluated risk of LGA and did not find a relationship with milk intake.
    - One study (the RCT) examined risk of LBW and found milk was related to lower risk.
- Overall, findings were inconsistent in both direction and statistical significance, limiting the ability to draw conclusions.
- This body of evidence had several limitations:
    - SES differed by geographic location, with the 2 studies conducted in Asia enrolling populations with substantially lower SES than did the European and Canadian studies, potentially limiting generalizability of those findings.
    - Two studies, including the RCT, had attrition rates of more than 25 percent, and neither provided information on the potential for selective attrition across intervention or exposure groups.
    - Outcomes examined, definitions used, and adjustment techniques varied across studies.
    - Many studies did not adjust for birth weight for gestational age and sex.
    - All studies failed to adjust for at least one key confounder.

Tea

- Eight PCS examined the relationship between tea consumption and birth weight outcomes.
- Studies varied in the type of tea examined:
    - Three studies reported on overall tea intake.

    - Three studies reported on caffeinated tea only.
    - Three studies reported on specific types of tea (e.g., green, black, dark, oolong).
- Most studies examined tea intake in early pregnancy.
- Continuous birth weight was examined in 6 studies, and categorical birth weight outcomes were examined in 8.
- The 6 studies examining continuous birth weight reported mixed findings:
    - Three studies found tea intake at the highest amount related to lower birth weight.
    - Three studies found the relationship was not significant.
- The 8 studies examining categorical birth weight reported similarly mixed findings:
    - Of the 7 that examined risk of SGA or IUGR at birth, 3 found greater tea intake was related to higher risk of SGA, while the relationship was non-significant for the remaining 4.
    - Low birth weight (LBW) was examined in 2 studies, and greater risk of LBW was significantly associated with greater tea intake in 1 study and was non-significant in the other.
- This body of evidence had several limitations:
    - The majority of participants were White, well-educated, and higher SES, potentially limiting generalizability.
    - Three studies examined only caffeinated tea, which may not accurately represent total tea intake and limited the ability to draw independent conclusions about the beverage as compared to caffeine.
    - Outcomes examined and the definitions used varied across studies.
    - Studies inconsistently adjusted birth weight for gestational age and sex.
    - Two studies had attrition rates of more than 20 percent, and neither provided information on the potential for selective attrition across exposure groups.
    - Seven of the 8 studies failed to adjust for at least one key confounder, most commonly pre-pregnancy body mass index (BMI) and diabetes diagnosis.

Coffee

- Seven PCS examined the relationship between coffee consumption and birth weight outcomes.
- The timing of exposure assessment showed little consistency (ranging from 5 to 39 weeks gestation).
- Continuous birth weight was examined in 5 studies, and categorical birth weight outcomes were examined in 6.
- The 5 studies examining continuous birth weight reported mixed findings:
    - Three studies found greater coffee intake was related to lower birth weight.
    - Two studies found the relationship was not significant.
- The 6 studies examining categorical birth weight reported similarly mixed findings:
    - Of the 5 that examined risk of SGA or IUGR at birth, 2 found greater

coffee intake was related to higher risk of SGA, while the relationship was not significant for the remaining 3.
    - LBW was examined in 3 studies. One found greater coffee intake was related to greater risk of LBW, while the other 2 were not significant.
- This body of evidence had several limitations:
    - The majority of participants were White, well-educated, and higher SES, potentially limiting generalizability.
    - Three studies examined only caffeinated coffee, which may not accurately represent total coffee intake and limited the ability to draw conclusions about the beverage as compared to caffeine.
    - Outcomes examined and the definitions used varied across studies.
    - Studies inconsistently adjusted birth weight for gestational age and sex
    - Seven of the 8 studies failed to adjust for at least 1 key confounder, most commonly pre-pregnancy BMI and diabetes diagnosis.
    - Two studies had attrition rates of more than 20 percent, and neither provided information on the potential for selective attrition across exposure groups.

Sugar-sweetened beverages and low- or no-calorie sweetened beverages

- Seven PCS examined the relationship between birth weight outcomes and intake of sugar-sweetened beverages (SSB), low- or no-calorie sweetened beverages (LNCSB), or both:
    - Three studies examined SSB independently.
    - Two examined LNCSB independently.
    - Two examined combined SSB and LNCSB.
    - Two did not specify whether the exposure represented SSB only or SSB plus LNCSB.
- The 3 studies examining SSB independently:
    - Measured intake across early, mid- and late-pregnancy.
    - Examined both continuous (n=3) and categorical (n=2) birth weight outcomes and were inconsistent in both the direction and statistical significance of their findings.
        - For continuous birth weight, 1 study found a positive relationship, 1 a negative relationship, and the third found no relationship with SSB intake.
        - No categorical outcomes were examined in more than 1 study.
- The 2 studies examining LNCSB independently:
    - Measured intake across early, mid- and late-pregnancy.
    - Examined continuous birth weight and found mixed results. One study showed greater LNCSB intake was related to lower birth weight, while the other did not find a significant association.
- The 2 studies that combined SSB and LNCSB intake looked specifically at caffeinated versions of the beverages:
    - Both examined risk of SGA, with one finding a significant association between greater intake and greater risk of SGA while the other did not report a significant relationship.
    - One study also examined continuous birth weight and found combined

    - caffeinated SSB and LNCSB intake in early and mid-pregnancy was related to lower birth weight, but intake at 30 weeks was not.
- The 2 studies that did not clearly define the exposure variable and may have combined SSB and LNCSB intake defined the exposure as “cola” or “soda” and measured different outcomes.
    - One study found significant associations between greater intake and higher birth weight and higher risk of SGA, while the other found no relationship with intake and risk of IUGR.
- The body of evidence for SSB and LNCSB had several limitations:
    - The number of studies available for each beverage type was very small.
    - The exposure variable is poorly defined in multiple studies.
    - Three studies examined caffeinated versions of these beverages specifically, which may not represent complete intake of the beverage.
    - The studies showed little consistency in exposure assessment timing, outcome definitions, or direction of findings across studies.
    - Studies inconsistently adjusted birth weight for gestational age and sex.
    - Five studies had attrition rates of more than 20 percent for the full sample and did not include attrition rates by exposure group.

Plain water

- Two PCS assessed the relationship between water intake during pregnancy and birth weight outcomes.
- Exposure definitions made it difficult to determine whether the assessment included plain water intake only or also included water-based beverages, limiting the usefulness of the data.
- Both studies measured continuous birth weight and risk of SGA, and neither found a significant association with plain water intake for either outcome.
- This body of evidence had several limitations:
    - The number of studies available for this beverage type was very small.
    - Exposure definitions lacked clarity to confidently state they include plain water only.
    - Studies inconsistently adjusted birth weight for gestational age and sex.

FULL REVIEW

Systematic review question

What is the relationship between beverage consumption during pregnancy and birth weight standardized for gestational age and sex?

Conclusion statement and grade

Insufficient evidence is available to determine the relationship between consumption of milk during pregnancy and birth weight outcomes. (Grade: Grade not assignable)

Insufficient evidence is available to determine the relationship between consumption of tea during pregnancy and birth weight outcomes. (Grade: Grade not assignable)

Insufficient evidence is available to determine the relationship between consumption of coffee during pregnancy and birth weight outcomes. (Grade: Grade not assignable)

Insufficient evidence is available to determine the relationship between consumption of sugar-sweetened beverages or low- or no-calorie sweetened beverages during pregnancy and birth weight outcomes. (Grade: Grade not assignable)

Insufficient evidence is available to determine the relationship between consumption of water during pregnancy and birth weight outcomes. (Grade: Grade not assignable)

Summary of the evidence

- Nineteen studies published between January 2000 and June 2019 met the criteria for inclusion in this systematic review, including 1 randomized controlled trial (RCT)[1] and 18 prospective cohort studies (PCS).[2-19]
- Many studies examined intake of multiple beverages.
- Evidence is summarized below by beverage type.

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- The 3 studies examining categorical birth weight outcomes had limited

consistency in the outcomes measured and in findings:
  - Two of the 3 studies examined risk of small-for-gestationa-age (SGA); 1 found greater milk intake was associated with lower risk, while the other did not find a significant relationship. One of those studies also evaluated risk of large-for-gestational-age (LGA) and did not find a relationship with milk intake.
  - One study (the RCT) examined risk of LBW and found milk was related to lower risk.
- Overall, findings were inconsistent in both direction and statistical significance, limiting the ability to draw conclusions.
- This body of evidence had several limitations:
  - Socioeconomic status (SES) differed by geographic location, with the 2 studies conducted in Asia enrolling populations with substantially lower SES than did the European and Canadian studies, potentially limiting generalizability of those findings.
  - Two studies, including the RCT, had attrition rates of more than 25 percent, and neither provided information on the potential for selective attrition across intervention or exposure groups.
  - Outcomes examined, definitions used, and adjustment techniques varied across studies.
  - Many studies did not adjust birth weight for gestational age and sex.
  - All studies failed to adjust for at least one key confounder.

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  - LBW was examined in 2 studies, and greater risk of LBW was significantly

associated with greater tea intake in 1 study and was non-significant in the other.

- This body of evidence had several limitations:
    - The majority of participants were White, well-educated, and higher SES, potentially limiting generalizability.
    - Three studies examined only caffeinated tea, which may not accurately represent total tea intake and limited the ability to draw independent conclusions about the beverage as compared to caffeine.
    - Outcomes examined and the definitions used varied across studies.
    - Studies inconsistently adjusted birth weight for gestational age and sex.
    - Two studies had attrition rates of more than 20 percent, and neither provided information on the potential for selective attrition across exposure groups.
    - Seven of the 8 studies failed to adjust for at least one key confounder, most commonly pre-pregnancy BMI and diabetes diagnosis.

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    - Two studies had attrition rates of more than 20 percent, and neither provided information on the potential for selective attrition across exposure groups.

Sugar-sweetened beverages and low- or no-calorie sweetened beverages

- Seven PCS examined the relationship between birth weight outcomes and intake of sugar-sweetened beverages (SSB), low- or no-calorie sweetened beverages (LNCSB), or both:
    - Three studies examined SSB independently.
    - Two examined LNCSB independently.
    - Two examined combined SSB and LNCSB.
    - Two did not specify whether the exposure represented SSB only or SSB plus LNCSB.
- The three studies examining SSB independently:
    - Measured intake across early, mid- and late-pregnancy
    - Examined both continuous (n=3) and categorical (n=2) birth weight outcomes and were inconsistent in both the direction and statistical significance of their findings.
        - For continuous birth weight, 1 study found a positive relationship, 1 a negative relationship, and the third found no relationship with SSB intake.
        - No categorical outcomes were examined in more than 1 study.
- The 2 studies examining LNCSB independently:
    - Measured intake across early, mid- and late-pregnancy.
    - Examined continuous birth weight and found mixed results. One study showed greater LNCSB intake was related to lower birth weight, while the other did not find a significant association.
- The 2 studies that combined SSB and LNCSB intake looked specifically at caffeinated versions of the beverages:
    - Both examined risk of SGA, with one finding a significant association between greater intake and greater risk of SGA while the other did not report a significant relationship.
    - One study also examined continuous birth weight and found combined caffeinated SSB and LNCSB intake in early and mid-pregnancy was related to lower birth weight, but intake at 30 weeks was not.
- The 2 studies that did not clearly define the exposure variable and may have combined SSB and LNCSB intake defined the exposure as “cola” or “soda” and measured different outcomes.
    - One study found significant associations between greater intake and higher birth weight and higher risk of SGA, while the other found no relationship with intake and risk of IUGR.
- The body of evidence for SSB and LNCSB had several limitations:
    - The number of studies available for each beverage type was very small.
    - The exposure variable was poorly defined in multiple studies.

    - Three studies examined caffeinated versions of these beverages specifically, which may not represent complete intake of the beverage.
    - The studies showed little consistency in exposure assessment timing, outcome definitions, or direction of findings across studies.
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Plain water

- Two PCS assessed the relationship between water intake during pregnancy and birth weight outcomes.
- Exposure definitions made it difficult to determine whether the assessment included plain water intake only or also included water-based beverages, limiting the usefulness of the data.
- Both studies measured continuous birth weight and risk of SGA, and neither found a significant association with plain water intake for either outcome.
- This body of evidence had several limitations:
    - The number of studies available for this beverage type was very small.
    - Exposure definitions lacked clarity to confidently state they include plain water only.
    - Studies inconsistently adjusted birth weight for gestational age and sex.

Description of the evidence

This systematic review included 19 articles, published between January 2000 and June 2019 that examined the relationship between beverage intake during pregnancy and birth weight and met criteria for inclusion. The body of evidence included one RCT and 18 PCS from 17 independent cohorts. Included studies covered a range of beverage types, with many studies examining more than one individual beverage (**Table 1**). Results supporting this research question were synthesized by beverage type.

Table 1: Types of beverages examined across studies

Study	Tea	Coffee	SSB	LNCSB	Milk	Plain water
Azad, 2016[2]			✓	✓		
Bae, 2010[3]		✓				
Bech, 2015[4]	✓	✓	✓	✓		
Chen, 2018[5]	✓	✓				
Colapinto, 2015[6]	✓					
Grosso, 2001[7]	✓	✓	✓	✓		
Grundt, 2017[8]			✓	✓		
Heppe, 2011[9]					✓	
Hrolfsdottir, 2013[10]					✓	
Li, 2014[1]					✓	
Lu, 2017[11]	✓					
Mannion, 2006[12]					✓	
Miyake, 2016[13]					✓	
Okubo, 2015[14]	✓	✓	✓	✓		
Olmedo-Requena, 2016[15]					✓	
Patelarou, 2011[16]	✓	✓				✓
Phelan, 2011[17]			✓			
Sengpiel, 2013[18]	✓	✓	✓	✓		
Wright, 2010[19]						✓

Abbreviations: SSB: Sugar-sweetened beverages; LNCSB: Low- or no-calorie sweetened beverages

There was substantial variability in the timing of intervention and exposure assessment and the period of intake represented, ranging from five to 39 weeks of pregnancy, although many studies focused on intake during the first and second trimesters.

Birth weight, as a continuous or categorical variable, was the main outcome of interest. Studies assessing birth weight were eligible regardless of adjustment for gestational age and sex, and differences in adjustment were explored in the synthesis. Studies examining birth weight-for-length were also considered. Most outcome data were collected from medical records, which record the measurement taken by the obstetrician or midwife at birth, though in a small number of studies (n=3) birth weight was reported by the mother during the postpartum period.

Evidence synthesis

Milk

Description

Six articles studying milk intake met the inclusion criteria for this question.[1,9,10,12,13,15] Details for each study are provided in **Table 2**. Even though the definition of milk included both cow's milk and soymilk, no eligible studies were found for soymilk. There was one RCT and five PCS. The RCT was conducted in China,[1] and one PCS was conducted in each of the following countries: Canada,[12] Denmark,[10] Japan,[13] the Netherlands,[9] and Spain.[15]

The RCT enrolled 2,016 participants, and the cohort sample sizes ranged from 269[12] to 3,405.[9] Women were of childbearing age, and on average participants were approximately 25 to 34 years of age. The RCT enrolled roughly equivalent proportions of Mongolian (~52%) and Han (~48%) participants.[1] Only one cohort study reported race/ethnicity (100% Dutch/White),[10] likely due, in many cases, to the low levels of racial/ethnic diversity of the sample, representative of the country in which the study was conducted. Socioeconomic status (SES) showed considerable variability across these studies, with the Asian populations having considerably lower education and relatively high levels of unemployment[1,13] compared to the European and Canadian samples.

Most studies reported a majority of participants were nulliparous, ranging from 41%[13] to 94%.[1] Average pre-pregnancy body mass index (BMI) fell within the healthy range (18.5-24.9 kg/m^2) for all studies examining milk intake.

The Analytic Framework and Inclusion/Exclusion Criteria (**Figure 1** and **Table 5**) detail the types of beverages eligible for inclusion as well as the comparisons of interest. All included studies considered milk intake as a composite variable and did not distinguish across fat or sweetener levels.

Five studies, including the RCT, reported continuous birth weight data.[1,9,10,12,13] Two of those studies adjusted for both gestational age and sex,[9,10] one adjusted for gestational age only,[12] and two did not adjust for gestational age or sex.[1,13] Three studies reported categorical birth weight data in one or more of the following forms: small for gestational age (SGA), large for gestational age (LGA), or low birth weight (LBW).[1,9,15] Half the studies adjusted for total energy intake (TEI),[9,10,15] while the other half (n=3) did not.[1,12,13]

Synthesis

All studies examining the relationship between milk intake during pregnancy and birth weight found statistically significant associations (**Table 2**).

The three studies that did not adjust for TEI, including the RCT, found mixed results. In the RCT, women were randomized to either consume 243 mL/day (roughly one cup; n=914) or to consume no milk for the duration of pregnancy (n=1,102). They were enrolled during a prenatal visit and began receiving milk as soon as pregnancy was confirmed (4-5 weeks gestation). Milk provision continued until delivery. Half of each group also received folic acid supplements before pregnancy and during the first trimester. The RCT found the groups receiving milk during pregnancy had significantly higher weight infants at birth and lower risk of LBW compared to the groups not receiving milk, regardless of folic acid supplementation status. Birth weight values were not adjusted for gestational age or sex. Additionally, the average SES of participants was substantially lower than the European and Canadian cohorts.

The two cohort studies that also did not adjust for TEI differed from one another in direction of effect, with greater milk intake associated with higher birth weight (adjusted for gestational age only) in one[12] and lower birth weight (unadjusted) in the other.[13]

Specifically, Mannion et al[12] studied milk intake during pregnancy in 269 women using three to four 24-hour dietary recalls. Milk type was not specified, nor was the timing of exposure assessment. A majority (74%) of the sample reported they were not restricting their milk intake (i.e., consuming <250 mL/day). Greater milk intake was associated with higher birth weight adjusted for gestational age.

Miyake et al[13] enrolled 1,319 women between 5 and 39 weeks gestation (Median: 17 weeks). Milk intake was assessed using a diet history questionnaire that asked about intake over the past month. Milk intake was considerably lower in this cohort than all other studies in this body of evidence. Additionally, the average SES was substantially lower than the European and Canadian cohorts.

The three studies that adjusted for TEI found consistent relationships between greater milk intake and higher birth weight.[9,10,15]

Heppe et al[9] studied the relationship between milk intake during the 1^{st} trimester and both continuous and categorical birth weight outcomes (n=3,405). Greater milk intake was associated with significantly higher birth weight (adjusted for gestational age and sex). They did not find significant associations between milk intake and risk of SGA or LGA.

Hrolfsdottir et al[10] studied milk intake during the 2^{nd} trimester in 809 women and found that greater intake was related to higher birth weight (adjusted for gestational age and sex). The study examined intake categorically but did not find a dose-response effect for milk intake. All groups consuming more than 150 mL/day had higher birth weight infants compared to the group that consumed less.

Olmedo-Requena et al[15] examined milk intake from the start of pregnancy to roughly 21 weeks gestation and its relationship with SGA. Higher milk intake in the first half of pregnancy was associated with lower risk of SGA.

The two studies examining continuous birth weight found greater milk intake related to higher birth weight, and both adjusted birth weight values for gestational age and sex. Of those reporting categorical birth weight outcomes, there was a significantly lower risk of SGA with higher milk intake when SGA was defined with the more common definition <10^{th} percentile for gestational age.[15] However, risk of SGA when defined as birth weight <5^{th} percentile for gestational age (not adjusted for sex) was not associated with milk intake.[9]

Overall, despite some consistency in direction of findings, this body of evidence was impacted by too many limitations to allow conclusion development. All cohort studies failed to adjust for at least one of the key confounders identified. Diagnosis of diabetes and race/ethnicity were the most common unadjusted confounders, though the latter may be due to sample homogeneity. Methodological differences across studies make it difficult to determine whether intake during a specific time point in pregnancy is more or less beneficial, and relatively high attrition rates across multiple studies limit the strength of evidence. Furthermore, the various types of milk were not distinguished in many of these studies, which prevents drawing conclusions regarding the effect of varying fat or sweetener levels. For the main outcome of interest, birth weight, neither gestational age, sex, nor TEI were consistently adjusted for, limiting the ability to compare across studies. Finally, none of the studies, including the RCT, had registered protocol information to verify the analytic plan; and there is a risk of publication bias in this body of evidence because all studies reported significant findings and no small or large cohorts with exclusively null data were found.

Tea

Description

Eight PCS examined tea intake during pregnancy. Brief details for each study are provided in **Table 2**. One study was conducted in each of the following countries: Canada,[6] China,[11] Denmark,[4] Greece,[16] Ireland,[5] Japan,[14] Norway,[18] and the United States.[7]

The cohort sample sizes ranged from 858[14] to 71,000.[4] Women were of childbearing age, on average ranging from 25 to 34 years of age. Most studies did not report race/ethnicity, and none reported >10% minority enrollment. The U.S. study enrolled 90% White participants.[7] Participant SES did not vary substantially across this body of evidence; the majority of participants were highly educated.

Most studies reported roughly half of participants were nulliparous, though one study reported a majority (87%).[11] Average pre-pregnancy BMI fell within the healthy range (18.5-24.9 kg/m^2) for all studies examining tea intake.

The Analytic Framework and Inclusion/Exclusion Criteria (**Figure 1** and **Table 5**) detail the types of beverages eligible for inclusion as well as the comparisons of interest. Most studies did not differentiate between types of tea, although some presented findings by specific types of tea (e.g., green, oolong, black).

Six studies reported continuous birth weight data.[4-6,11,16,18] Four of those studies adjusted for both gestational age and sex,[4,11,16,18] and two did not adjust for either gestational age or sex.[5,6] All eight studies also reported categorical birth weight data in one or more of the following forms: SGA, LGA, LBW, or intrauterine growth restriction (IUGR). In terms of energy intake, six of the eight studies did not adjust for TEI.

Synthesis

Studies examining the relationship between tea intake during pregnancy and birth weight reported one of two main findings: that greater tea intake was related to lower birth weight or that the relationship between tea intake and birth weight was not statistically significant (**Table 2**). No studies found greater tea intake related to higher birth weight.

Six of the eight studies did not adjust for TEI. Of those six, five reported a continuous birth weight outcome, and results were mixed. Two of the five reported a significant relationship between tea intake during pregnancy and birth weight. The remaining three found the relationship between tea intake and birth weight was not significant. All eight studies examined categorical birth weight data and reported similarly mixed findings.

Bech et al[4] reported that increased tea intake during the 2nd trimester in a Danish sample (n=71,000) was related to a significant decrease in birth weight adjusted for gestational age and sex. The relationship was found in participants consuming 7-15 cups per day but not at intake levels below that. Consuming ≥16 cups per day trended toward the same relationship, though the portion of the sample with that level of intake was very small (0.4%).

Chen et al[5] examined tea intake during the 1st trimester in an Irish sample (n=941) and found the highest level of caffeine intake from tea (≥100 mg/day) was significantly associated with lower birth weight (unadjusted) and greater risk of LBW. They also examined exclusive tea drinkers (i.e., excluding coffee drinkers) and found the same relationship with tea intake and continuous birth weight; however, the relationship with risk of LBW was no longer significant.

Colapinto et al[6] studied tea intake during the 1st trimester in a Canadian sample (n=1,743). Tea intake was dichotomized as either <1 cup per week or ≥1 cup per week. They found no significant relationship between tea intake and birth weight (unadjusted) or risk of SGA.

Grosso et al[7] examined tea intake during the first month of pregnancy and risk of IUGR at birth in a U.S. sample (n=2,714). They used the same definition for IUGR at birth as many other studies used for SGA (≤10th percentile of birth weight for gestational age). They found no significant relationships between tea intake and risk of IUGR at birth. Stratifying outcome data by smoking status did not change the results.

Lu et al[11] considered overall tea intake during early pregnancy as well as intake of different types of tea, including green, oolong, and dark/black teas. Outcomes in this Chinese sample (n=8,775) included both continuous birth weight adjusted for gestational age and sex (z-scores) and categorical outcomes of SGA and LGA. Green tea was the only type significantly related to the outcomes of interest. Higher green tea intake (>3 servings per week) was related to higher risk of having a LGA infant (>90th percentile). This relationship remained when individuals who consumed any other types of tea were excluded from the analysis. Total tea, oolong tea, and black/dark tea intake were not associated with birth weight outcomes.

Patelarou et al[16] examined tea/herb infusion intake during the 1st trimester in a Greek sample (n=1,359). They found no significant relationships between tea intake and birth weight adjusted for gestational age and sex or risk of LBW or SGA.

The two studies that adjusted for TEI showed mixed results as well.

Okubo et al[14] considered specific types of tea intake and their relationship with risk of LBW and SGA in a Japanese sample (n=858). The majority of intake assessments reflected 1st trimester intake, but enrollment ranged across pregnancy, so exposure data reflected 2nd or 3rd trimester intake for some participants. Neither Japanese and Chinese tea intake (as a combined exposure) nor black tea intake were significantly associated with either outcome.

Sengpiel et al[18] used three different Northern European growth charts to assess the relationship between black tea intake during pregnancy and birth weight adjusted for gestational age and sex. This Norwegian sample (n=59,123) reported average tea intake for the first half of pregnancy (0-22 weeks) and for specific time points (17 weeks and 30 weeks). The ultrasound-based and population-based growth curves demonstrated consistently significant relationships with the birth weight outcomes.

Greater black tea intake from 0-22 weeks and at 30 weeks was related to lower birth weight adjusted for gestational age and sex. Black tea intake at 17 weeks was not associated with birth weight. They also found higher average tea intake during 0-22 weeks gestation was associated with greater risk of SGA. The 1992 customized growth curves found consistently non-significant relationships with the exception of higher average black tea intake from 0-22 weeks gestation, which was related to lower birth weight. This was the only exposure/outcome combination that was significant for all three growth curves.

Overall, the evidence examining the relationship between tea intake during pregnancy and birth weight outcomes is too mixed to support conclusions of its impact. Although a number of studies, including the largest cohort, suggest greater tea intake may be related to lower birth weight, an equal number of studies found no association. Therefore, further research is need to determine if tea intake during pregnancy impacts birth weight outcomes and whether relationships are specific to the type of tea or timing of intake.

Limitations in this body of evidence also affect the ability to draw conclusions. Specifically, there is a lack of generalizability to lower SES or racial/ethnic minority populations due to the homogeneity across samples. The inconsistency in exposure measurement (e.g., only examining certain types of teas or only caffeinated versions) also limits the ability to draw conclusions across studies. In particular, some studies examined overall tea intake while others differentiated by type, making it difficult to draw conclusions about either given the size of this body of evidence. Further contributing to the difficulty in comparing across studies, the main outcome of interest, birth weight, was not consistently adjusted for gestational age and sex within these studies, nor did studies consistently adjust for TEI. Potential confounders including pre-pregnancy BMI and diabetes diagnosis were not accounted for in multiple studies, and none of the studies had registered protocol information to verify the analytic plan. Publication bias is always a consideration; however, it was not a serious concern for this body of evidence because multiple studies reported only non-significant findings while others reported significant findings or a mix of significant and non-significant findings.

Coffee

Description

Seven PCS examined coffee intake during pregnancy and its relationship with birth weight outcomes. Brief details for each study are provided in **Table 2**. One study was conducted in each of the following countries: China,[5] Denmark,[4] Greece,[16] Japan,[14] Korea,[3] Norway,[18] and the United States.[7]

The cohort sample sizes ranged from 112[3] to 71,000.[4] Women were of childbearing age, and on average participants were 25 to 34 years of age. Most studies did not report race/ethnicity, and none reported >10% minority enrollment. The U.S. study enrolled 90% White participants.[7] Participant SES did not vary substantially across this body of evidence; the majority of participants were highly educated.

All studies reported roughly half of their participants were nulliparous. Average pre-pregnancy BMI fell within the healthy range (18.5-24.9 kg/m^2) for the five studies reporting those data in this body of evidence.

The Analytic Framework and Inclusion/Exclusion Criteria (**Figure 1** and **Table 5**) detail the types of beverages eligible for inclusion as well as the comparisons of interest. All studies examined either overall coffee intake or caffeine from coffee, but none of them studied more nuanced distinctions like preparation technique or additives.

Five studies reported continuous birth weight data.[3-5,16,18] Three of those studies adjusted for both gestational age and sex,[4,16,18] and two did not adjust for either.[3,5] Six of the seven total studies also reported categorical birth weight data in one or more of the following forms: SGA, LGA, LBW, or IUGR.[4,5,7,14,16,18] In terms of energy intake, five of the seven studies did not adjust for TEI.

Synthesis

Studies examining the relationship between coffee intake during pregnancy and birth weight outcomes found mixed results. Of note, all but one of these studies also examined tea intake.[3]

Five studies did not adjust for TEI. Roughly half of those studies reported significant relationships between continuous and categorical birth weight outcomes, while the others did not find significant relationships.

Bae et al[3] examined coffee intake in relation to continuous birth weight (unadjusted) in a Korean sample (n=112). They found no significant associations between a range of exposure amounts and birth weight. Analyses were not adjusted for any potential confounders.

Bech et al[4] studied coffee intake during the 2nd trimester in a large sample of Danish women (n=71,000). They found that any amount of coffee intake was associated with lower birth weight adjusted for gestational age and sex, including consumption in the range of 0.5-3 cups per day. This relationship remained when coffee intake was analyzed as a continuous variable. Risk of SGA also increased in parallel with coffee intake, though the relationship with categorical intake was only significant at ≥4 cups per day, not lower amounts. They also stratified coffee intake by smoking status and reported the same relationship with continuous birth weight and risk of SGA in non-smokers. However, as daily cigarette frequency increased, the association with coffee intake was attenuated so that at the highest smoking frequency, only the highest amount of coffee intake (≥8 cups/day) remained significantly associated with birth weight.

Chen et al[5] assessed coffee intake during the 1st trimester and its association with birth weight (unadjusted) in an Irish sample (n=941). They found the highest levels of caffeinated coffee intake (≥200 mg/day) were associated with significantly lower unadjusted birth weight. This level of coffee intake also related to greater risk of LBW.

Grosso et al[7] examined caffeinated coffee intake in the first month of pregnancy in a U.S. sample (n=2,714). Their outcome of interest was IUGR at birth, which was defined in the same way as SGA in other studies (≤10th percentile of birth weight for gestational age). They found no significant relationship between coffee intake and risk of IUGR at birth. They also stratified data by smoking status during the first month of pregnancy and found no significant associations between coffee intake and risk of

IUGR at birth.

Patelarou et al[16] enrolled a Greek sample (n=1,359) and assessed coffee intake at approximately three months gestation. The association between coffee intake and birth weight adjusted for gestational age and sex was not significant. The relationships between coffee intake and risk of LBW and SGA were also reported to be non-significant, though specific values were not provided.

The two studies that controlled for TEI reported similarly mixed results.

Okubo et al[14] studied coffee intake and risk of LBW and SGA in a Japanese sample (n=858). There were no significant associations between coffee intake and risk of either birth weight outcome.

Sengpiel et al[18] examined caffeinated coffee intake in a Norwegian sample (n=59,123) and its relationship with birth weight adjusted for gestational age and sex and risk of SGA. They used three different Northern European growth charts to assess these relationships. Average coffee intake was reported for the first half of pregnancy (0-22 weeks) and for specific time points (17 weeks and 30 weeks). Higher coffee intake at all time points was consistently associated with lower birth weight and higher risk of SGA. The relationship remained significant for all three growth assessment methods (ultrasound-based, population-based, and older customized growth curves).

All significant findings were in the direction of greater coffee intake during pregnancy relating to lower birth weight and greater risk of detrimental outcomes, such as SGA. However, because an equal number of studies did not find a statistically significant relationship, the evidence does not provide a clear answer to this research question.

Due to the overlap in studies between the bodies of evidence for tea and coffee, the limitations are similar. These samples provide weak generalizability to lower SES and racial/ethnic minority populations. Exposure measures provide limited specificity about any additives consumed with coffee, and others looked only at caffeinated coffee intake. For the main outcome of interest, birth weight, gestational age and sex were not consistently adjusted for within these studies, nor did studies consistently adjust for TEI, limiting the ability to compare across findings. Many studies also fail to adjust for confounders such as pre-pregnancy BMI and diabetes diagnosis. Publication bias is always a consideration; however, it was not a serious concern for this body of evidence because multiple studies with a range of sample sizes reported only non-significant findings. Finally, none of the studies had registered protocol information to verify the analytic plan.

SSB and LNCSB

Description

Seven PCS examining sugar-sweetened beverages (SSB) exclusively, low- or no-calorie sweetened beverages (LNCSB) exclusively, or SSB combined with LNCSB intake met the inclusion criteria for this question (**Table 2**). Two studies each were conducted in Norway[8,18] and the United States,[7,17] and one study each was conducted in Canada,[2] Denmark,[4] and Japan.[14]

Cohort sample sizes ranged from 285[17] to 71,000.[4] Women were of childbearing age, and on average were approximately 25 to 34 years of age. Studies enrolled predominantly White participants who were well educated. Average pre-pregnancy BMI fell in the healthy weight category (18.5-24.9 kg/m^2) for all studies except one, in which targeted recruitment resulted in roughly half the participants being overweight or having obesity.[17] The majority of studies reporting data on parity enrolled roughly half nulliparous women.

The Analytic Framework and Inclusion/Exclusion Criteria (**Figure 1** and **Table 5**) detail the types of beverages eligible for inclusion as well as the comparisons of interest. Any beverages with caloric sweetener or low- and no-calorie sweetener added were eligible for inclusion; however, many of the studies focused specifically on carbonated SSB/LNCSB or “soda”. Multiple studies did not report a clear distinction between SSB and LNCSB.

Both continuous and categorical birth weight outcomes were represented in this body of evidence. Five studies assessed continuous birth weight,[2,4,8,17,18] three of which adjusted for both gestational age and sex,[4,17,18] while the other two adjusted for neither.[2,8] Six studies reported categorical birth weight outcomes in one or more of the following forms: SGA, LGA, LBW, high birth weight (HBW), or IUGR.[4,7,8,14,17,18]

Synthesis

The SSB and LNCSB studies are synthesized by group depending on exposure definition. The three studies that examined SSB specifically did not adjust for TEI in their final analyses, though two of the three examined TEI in either stepwise regression or sensitivity analyses and did not find differences in results.

Azad et al[2] examined SSB intake in 2,413 Canadian women during the second or third trimester. SSB intake ranging from <1 serving per month to ≥1 serving per day was not related to birth weight (unadjusted).

Grundt et al[8] assessed carbonated SSB intake at multiple time points during pregnancy in a large Norwegian sample (n=50,712). Average intake was then calculated. They focused primarily on women who were not diagnosed with gestational diabetes (GDM) but also reported findings for GDM pregnancies separately. The majority of other studies in this body of evidence excluded participants with GDM. In non-GDM pregnancies, greater carbonated SSB intake was associated with significantly lower birth weight. A secondary analysis adjusting for gestational age was conducted, and this adjustment attenuated the association between intake and birth weight. Results stratified by pre-pregnancy BMI revealed a similar association, with the relationship remaining significant for all but the underweight BMI group (<18.5 kg/m^2; 2.7%). The same held true when stratified by smoking status; greater intake was related to lower birth weight in both nonsmokers and smokers.

Analysis of categorical outcomes of LBW (<2500 grams) and HBW (>4500 grams) showed mixed findings. Greater carbonated SSB intake was not related to risk of LBW in the full sample or when stratified by pre-pregnancy BMI. When stratified by smoking status, higher carbonated SSB intake was associated with greater risk of LBW in smokers only. For HBW, greater carbonated SSB intake was associated with greater risk of HBW in the full sample. In the stratified analyses, the relationship remained significant in those with pre-pregnancy BMI >25 kg/m^2 and in nonsmokers. All analyses exclusively examining GDM pregnancies were non-significant.

Phelan et al[17] assessed SSB intake early in pregnancy in a U.S. sample (n=285). Normal weight women (defined as BMI 19.8-26.0 kg/m^2 at enrollment) were analyzed separately from women who were overweight or had obesity. Greater SSB intake was related to higher birth weight-for-age z-scores in normal weight women before adjusting for gestational weight gain but not after. The relationship was not significant in women who were overweight or had obesity. SSB intake was not related to risk of LGA (>90th percentile) or macrosomia (>4000 grams) in either weight group.

Two studies examined LNCSB intake independently of SSB intake. Neither adjusted for TEI.

Azad et al[2] which also examined SSB intake specifically (described above), analyzed the relationship between LNCSB and birth weight (unadjusted) in a Canadian sample (n=2,413). Intake during the 2nd or 3rd trimester was not significantly related to birth weight.

Grundt et al[8] studied LNCSB intake at multiple time points during pregnancy (15, 22, and 30 weeks) in a Norwegian sample (n=50,280). Intake was averaged across time points and was significantly related to continuous birth weight (unadjusted). Researchers examined overall LNCSB intake as well as carbonated LNCSB intake specifically. Greater average intake was related to significantly lower birth weight for both overall LNCSB and carbonated LNCSB intake.

Two additional studies clearly combined SSB and LNCSB in their exposure assessment, and both adjusted for TEI.

Okubo et al[14] examined maternal soft drink intake during pregnancy in a Japanese sample (n=858). Soft drink intake included both “cola” and “diet cola.” Intake was not significantly related to risk of either SGA or LBW.

Sengpiel et al[18] also examined combined SSB/LNCSB as their exposure of interest, caffeinated soft drinks in particular. Average intake for the first half of pregnancy was measured in this Norwegian sample (n=59,123), as was intake at 17 weeks and 30 weeks, specifically. Continuous birth weight, adjusted for gestational age and sex, was defined using three distinct growth charts and findings were consistent across all three. Greater caffeinated soda intake from 0-22 weeks gestation was related to significantly lower birth weight, as was intake at 17 weeks. Intake at 30 weeks was not significantly related to birth weight. Greater intake from 0-22 weeks gestation was also related to higher risk of SGA for two of the three growth curves.

Two studies did not use an assessment method that clearly defined their exposure of interest, potentially resulting in participants reporting combined SSB and LNCSB intake. These two studies did not adjust for TEI.

Bech et al[4] assessed maternal cola intake during the second trimester in a large Danish cohort (n=71,000). Cola intake was assessed using a single question and was not further defined to participants or in the study description; therefore, it is unclear whether the exposure was SSB exclusively or also included LNCSB. The authors noted the exposure assessment was crude (0, <1 L/week, or ≥1 L/week). Greater cola intake in the second trimester was related to higher birth weight and higher risk of SGA.

Grosso et al[7] examined caffeinated soda intake in the first 16 weeks of gestation. As with Bech et al,[4] the exposure was not well-defined and may have included both SSB and LNCSB. Intake of soda was not related to risk of IUGR in the overall sample or when stratified by smoking status.

Overall, the three studies assessing SSB independently found mixed results, including a relationship with higher birth weight, a relationship with lower birth weight, and a non-significant relationship. The two studies examining LNCSB intake also found mixed results, one showing a significant relationship between greater intake and lower birth weight, the other not finding a significant association. Finally, those that either clearly or potentially combined SSB and LNCSB intake found mixed results with continuous birth weight, as well. Two studies did find that greater intake was related to higher risk of SGA, but the other two did not find a significant association with SGA/IUGR at birth.

Numerous limitations affect the interpretability of this evidence. Notably, the variability across exposure definition prevents synthesis across the full body of evidence by limiting the ability to distinguish SSB from LNCSB intake. Only a small number of studies, three and two, respectively, clearly study SSB and LNCSB exclusively. Additionally, the included samples also have low generalizability to lower-SES and minority populations. Publication bias, while always an important consideration, is not a major concern in this body of evidence due to the mix of cohort sizes and significant and non-significant findings.

Plain Water

Description

Two PCS examining plain water intake were included. One was conducted in the United States,[19] the other in Greece.[16]

Cohort sample sizes ranged from 1,359[16] to 1,854.[19] Women were of childbearing age, and on average were approximately 25 to 34 years of age. The education level was substantially lower in the Greek sample.

The Analytic Framework and Inclusion/Exclusion Criteria (**Figure 1** and **Table 5**) detail the types of beverages eligible for inclusion as well as the comparisons of interest. Any studies measuring water intake during pregnancy were eligible for inclusion, and both studies focused on plain water and did not include carbonated or flavored varieties.

Both continuous and categorical birth weight outcomes were represented in this body of evidence. Both studies assessed continuous birth weight; one adjusted for both gestational age and sex while the other adjusted for sex only. Both studies measured risk of SGA, and one examined risk of LBW, as well.

Synthesis

Studies examining the relationship between plain water intake and birth weight outcomes were too limited in number and scope to evaluate the relationship.

Patelarou et al[16] assessed water intake at three months of pregnancy and during the third trimester in relation to continuous birth weight and risk of SGA and LBW. Water intake was not associated with birth weight adjusted for gestational age and sex at either time point. When separated by water type (i.e., spring/bottled water or tap water), the relationship remained non-significant. Water intake was also not related to risk of SGA or LBW, though data were not reported.

Wright et al[19] examined plain water intake in the first trimester and in mid pregnancy. Their assessment of tap water intake included water-based beverages such as coffee, tea, and juice; therefore, data from this study could not be used to answer this question. Bottled water intake was assessed separately and was not associated with birth weight adjusted for sex or risk of SGA.

Assessment of the evidence[ii]

As outlined and described below, the body of evidence examining beverage consumption during pregnancy and birth weight was assessed for the following elements used when grading the strength of evidence.

Risk of bias (see **Table 3** and **Table 4**)

- Key confounders not adjusted for
- Exposure assessment tools not validated
- Exposure not well defined
- High attrition

Consistency

- Limited across all beverage types

Directness

- Poor exposure definitions limit ability to comment on any specific beverage types, as intended
- Most cohort studies were designed for a different purpose – data for this question often result from secondary analysis

Precision

- Limited confidence that results would be comparable if many of these studies were repeated

Generalizability

- Limited for lower-SES and racial/ethnic minority populations

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[ii] A detailed description of the methodology used for grading the strength of the evidence is available on the NESR website: https://nesr.usda.gov/2020-dietary-guidelines-advisory-committee-systematic-reviews and in Part C of the following reference: Dietary Guidelines Advisory Committee. 2020. *Scientific Report of the 2020 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Agriculture and the Secretary of Health and Human Services*. U.S. Department of Agriculture, Agricultural Research Service, Washington, DC.

Research recommendations

- Exposures
  - Differentiate between different types of milk (fat and sweetener content, milk substitutes), tea/coffee (types/flavors, additives, caffeine), SSB/LNCSB (cleanly separate the two), water (including flavored and carbonated varieties)
  - More research is needed examining both before pregnancy and specific time periods during pregnancy to determine timing of greatest impact
  - Consistently use validated measures
- Comparators
  - Many valid comparators for these beverages (e.g., SSB) were not examined in any studies—(e.g., SSB consumption vs. water or nothing or LNCSB) and should be considered in future research
- Outcomes
  - Consistently adjust for gestational age and sex
  - Run analyses both adjusting and not adjusting for TEI – consider adjusting only for non-beverage energy intake

Included articles

1. Li YF, Hu NS, Tian XB, et al. Effect of daily milk supplementation on serum and umbilical cord blood folic acid concentrations in pregnant Han and Mongolian women and birth characteristics in China. *Asia Pac J Clin Nutr.* 2014;23(4):567-574. doi: 10.6133/apjcn.2014.23.4.18.
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Table 2: Results across beverages types for the relationship between beverage intake during pregnancy and birth weight[iii]

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations
Randomized controlled trials—Milk			

[iii] Abbreviations: BW: birth weight; CI: confidence interval; d: day(s); g: gram(s); FFQ: food frequency questionnaire; GA: gestational age; GDM: gestational diabetes mellitus; gls: glasses; HBW: high birth weight; IQR: interquartile range; IUGR: intrauterine growth restriction; kg/m^2: kilograms per meters squared; LBW: low birth weight; LGA: large for gestational age; LMP: last menstrual period; mo: month(s); N/A: not applicable; NR: not reported; NS: not significant; OR: odds ratio; oz: ounce(s); RR: risk ratio; Ref: reference group; SD: standard deviation; Serv: serving; SGA: small for gestational age; TEI: total energy intake; wk: week(s); y: year(s)
Blue font indicates a statistically significant relationship.

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations
<u>**Li, 2014**</u>[1] **Randomized Controlled Trial, Project of a Glass of Milk, China** Baseline N=3,526 Analytic N=2,016 (Attrition: 43%) **Maternal characteristics:** • Maternal age: 19-25y ~41.4%, 25-30y ~40.7%, 30-43y 17.9% • Race/ethnicity: Mongolian ~52.4%, Han 47.6% • SES: Education level, ≤7y ~25.6%, 7-9y ~48.4%, ≥10y ~26.0% • Pre-pregnancy BMI: Mean~22.7 kg/m² • Smoking: Almost all non-smokers • Parity: Offspring, Zero 94.4%, One 5.6% • Diabetes: NR • Total energy intake: NR **Child characteristics:** • Female child: %NR • Gestational age: NR • Birth weight: Mean~3375 g	**Intervention:** Parallel arm, 4 groups: • Folic acid supplementation (pre- & early pregnancy) • Milk consumption (during pregnancy) • Folic acid supplementation (pre- & early pregnancy) • + milk consumption (during pregnancy) • No folic acid or milk <u>Milk intervention</u>: Women provided 243 mL/d of ultra-high temperature treated liquid milk upon confirmation of pregnancy (5-7wk gestation) <u>Compliance</u>: trained study organizers periodically recorded compliance (no further information given on method or results) **Comparators:** Milk intake intervention: Milk group (243 ml/d) vs. No milk group **Study beverage intake:** Milk group: 243ml container of milk in the morning daily from confirmation of pregnancy (5-7wk gestation) to parturition **Outcomes and assessment methods:** Birth weight in g measured by obstetrician/gynecologist, restricted to term births (38-42wk gestation)	*BW & LBW: not adjusted* *TEI adjusted: No* <u>**Birth weight**</u>, T-test No milk group (n=1,102): Mean=3346 g, SD=408 **Milk group (n=914): Mean=3410 g, SD=425, P=0.01** <u>**LBW**</u> (<2500 g), Chi-square difference **No milk group (n=20): 1.8% vs Milk group (n=7): 0.8%, P=0.04** <u>**Birth weight ≤2500 g**</u>, Chi-square difference **No milk group (n=32): 2.9% vs Milk group (n=13): 1.4%, P=0.03** <u>**Birth weight <3000 g**</u>, Chi-square difference **No milk group (n=129): 11.7% vs Milk group (n=81): 8.9%, P=0.04** <u>**Birth weight ≤3000 g**</u>, Chi-square difference **No milk group (n=242): 22.0% vs Milk group (n=164): 17.9%, P=0.03** <u>**Birth weight <3500 g**</u>, Chi-square difference **No milk group (n=656): 59.5% vs Milk group (n=496): 54.3%, P=0.02** <u>**Birth weight ≤3500 g**</u>, Chi-square difference **No milk group (n=815): 74.0% vs Milk group (n=628): 68.7%, P=0.01**	No model adjustments reported Baseline characteristics were not reported by milk group, so it cannot be determined if they varied. **Limitations:** • Birth weight not standardized by gestational age or sex • Limited generalizability (education, race/ethnicity) **Funding source:** National Basic Research Program from Ministry of Science and Technology

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations
Prospective cohort studies—Milk			
Mannion, 2006[2] **Prospective Cohort Study, Canada** Baseline N= 279 Analytic N=269 (Attrition: 4%) **Maternal characteristics:** • Maternal age: Mean~30.9y • Race/ethnicity: NR • SES: University education ~47.0% • Pre-pregnancy BMI: Mean~23.1 kg/m^2 • Smoking: Yes ~5.7% • Parity: NR • Diabetes: 100% without diabetes • Total energy intake: Mean~2454 kcal/d **Child characteristics:** • Female child: %NR • Gestational age: NR • Birth weight: Mean~3499 g	**Exposure of interest:** Maternal milk intake during pregnancy Assessment method: three to four 24-hour dietary telephone recalls conducted by trained nutritional interviewers (previously validated approach) on random days of the week (including Saturday and Sunday) Timing of assessment: NR Represents: current intake during pregnancy **Comparator:** • Milk intake (per 250 mL/d and per total L) modeled continuously **Study beverage intake:** • Milk intake restriction (<250 mL/d): No 74%, Yes 26% **Outcomes and assessment methods:** • Birth weight abstracted from medical records	*BW adjusted: GA only* *TEI adjusted: No* **Birth weight**, Linear regression No milk intake (Ref) **Per cups/day (250 mL): B: 41.21 g, 95% CI: 13.96, 75.12, P=0.02**	**Confounders accounted for:** • Key confounders: Gestational age, maternal age, pre-pregnancy BMI, SES, smoking, diagnosis of diabetes • Other factors considered: Total energy intake **Confounders NOT accounted for:** • Key confounders: Child sex, race/ethnicity, pre-pregnancy beverage intake • Other factors considered: Parity, timing, temporal use, sugar, protein, fiber, energy density, medications, supplements **Additional model adjustments:** • Gestational weight gain, maternal height **Limitations:** • Serious risk of bias due to confounding • Weeks gestation at recruitment and at 24-hour dietary recalls was not reported • Birth weight not adjusted for child sex **Funding sources:** Dairy Farmers of Canada; Fonds de recherche en Sante du Quebec

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations
<u>Miyake, 2016</u>[3] **Prospective Cohort Study, Kyushu Okinawa Maternal and Child Health Study, Japan** Baseline N= 1,757 Analytic N=1,319 (Attrition: 25%) **Maternal characteristics:** • Maternal age: Median=32.0y, IQR=28.0-34.0 • Race/ethnicity: NR • SES: Education <13y 22.3%, 13-14y 33.5%, ≥15y 44.2%; Job type, Unemployed 38.5%, Professional or technical 26.5%, Clerical or related occupation 19.0%, Sales 4.8%, Service 6.9%, Production 2.7% • Pre-pregnancy BMI: Median=20.9 kg/m^2 (IQR=19.5-22.7) • Smoking: pregnancy, 8.1% • Parity: Number of children, Zero 40.6%, One 40.0%, ≥Two 19.3% • Diabetes: NR • Total energy intake: Median=7137.9 kJ/d, IQR=6083.5-8493.5) **Child characteristics:** • Female child: 51.2% • Gestational age: NR • Birth weight: Median=3006 g, IQR=2765-3244	**Exposure of interest:** Milk intake (g/d; sum of full-fat milk and low-fat milk) during pregnancy <u>Assessment method</u>: validated semi-quantitative diet history questionnaire <u>Assessment timing</u>: between 5th and 39th wk (Median=17.0wk gestation, IQR=14.0-21.0) <u>Represents</u>: previous month's intake **Comparator:** • Milk intake: Quartile 1 (<12.5 g/d), Quartile 2, Quartile 3, Quartile 4 (>150 g/d) **Study beverage intake:** • Milk intake (g/d): Median 67.0, IQR=12.5-150 **Outcomes and assessment methods:** • Birth weight in g, measured via self-administered questionnaire after delivery	*BW not adjusted* *TEI adjusted: No* **<u>Birth weight</u>**, Logistic regression **Quartile 1: Median=3030 g, IQR=2780-3266** *Quartile 2 (Data NR)* *Quartile 3 (Data NR)* **Quartile 4: Median=2966 g, IQR=2709-3210** **P for trend: 0.003**	**Confounders accounted for:** • Key confounders: Child sex, SES • Other factors considered: Parity, total energy intake **Confounders NOT accounted for:** • Key confounders: Gestational age, maternal age, race/ethnicity, pre-pregnancy BMI, pre-pregnancy beverage intake, smoking, diagnosis of diabetes • Other factors considered: Timing, temporal use, sugar, protein, fiber, energy density, medications, supplements **Additional model adjustments:** N/A **Limitations:** • Serious risk of bias due to confounding • Birth weight measured using maternal self-report and recall • Birth weight not adjusted for gestational age or child sex **Funding sources:** JSPS KAKENHI; Ministry of Health, Labor and Welfare, Japan; Meiji Co. Ltd; Food Science Institute Foundation; Dairy Products Health Science Council;

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations
Heppe, 2011[4] **Prospective Cohort Study, Generation R Study, The Netherlands** Baseline N= 4,057 Analytic N=3,405 (Attrition: 16%) **Maternal characteristics:** • Maternal age: Mean=31.4y, SD=4.4 • Race/ethnicity: 100% Dutch/White • SES: High education 58.9%; Married/living together 91.3% • Pre-pregnancy BMI: Mean=23.2 kg/m^2, SD=3.9 • Smoking: Never 69.6%, First trimester 8.1%, Continued 14.7% • Parity: ≥1 39.8% • Diabetes: NR • Total energy intake: Mean=2145 kJ, SD=511 **Child characteristics:** • Female child: 49.5% • Gestational age: Mean=40.0wk, SD=1.7 • Birth weight: Mean=3489 g, SD=556	**Exposure of interest:** Maternal milk intake (glasses/d; including skimmed, semi-skimmed, full-fat, sweetened milk, milk products with additional fruit, and milk products enriched with vitamins or extra calcium) Assessment method: semi-quantitative FFQ (modified version of Klipstein-Grobusch FFQ validated in older White population) Assessment timing: ~13.5wk Represents: 1st trimester intake **Comparator:** • Milk intake: 0-1 glasses/d, >1-2 glasses/d, >2-3 glasses/d, >3 glasses/d **Study beverage intake:** • Milk intake (glasses/d): Median=2.6, IQR=2.1 • Frequency of milk intake (glasses/d): 0-1 29.1%, >1-2 23.6%, >2-3 27.6%, >3 19.7% **Outcomes and assessment methods:** • Birth weight obtained from medical records and hospital registries; gestational age estimated from first fetal ultrasound • SGA and LGA defined as <5th percentile and >95th percentile, respectively, in study cohort for sex and gestational age adjusted birth weight	*BW/SGA/LGA adjusted: GA & sex* *TEI adjusted: Yes* **Birth weight**, Linear regression, B (95% CI) 0-1 glasses (gls)/d (Ref) (n=961) **>1-2 gls/d (n=779): 63.8 g (20.3, 107), P<0.05** **>2-3 gls/d (n=921): 63.8 g (21.7, 106), P<0.05** **>3 gls/d (n=653): 87.5 g (39.3, 135), P<0.05** **P for trend: <0.01** **SGA**, Logistic regression, OR (95% CI) 0-1 (Ref) >1-2 gls/d: 0.81 g (0.49, 1.34), P>0.05 >2-3 gls/d: 0.79 g (0.28, 2.19), P>0.05 >3 gls/d: 0.84 g (0.49, 1.43), P>0.05 P for trend: 0.25 **LGA**, Logistic regression, OR (95% CI) 0-1 (Ref) >1-2 gls/d: 1.21 g (0.73, 2.01), P>0.05 >2-3 gls/d: 1.56 g (0.97, 2.49), P>0.05 >3 gls/d: 1.59 g (0.94, 2.70), P>0.05 P for trend: 0.17	**Confounders accounted for:** • Key confounders: Child sex, gestational age, maternal age, race/ethnicity, SES, pre-pregnancy BMI, pre-pregnancy beverage intake, smoking • Other factors considered: Parity, total energy intake **Confounders NOT accounted for:** • Key confounders: Pre-pregnancy beverage intake, diagnosis of diabetes • Other factors considered: Timing, temporal use, sugar, protein, fiber, energy density, medications, supplements **Additional model adjustments:** • Maternal height, marital status, alcohol use, folic acid supplements, vomiting, nausea, daily energy intake, paternal height, consumption of fruit, vegetables, meat, fish and coffee **Limitations:** • Serious risk of bias due to confounding • Study not generalizable to other racial/ethnic groups **Funding sources:** Erasmus Medical Center, Rotterdam; Erasmus University Rotterdam; Dutch Ministry of Health, Welfare and Sport; Netherlands Organization for Health Research and Development

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations
Hrolfsdottir, 2013[5] **Prospective Cohort Study; Aarhus Birth Cohort; Denmark** Baseline N= 965 Analytic N=809 (Attrition: 16%) **Maternal characteristics:** • Maternal age: Mean=29.1y, SD=4.2 • Race/ethnicity: NR • SES: Education, Elementary schooling 13.9%, High/technical school 25.4%, University 35.1%, Higher academic 15.2%, Other education 10.4% • Pre-pregnancy BMI: Mean=21.5 kg/m^2, SD=3.2 • Smoking: Never 66.5%, Occasional 16.2%, Daily 17.3% • Parity: Nulliparous 56.4% • Diabetes: NR • Total energy intake: Mean=8.5 MJ/d, SD=2.4 **Child characteristics:** • Female child: 48.1% • Gestational age: Mean=282.1d, SD=7.5 • Birth weight: Mean=3497 g, SD=494	**Exposure of interest:** Maternal cow's milk intake (ml/d; including whole, semi-skimmed, skimmed, and cultured milk) Assessment method: FFQ validated against dietary records and n-3 fatty acids (but not milk) Assessment timing: ~29wk gestation Represents: Previous 3 months (~2nd trimester) **Comparator:** • Milk intake (ml/d): 0-150, ≥150-600, ≥600-900, ≥900, ≥150 **Study beverage intake:** • Milk intake (ml/d): Mean=712, SD=367 • Milk intake (ml/d): 0-150 6.2%, ≥150-600 32.8%, ≥600-900 31.6%, ≥900 29.4% • Type of milk consumed: Predominantly low-fat; 17% drank whole-fat milk **Outcomes and assessment methods:** • Birth weight adjusted for gestational age sex-specific z-score, extracted from birth certificates, clinical records, and antenatal visit records; gestational age determined from LMP or early ultrasound examination (in cases of uncertainty in remembering the date, irregular/prolonged cycles, or contraceptive pill use ≤4mo before LMP)	*BW adjusted: GA & sex* *TEI adjusted: Yes* **Birth weight z-score**, Linear regression, B (95% CI) 0-150 (Ref) (n=809) **≥150-600 ml/d (n=50): 0.37 (0.11, 0.64)** **≥600-900 ml/d (n=256): 0.30 (0.03, 0.58)** **≥900 ml/d (n=238): 0.33, (0.06, 0.61)** P for effect: 0.06 **≥150 ml/d: 0.34 (0.08, 0.60)** *(No dose response – all groups ≥150mL/d were significant different than reference group but not significantly different from one another)*	**Confounders accounted for:** • Key confounders: Child sex, gestational age, maternal age, SES, pre-pregnancy BMI, smoking • Other factors considered: Parity, total energy intake **Confounders NOT accounted for:** • Key confounders: Race/ethnicity, pre-pregnancy beverage intake, diagnosis of diabetes • Other factors considered: Timing, temporal use, sugar, protein, fiber, energy density, medications, supplements **Additional model adjustments:** • Maternal height, total energy intake, maternal weight gain recruitment to 30wk gestation **Limitations:** • Serious risk of bias due to confounding • Small number of participants in low intake reference category **Funding source:** Danish Council for Strategic Research

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations
<u>Olmedo-Requena, 2016</u>[6] **Prospective Cohort Study, Spain** Baseline N= 1,175 Analytic N=973 (Attrition: 17%) **Maternal characteristics:** • Maternal age: Mean=29.74y, SD=5.1 • Race/ethnicity: NR • SES: Academic level, primary 41.9%, secondary 29.5%, university 28.6%; Social class, class I-II 25.2%, class III 30.0%, class V-IV 44.8% • Pre-pregnancy BMI: Mean=23.99 kg/m², SD=4.3 • Smoking: During pregnancy, Yes 19.5%, No 80.5% • Parity: Nulliparous 48.3%, Parous 51.7% • Diabetes: NR • Total energy intake: NR **Child characteristics:** • Female child: %NR • Gestational age: Mean=39.3wk, SD=1.7 • Birth weight: Mean=3219.1 g, SD=496.4 (Range: 735-4890 g)	**Exposure of interest:** Milk intake (g/d; including skimmed, semi-skimmed, and whole milk) <u>Assessment method</u>: 118-item FFQ translated, adapted, and validated in a sample of Spanish women <u>Assessment timing</u>: ~21wk <u>Represents</u>: intake from the start of pregnancy to ~21wk gestation **Comparators:** • Milk intake (g/d) modeled continuously **Study beverage intake:** • Milk intake: NR **Outcomes and assessment methods:** • Risk of SGA (<10th percentile) compared to AGA (10th-90th percentile; LGA excluded), determined through Spanish neonatal growth curves using birth weight collected from maternal history and gestational age calculated from LMP	*SGA adjusted: GA only* *TEI adjusted: Yes* **<u>SGA</u>**, Logistic regression **Higher milk intake during the first half of pregnancy was associated with lower risk of SGA** (Data NR) [Note: Authors report that OR for the analysis of milk intake was similar to the primary analysis which used total dairy intake in 100 g/d increments as the exposure: OR: 0.89, 95% CI: 0.83, 0.96, P=0.005; Correlation between dairy and milk intake was 80%]	**Confounders accounted for:** • Key confounders: Gestational age, maternal age, SES, pre-pregnancy BMI, smoking • Other factors considered: Parity, total energy intake **Confounders NOT accounted for:** • Key confounders: Child sex, race/ethnicity, pre-pregnancy beverage intake, diagnosis of diabetes • Other factors considered: Timing, temporal use, sugar, protein, fiber, energy density, medications, supplements **Additional model adjustments:** • Physical activity, pregnancy-induced hypertension, pregnancy weight gain, energy intake, alcohol during pregnancy, intake of vegetables, fruits, and fish **Limitations:** • Serious risk of bias due to confounding • Unknown whether SGA/AGA was standardized/adjusted for child sex • Data on the association between milk intake and risk of SGA NR in paper **Funding sources:** FIS Scientific Research Project; Junta de Andalucia Excellence Project; Biomedical Research Centre Network for Epidemiology and Public Health

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations
Prospective cohort studies—Tea			
Bech, 2015[7] **Prospective Cohort Study, Danish National Birth Cohort (DNBC), Denmark** Baseline N= 92,672 Analytic N=71,000 (Attrition: 23%) **Maternal characteristics:** • Maternal age: <25y 13.0%, 25-29y 41.7%, 30-34y 33.9%, ≥35y 11.4% • Race/ethnicity: NR • SES: Socio-occupational status, High 50.4%, Middle 36.1%, Low 9.1%, Missing 4.4% • Pre-pregnancy BMI: <18.5 4.3%, 18.5-24.9 64.0%, 25-29.9 18.3%, ≥30 7.7%, Missing 5.6% • Smoking: 2nd trimester, Non-smoker 72.9%, 1-10 cigarettes/d 11.0%, ≥11 cigarettes/d 3.4%, Missing 12.8% • Parity: Primiparous 45.2%, Multiparous 50.8%, Missing 4.0% • Diabetes: NR • Total energy intake: NR **Child characteristics:** • Female child: 48.8% • Gestational age: Mean=280d, SD=13 • Birth weight: Mean=3582 g, SD=563	**Exposure of interest:** Maternal tea, coffee, and cola intake (No information was available on the type or brewing method for coffee and tea, or the definition of cola.) Assessment method: telephone interviews (single question) Assessment timing: ~31wk gestation (IQR: 29-33wk) Represents: usual daily intake—2nd trimester **Other exposures measured:** coffee, cola **Comparators:** • Tea intake (cups/d): 0, 0.5-6, 7-15, ≥16 • Tea intake (cups/d) modeled continuously **Study beverage intake:** • 2nd trimester tea intake: 0 cups/d 36.9%, 0.5-6 cups/d 58.7%, 7-15 cups/d 4.0%, ≥16 cups/d 0.4% **Outcomes and assessment methods:** • Birth weight and gestational age abstracted from the Danish Medical Birth Register • SGA defined as birth weight >2 SD below the mean birth weight for gestational age and sex according to Scandinavian reference curves	*BW & SGA adjusted: GA & sex* *TEI adjusted: likely No* *Tea intake, categorical—2nd trimester*: **Birth weight**, Linear regression, B (95% CI) 0 cups/d (Ref) (n=26,176) 0.5-6 cups/d (n=41,700): -5 g (-12, 1) **7-15 cups/d (n=2,860): -17 g (-33, -1)** ≥16 cups/d (249): -53 g, (-106, 0) **SGA**, Logistic regression, OR (95% CI) 0 cups/d (Ref) 0.5-6 c/d: 1.00 (0.90, 1.10) 7-15 c/d: 1.16 (0.91, 1.47) **≥16 c/d: 2.62 (1.55, 4.41)** *Tea intake, continuous—2nd trimester*: **Birth weight**, Linear regression, B (95% CI) **Change per cup/d increase: -2.6 g (-3.9, -1.3)** **SGA**, Logistic regression, OR (95% CI) Per cup/d increase: OR: 1.02, 95% CI: 1.00, 1.04	**Confounders accounted for:** • Key confounders: Child sex, gestational age, maternal age, SES, pre-pregnancy BMI, smoking, diagnosis of diabetes • Other factors considered: Parity **Confounders NOT accounted for:** • Key confounders: Race/ethnicity, pre-pregnancy beverage intake • Other factors considered: Total energy intake, timing, temporal use, sugar, protein, fiber, energy density, medications, supplements **Additional model adjustments:** • Alcohol, maternal height, nausea **Limitations:** • Serious risk of bias due to confounding • Serious risk of bias in classification of exposures **Funding sources:** Danish National Research Foundation; Pharmacy Foundation; Egmont Foundation; March of Dimes Birth Defects Foundation; Health Foundation; Augustinus Foundation

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations
<u>Chen, 2018</u>[8] **Prospective Cohort Study, Lifeways Cross Generation Cohort Study, Ireland** Baseline N=1,114 Analytic N=941 (Attrition 16%) **Maternal characteristics:** • Maternal age: Mean=30.1y, SD=5.8y • Race/ethnicity: NR • SES: Eligibility to join the General Medical Services, Yes 17%; Education status, Tertiary or above 50% • Pre-pregnancy BMI: Mean=23.8 kg/m², SD=4.1 • Smoking during pregnancy: Yes 27% • Pregnancy complications (gestational diabetes and/or preeclampsia) 3.7% • Parity: Nulliparous 45% • Total energy intake: NR **Child characteristics:** • Female child: 49% • Gestational age: NR • Birth weight: NR	**Exposure of interest:** Maternal tea intake <u>Assessment method</u>: modified, self-completed 149-item semi quantitative FFQ based on the European Prospective Investigation into Cancer and Nutrition instrument, which has been validated for use in the Irish population (not necessarily pregnant women). <u>Assessment timing</u>: 1st antenatal visit (14-16wk) <u>Represents</u>: 1st trimester intake **Other exposures measured:** coffee **Comparators:** • Caffeine intake from tea: <50 mg/d, 50 to <100 mg/d, ≥100 mg/d **Study beverage intake:** • Caffeine intake from tea: <50 mg/d 35.1%; 50 to <100 mg/d 40.3%; and ≥100 mg/d 24.7% • Predominant sources of caffeine: tea (48%), coffee (39%), soft drinks (8%) **Outcomes and assessment methods:** • Birth weight abstracted from hospital record • LBW defined as <2500 g	*BW & LBW not adjusted* *TEI adjusted: Uncertain (reported in methods section but not results table)* *Caffeine from tea (sample size only provided for overall caffeine intake groups, not tea specifically)* **<u>Birth weight</u>**, Linear regression, B (95% CI) <50 mg/d (Ref) 50-<100 mg/d: -20.6 g (-100.3, 59.1) **≥100 mg/d: -178.6 g (-271.5, -85.7)** **P-trend<0.001** **<u>LBW</u>** (<2500g), Logistic regression, OR (95% CI) <50 mg/d (Ref) 50-<100 mg/d: NS (Data only reported graphically) **≥100 mg/d: 2.47 (1.02, 6.01)** *Caffeine from tea (excluding coffee drinkers)* **<u>Birth weight</u>**, Linear regression, B (95% CI) <50 mg/d (Ref) 50-<100 mg/d: 13.0 g (-93.3, 119.2) **≥100 mg/d: -169.8 g (-286.0, −53.6)** **<u>LBW</u>** (<2500g), Logistic regression, OR (95% CI) <50 mg/d (Ref) 50-<100 mg/d: 1.81 (0.38, 8.57) ≥100 mg/d: 4.38 (0.99, 19.50)	**Confounders accounted for:** • Key confounders: Child sex, maternal age, SES, pre-pregnancy BMI, smoking • Other factors considered: Parity **Confounders NOT accounted for:** • Key confounders: Gestational age, race/ethnicity, pre-pregnancy beverage intake, diagnosis of diabetes • Other factors considered: Total energy intake, timing, temporal use, sugar, protein, fiber, energy density, medications, supplements **Additional model adjustments:** • Alcohol **Limitations:** • Serious risk of bias due to confounding • Birth weight not standardized by gestational age **Funding sources:** Irish Health Research Board, ERA-Net; Science Foundation Ireland; European Union

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations
<u>Colapinto, 2015</u>[9] **Prospective Cohort Study, Maternal-Infant Research on Environmental Chemicals (MIREC) Study, Canada** Baseline N= 1,967 Analytic N=1,743 (Attrition: 11%) **Maternal characteristics:** • Maternal age: <20y 0.6%, 20-24y 6.4%, 25-29 23.7%, 30-34y 35.4%, ≥35y 33.8% • Race/ethnicity: NR • SES: Education, Less than college 8.7%, College educated 29.0%, Completed university 36.8%, Graduate degree 25.5%; Household income ≤$50,000 18.1%, $50,001-100,000 42.0%, >$100,000 39.8% • Pre-pregnancy BMI: <18.5 2.8%, 18.5-24.9 60.8%, 25-29.9 21.7%, ≥30 14.7% • Smoking: 1st trimester, Daily 4.5%, Occasionally 1.4%, Not at all 94.1% • Parity: NR • Total energy intake: NR **Child characteristics:** • Female child: %NR • Gestational age: Mean=38.9wk • Birth weight: NR	**Exposure:** Maternal tea intake (any tea including regular, green, and herbal tea) <u>Assessment method</u>: unspecified questionnaire which asked women to report frequency of consumption (number of 6 oz cups/d, wk, or mo) <u>Assessment timing</u>: 1st trimester <u>Represents</u>: 1st trimester intake **Comparators:** • Tea intake: <1 (6 oz) cup/wk, ≥1 (6 oz) cup/wk **Study beverage intake:** • Frequency of tea intake (cup=6 oz): <1 cup/wk: 78.9%, ≥1 cup/wk: 21.1%; ≥7 cups/wk ~5% **Outcomes and assessment methods:** • Birth weight abstracted from medical charts (categorized into deciles); gestational age determined via LMP and ultrasound • SGA defined as <10th percentile according to sex-specific Canadian reference charts for birth weight for gestational age	*BW not adjusted* *SGA adjusted: GA & sex* *TEI adjusted: No* **<u>Birth weight</u>**, Generalized linear model <1 cup/wk (Ref) vs ≥1 cup/wk: No association (Data NR) (Sensitivity analysis examining women with no tea consumption at all as the reference group did not change the results of the analyses.) **<u>SGA</u>** Logistic regression, OR (95% CI) <1 (Ref) vs ≥1 cup/wk: 1.43 (0.83, 2.46)	**Confounders accounted for:** • Key confounders: Child sex, gestational age, maternal age, SES, pre-pregnancy BMI, smoking • Other factors considered: None **Confounders NOT accounted for:** • Key confounders: Race/ethnicity, pre-pregnancy beverage intake, diagnosis of diabetes • Other factors considered: Parity, total energy intake, timing, temporal use, sugar, protein, fiber, energy density, medications, supplements **Additional model adjustments:** • Country of birth, household income, coffee intake **Limitations:** • Serious risk of bias due to confounding • Birth weight analysis not adjusted for gestational age or sex • Low number of participants reporting any tea intake resulting in a very broad categorization (<1 cup/wk vs. ≥1 cup/wk compared to other studies) **Funding sources:** Health Canada's Chemicals Management Plan; Canadian Institute of Health Research; Ontario Ministry of the Environment

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations
Grosso, 2001[10] **Prospective Cohort Study, Yale Health in Pregnancy Study, United States** Baseline N= 2,967 Analytic N=2,714 (Attrition: 9%) **Maternal characteristics:** • Maternal age: ≤24y 7.2%, 25-29y 30.7%, 30-34y 41.5%, ≥35y 20.5% • Race/ethnicity: White 90.3%, Other 9.7% • SES: Education, ≤11y 1.5%, 12y 17.0%, 13-15y 26.1%, 16y 29.5%, ≥17y 26.0% • Pre-pregnancy BMI: NR • Smoking: # Cigarettes/d during month 1 of pregnancy, 0/d 86.2%, 1-10/d 7.8%, >10 6.0% • Diabetes: GDM 5.1% • Parity: None 44.2%, ≥One 55.8% • Total energy intake: NR **Child characteristics:** • Female child: 50.3% • Gestational age: NR • Birth weight: NR	**Exposure:** Caffeinated tea intake Assessment method: structured questionnaires administered by trained interviewers in the women's home Assessment timing: 0-16wk Represents: 1st month of pregnancy **Other exposures measured:** caffeinated coffee, caffeinated soda **Comparator:** • Tea intake: 0 cups/d, 1-6 cups/wk, 2 cups/d, >2 cups/d **Study beverage intake:** • Frequency of tea intake ○ During month 1 of pregnancy: 0 cups/d: 75.9%, 1-6 cups/wk: 12.8%, 1-2 cups/d: 9.7%, >2 cups/d: 1.6% **Outcomes and assessment methods:** • IUGR (≤10th percentile of birth weight for gestational age) according to standards developed by Babson, 1970. Birth weight measured within 24 hours after hospital delivery using standardized protocols for use of scales and scale calibration; gestational age assessed via Ballard examination within 6-24hr of delivery by study nurses trained to administer Ballard examination, or LMP for those that did not have a Ballard examination (5.7%)	*IUGR adjusted: GA only* *TEI adjusted: No* *Tea intake during month 1 of pregnancy* **IUGR** Logistic regression, OR (95% CI) 0 cups/d (Ref) (n=2,058) 1-6 cups/wk (n=346): 1.08 (0.68, 1.73) 1-2 cups/d (n=362): 0.79 (0.45, 1.42) >2 cups/d (n=43): 1.48 (0.55, 4.00) *Tea intake by smoking status during month 1* **IUGR** Logistic regression, OR (95% CI) *Nonsmokers* 0 cups/d (Ref) 1-6 cups/wk: 1.19 (0.70, 2.01) 1-2 cups/d: 0.89 (0.46, 1.75) >2 cups/d: 2.16 (0.62, 7.48) *Smokers* 0 cups/d (Ref) 1-6 cups/wk: 1.00 (0.33, 3.06) 1-2 cups/d: 0.50 (0.15, 1.70) >2 cups/d: 0.87 (0.16, 4.62)	**Confounders accounted for:** • Key confounders: Child sex, gestational age, maternal age, race/ethnicity, SES, smoking, diagnosis of diabetes • Other factors considered: Parity **Confounders NOT accounted for:** • Key confounders: Pre-pregnancy BMI, pre-pregnancy beverage intake • Other factors considered: Total energy intake, timing, temporal use, sugar, protein, fiber, energy density, medications, supplements **Additional model adjustments:** • Maternal height, GWG, preeclampsia, bleeding during 3rd trimester, other month 1 caffeinated beverage intake **Limitations:** • Serious risk of bias due to confounding • Birth weight (IUGR) not standardized by sex • Racial/ethnic minorities were underrepresented in the survey sample • Small percentage of sample had high caffeine intake **Funding source:** NR

Lu, 2017[11] **Prospective Cohort Study; Born in Guangzhou Cohort Study, China** Baseline N= 10,277 Analytic N=8,775 (Attrition: 15%) **Maternal characteristics:** • Maternal age: Mean~28.8y • Race/ethnicity: NR • SES: Education level, middle school or below 10.7%, college 25.5%, undergraduate 52.5%, postgraduate 11.3%; monthly income (Yuan), ≤1500 10.0%, 1501-4500 31.7%, 4501-9000 40.5%, ≥9001 15.3%, Missing 2.5% • Pre-pregnancy BMI: Mean~20.3 kg/m^2 • Smoking: environmental tobacco smoke exposure in early pregnancy ~30.5% • Parity: Primiparous ~88.6%, Multiparous 11.4% • Diabetes: NR • Total energy intake: NR **Child characteristics:** • Female child: %NR • Gestational age: Median=39wk, 25th percentile=38wk, 75th percentile=40wk • Birth weight: Mean~3188 g	**Exposure of interest:** Tea intake, specifying the type(s) of tea consumed: green (unfermented), oolong (semi-fermented), black, dark (fermented), and how many servings (150mL) consumed of each type per week Assessment method: NR Assessment timing: ~16wk gestation Represents: early pregnancy intake **Comparator:** • Any tea intake: <1 serving/wk, 1-3 servings/wk, >3 servings/wk, ≥1serving/wk • Green tea, oolong tea, dark/black tea intake: <1 serving/wk, 1-3 servings/wk, >3 servings/wk **Study beverage intake:** • Frequency of tea intake: ≥1 serving/wk 16.2% • Among tea drinkers, frequency of tea intake: Median=3 servings/wk, IQR: 2-5 **Outcomes and assessment methods:** • SGA (birth weight below 10th percentile), AGA, and LGA (birth weight above 90th percentile) derived from local population-based birth weight reference and calculated using birth weight extracted from the Guangzhou Perinatal Health Care and Delivery Surveillance System and gestational age at birth based on ultrasound examination • Birth weight Z-score derived using an undescribed method	*BW/SGA/LGA adjusted: GA & sex* *TEI adjusted: No* *All tea intake, early pregnancy* **SGA**, Logistic regression, OR (95% CI) <1 (Ref) (n=6,536) 1-3 serv/wk (n=750): 0.94 (0.70, 1.28) >3 serv/wk (n=491): 1.07 (0.75, 1.53) P for trend: 0.90 **LGA**, Logistic regression, OR (95% CI) r<1 (Ref) 1-3 serv/wk: 0.88 (0.68, 1.13) >3 serv/wk: 0.97 (0.72, 1.30) P for trend: 0.51 **Birth weight Z-score**, ANOVA, Kruskal-Wallis test, Mean (SD) <1 serv/wk (n=6,916): 0.091 (0.987) 1-3 serv/wk (n=783): 0.097 (0.964) >3 serv/wk (n=510): 0.049 (0.984) P=0.634 *Green tea intake, early pregnancy* **SGA**, Logistic regression, OR (95% CI) <1 (Ref) 1-3 serv/wk (n=345): 0.59 (0.33, 1.05) >3 serv/wk (n=114): 0.57 (0.21, 1.51) P for trend: 0.07 **LGA**, Logistic regression, OR (95% CI) <1 (Ref) 1-3 serv/wk: 0.89 (0.60, 1.34) **>3 serv/wk: 1.67 (1.01, 2.75)** P for trend: 0.19 **Birth weight Z-score**, ANOVA, Kruskal-Wallis test, Mean (SD) <1 serv/wk (n=7,760): 0.087 (0.982) 1-3 serv/wk (n=347): 0.118 (1.020) >3 serv/wk (n=124): 0.150 (1.066) P=0.661	**Confounders accounted for:** • Key confounders: Child sex, gestational age, maternal age, SES, pre-pregnancy BMI, smoking, diagnosis of diabetes • Other factors considered: Parity **Confounders NOT accounted for:** • Key confounders: Race/ethnicity, pre-pregnancy beverage intake • Other factors considered: Total energy intake, timing, temporal use, sugar, protein, fiber, energy density, medications, supplements **Additional model adjustments:** • Exposure to environmental tobacco smoke during early pregnancy, folic acid intake during early pregnancy, previous history of complications during pregnancy, frequency of other types of tea consumed (as appropriate) **Limitations:** • Serious risk of bias due to confounding • Tea intake was not assessed with a validated tool • Small number of frequent tea drinkers in cohort **Funding sources:** National Natural Science Foundation of China; Guangzhou Science and Technology Bureau

Oolong tea intake, early pregnancy
SGA, Logistic regression, OR (95% CI)
<1 (Ref)
1-3 serv/wk (n=375): 0.92 (0.58, 1.47)
>3 serv/wk (n=136): 1.38 (0.71, 2.66)
P for trend: 0.59

LGA, Logistic regression, OR (95% CI)
<1 (Ref)
1-3 serv/wk: 0.97 (0.66, 1.41)
>3 serv/wk: 0.63 (0.29, 1.36)
P for trend: 0.35

Birth weight Z-score,
ANOVA, Kruskal-Wallis test, Mean (SD)
<1 serv/wk (n=7,700): 0.089 (0.988)
1-3 serv/wk (n=397): 0.130 (0.934)
>3 serv/wk (n=132): 0.012 (0.942)
P=0.473

Dark/black tea intake, early pregnancy
SGA, Logistic regression, OR (95% CI)
<1 (Ref)
1-3 serv/wk (n=489): 1.20 (0.82, 1.76)
>3 serv/wk (n=172): 1.61 (0.92, 2.80)
P for trend: 0.07

LGA, Logistic regression, OR (95% CI)
<1 (Ref)
1-3 servings/wk: 0.82 (0.58, 1.16)
>3 servings/wk: 0.75, (0.41, 1.35)
P for trend: 0.18

Birth weight Z-score,
ANOVA, Kruskal-Wallis test, Mean (SD)
<1 serv/wk (n=7,552): 0.097 (0.989)
1-3 serv/wk (n=502): 0.003 (0.937)
>3 serv/wk (n=180): 0.001 (0.914)
P=0.054

ONLY green tea intake, early pregnancy (excluding those who consume other types of tea)
SGA, Logistic regression, OR (95% CI)
<1 (Ref)
1-3 serv/wk (n=196): 0.65 (0.32, 1.33)

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations
		>3 serv/wk (n=98): 0.18 (0.03, 1.29) **P for trend: 0.03** **<u>LGA</u>**, Logistic regression, OR (95% CI) <1 (Ref) 1-3 servings/wk: 0.96 (0.58, 1.58) **>3 servings/wk: 1.76 (1.04, 2.98)** P for trend: 0.09 *ONLY oolong tea intake, early pregnancy (excluding those who consume other types of tea)* **<u>SGA</u>**, Logistic regression, OR (95% CI) <1 (Ref) 1-3 serv/wk (n=205): 0.94 (0.52, 1.71) >3 serv/wk (n=88): 1.10 (0.47, 2.57) P for trend: 0.95 **<u>LGA</u>**, Logistic regression, OR (95% CI) <1 (Ref) 1-3 servings/wk: 1.05 (0.67, 1.65) >3 servings/wk: 0.73 (0.31, 1.70) P for trend: 0.66 *ONLY dark/black tea intake, early pregnancy (excluding those who consume other types of tea)* **<u>SGA</u>**, Logistic regression, OR (95% CI) <1 (Ref) 1-3 serv/wk (n=291): 1.20 (0.76, 1.88) >3 serv/wk (n=125): 1.76 (0.97, 3.19) P for trend: 0.05 **<u>LGA</u>**, Logistic regression, <1 (Ref) 1-3 servings/wk: 0.87 (0.57, 1.33) >3 servings/wk: 0.80 (0.41, 1.55) P for trend: 0.36	

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations
<u>**Patelarou, 2011**</u>[12] **Prospective Cohort Study, Rhea study, Greece** Baseline N= 1,606 Analytic N=1,359 (Attrition: 15%) **Maternal characteristics:** • Maternal age: <25y 17.4%; 25-35y 66.9%; >35y 15.7% • Race/ethnicity: Greek 90.1%; Non-Greek 9.9% • SES: Maternal education, ≤6y of school 21.1%, ≤12y of school 50.4%, University or technical college degree 28.5%; Paternal education, ≤6y of school 37.1%, ≤12y of school 42.2%, University or technical college degree 20.7% • Pre-pregnancy BMI: NR • Smoking: non-smoker 64.2%; ex-smoker 16.5%; smoker 19.3% • Parity: Primipara 37.8%; Multipara 62.2% • Diabetes: NR • Total energy intake: NR **Child characteristics:** • Female child: %NR • Gestational age: 11.5% Preterm • Birth weight: Mean=3179 g, SD=457	**Exposure of interest:** Coffee and tea/herb infusion intake (g/d) <u>Assessment method</u>: FFQ <u>Assessment timing</u>: ~3mo <u>Represents</u>: current intake **Other exposures measured:** coffee, water **Comparator:** • Tea/herb water-based fluid intake modeled continuously **Study beverage intake:** • 1st trimester tea/herb infusion intake (g/d): Mean=18.9, SD=70.5 **Outcomes and assessment methods:** • Birth weight assessed via face-to-face interview 1-2d after birth in the maternity ward; gestational age primarily assessed from LMP and date of delivery (quadratic regression formula if LMP inconsistent with ultrasound) • LBW defined as birth weight <2500g • SGA defined as <10th percentile of birth weight for gestational age based on Spanish referent population	*BW/LBW/SGA adjusted: GA & sex* *TEI adjusted: No* *Tea/herb infusion intake* <u>**Birth weight**</u>, Linear regression B: 0.04 g, 95% CI: -0.3, 0.4 <u>**LBW and SGA**</u>: NS (Data NR)	**Confounders accounted for:** • Key confounders: Child sex, gestational age, maternal age, race/ethnicity, SES, smoking • Other factors considered: Parity **Confounders NOT accounted for:** • Key confounders: Pre-pregnancy BMI, pre-pregnancy beverage intake, diagnosis of diabetes • Other factors considered: Total energy intake, timing, temporal use, sugar, protein, fiber, energy density, medications, supplements **Additional model adjustments:** N/A **Limitations:** • Serious risk of bias due to confounding **Funding source:** EU 6th Framework Programme

Okubo, 2015[13]
Prospective cohort study, Osaka Maternal and Child Health Study (OMCHS), Japan

Baseline N= 1,002 Analytic N=858 (Attrition: 14%)

Maternal characteristics:

- Maternal age: Median=30.0y, IQR=27.0-32.0
- Race/ethnicity: 100% Japanese
- SES: Education, <13y 29.8%, 13-14y 42.4%, ≥15y 27.7%; Maternal employment: full or part-time, 28.9%
- Baseline BMI at enrollment: Median=21.1 kg/m^2, IQR=19.6-22.8
- Smoking: during pregnancy, none 86.8%, 1st trimester only 4.9%, 2nd and/or 3rd trimester but not throughout 1.9%, throughout 6.4%
- Parity: Primiparous 49.1%
- Diabetes: NR
- Total energy intake: Median=1785 kcal/d, IQR=1540-2072

Child characteristics:

- Female child: 47.7%
- Gestational age: Median=39.0wk, IQR: 38.0-40.0
- Birth weight: Median=3069 g, IQR: 2815-3342

Exposure of interest:
Maternal tea intake including Japanese and Chinese tea (e.g., green tea, oolong tea) and black tea

Assessment method: self-administered dietary history questionnaire (previously validated using dietary record, 24-hr urine excretion, and serum biomarkers)
Assessment timing: at enrollment (5-39 wk)
Represents: previous month's intake

Other exposures measured: coffee, soft drink

Comparators:

- Japanese & Chinese tea intake: 0-1 cup/d, 2-3 cups/d, 4-5 cups/d, and ≥6 cups/d
- Black tea intake: none, 1 cup/d, 2 cups/d, and ≥3 cups/d

Study beverage intake:

- Japanese and Chinese tea intake: 0-1 cup/d: 17.6%, 2-3 cups/d: 33.3%, 4-5 cups/d: 29.1%, and ≥6 cups/d: 19.9%; Median (IQR): 3.4 (2.5-5.6)
- Black tea intake: none: 45.1%, 1 cup/d 48.1%, 2 cups/d: 0.3%, and ≥3 cups/d: 3.7%; Median (IQR): 0.14 (0-0.45)
- Contributors of caffeine in the diet during pregnancy were Japanese and Chinese tea (73.5%), coffee (14.3%), black tea (6.6%), and soft drinks (3.5%).

Outcomes and assessment methods:

- Birth weight and gestational age at birth obtained from self-report survey at 2-9mo postpartum; mothers referenced measurements recorded by obstetrician or midwife at birth
- LBW: <2500g
- SGA: <10th percentile of the Japanese neonatal anthropometric norms for babies of the same gestational age, sex, and parity

LBW & SGA adjusted: GA & sex
TEI adjusted: Yes

Japanese & Chinese tea intake
LBW (<2500g)
Logistic regression, OR (95% CI)
0-1 cups/d (Ref) (n=151)
2-3 cups/d (n=286): 1.39 (0.59, 3.27)
4-5 cups/d (n=250): 0.78 (0.30, 2.05)
≥6 cups/d (n=171): 1.39 (0.54, 3.63)
Per 1 cup/d increase: 1.01 (0.90, 1.13)
P for trend: 0.93

SGA,
Logistic regression, OR (95% CI)
0-1 cups/d (Ref),
2-3 cups/d: 1.00 (0.47, 2.12)
4-5 cups/d: 1.06 (0.49, 2.31)
≥6 cups/d: 1.04 (0.44, 2.48)
Per 1 cup/d increase: 1.04 (0.94, 1.15)
P for trend: 0.46

Black tea intake
LBW, Logistic regression, OR (95% CI)
None (Ref) (n=387)
1 cup/d (n=413): 1.26 (0.67, 2.37)
2 cups/d (n=26): 2.12 (0.38, 11.90)
≥3 cups/d (n=32): 0.55 (0.06, 4.93)
Per 1 cup/d increase: 1.16 (0.72, 1.86)
P for trend: 0.54

SGA, Logistic regression, OR (95% CI)
None (Ref),
1 cup/d: 0.92 (0.53, 1.58)
2 cups/d: 2.17 (0.53, 8.79)
≥3 cups/d: 0.37 (0.05, 2.95)
Per 1 cup/d increase: 0.92 (0.58, 1.46)
P for trend: 0.72

Confounders accounted for:

- Key confounders: Child sex, gestational age, maternal age, race/ethnicity, SES, smoking
- Other factors considered: Parity, total energy intake, supplements

Confounders NOT accounted for:

- Key confounders: Pre-pregnancy BMI, pre-pregnancy beverage intake, diagnosis of diabetes
- Other factors considered: Timing, temporal use, sugar, protein, fiber, energy density, medications

Additional model adjustments:

- Maternal height, GA at enrollment, alcohol, energy intake, folic acid, vitamin B, medical problems during pregnancy, dietary changes compared to pre-pregnancy

Limitations:

- Serious risk of bias due to confounding
- Serious risk of bias in selection of participants into the study
- Exact type and preparation technique for the beverages of interest cannot be determined
- Baseline measurement spanned from 5 to 39 weeks gestation, bringing into question the utility of BMI measurements and making it difficult to determine when during pregnancy beverages intake is most impactful
- Findings may not be generalizable to other racial/ethnic groups

Funding sources:
Ministry of Education, Culture, Sports, Science and Technology; Ministry of Health, Labour, and Welfare.

Sengpiel, 2013[14]
Prospective Cohort Study, Norwegian Mother and Child Cohort (MoBa), Norway

Baseline N= 103,835 Analytic N=59,123 (Attrition: 43%)

Maternal characteristics:
- Maternal age: <25y 11%, 25-29y 34%, 30-34y 43%, >34y 12%
- Race/ethnicity: NR
- SES: Education, ≤12y 30%, 13-16y 42%, ≥17y 26%; Partners with income >300,000 NOK/y, None 28%, One 41%, Two 28%
- Pre-pregnancy BMI: <18.5 3%, 18.5-24.9 67%, 25-29.9 21%, ≥30 8%
- Smoking: Habits, Never 92%, Occasionally 3%, Daily 5%, Missing 1%; Passive smoking, No 88%, Yes 10%, Missing 2%
- Diabetes: 100% without diabetes or GDM
- Parity: Zero 51%, One 32%, Two 14%, ≥Three 3%
- Total energy intake: <7.90 MJ/d 25%, 7.90-9.35 MJ/d 25%, 9.36-11.14 MJ/d 25%, >11.14 MJ/d 25%

Child characteristics:
- Female child: 49%
- Gestational age: Median=282d, IQR (276-287d) (Spontaneous deliveries, N=49,102)
- Birth weight: Median=3620 g

Exposure of interest:
Caffeine intake from coffee (including filtered, instant, boiled/pressed, decaffeinated, cafe latte/cappuccino, espresso, fig/barley coffee), black tea, or caffeinated soft drinks (including Coca Cola/Pepsi with sugar, Coca Cola/Pepsi Light)

Assessment method: 22wk: semi-quantitative FFQ designed to assess diet during pregnancy and validated in a MoBa subpopulation using 4d weighed food diaries and blood and urine biomarkers; 17wk & 30wk: single question to assess intake
Assessment timing: 17wk, 22wk (FFQ), 30wk
Represents: 0-22wk gestation intake (FFQ) or current intake (17wk & 30wk)

Other exposures measured: coffee, caffeinated soft drinks

Comparator:
- Caffeine intake from black tea (per 100 mg caffeine/d) modeled continuously

Study beverage intake:
- Caffeine intake from black tea: Median=5 mg/d, IQR (1-29 mg/d)

Outcomes and assessment methods:
- Birth weight extracted from the Medical Birth Registry of Norway and converted to percentage of expected birth weight for gestational age using three different growth curves from Northern European populations (Marsal 1996 ultrasound-based, Skjaerven 2000 population-based, and Gardosi 1992 customized);
- SGA defined using the three different growth curves (Marsal 1996, < -2 SD for GA; Skjaerven 2000 and Gardosi 1992, <10th percentile for GA) and relied on gestational age determined primarily through 2nd trimester ultrasound (98.3%) and LMP

BW adjusted: GA & sex
TEI adjusted: Yes

Black tea intake, 0-22wk gestation
Birth weight,
Linear regression, B (95% CI)
Marsal: -50 g (-61, -39), P<10^-17
Skjaerven: -48 g (-59, -36), P<10^-15
Gardosi: -29 g (-40, -18), P<10^-6

SGA, Logistic regression, OR (95% CI)
Marsal: 1.50 (1.22, 1.83), P<10^-4
Skjaerven: 1.21 (1.09, 1.34) P<0.001
Gardosi: 1.11 (0.99, 1.23), P=0.06

Prepregnancy black tea intake
Birth weight,
Linear regression, B (95% CI)
Marsal: -12 g (-21, -2), P=0.02
Skjaerven: -13 g (-22, -3), P=0.01
Gardosi: -3 g (-12, 7), P=0.6

Black tea intake, 17wk
Birth weight,
Linear regression, B (95% CI)
Marsal: -1 g (-12, 9), P=0.8
Skjaerven: 2 g (-9, 13), P=0.8
Gardosi: B: -3 g (-14, 7), P=0.5

Black tea intake, 30wk
Birth weight,
Linear regression, B (95% CI)
Marsal: -14 g (-24, -4), P<0.005
Skjaerven: -15 g (-25, -5), P<0.003
Gardosi: -6 g (-16, 3), P=0.2

Confounders accounted for:
- Key confounders: Child sex, gestational age, maternal age, race/ethnicity, SES, pre-pregnancy BMI, smoking, diagnosis of diabetes
- Other factors considered: Parity, total energy intake

Confounders NOT accounted for:
- Key confounders: Pre-pregnancy beverage intake
- Other factors considered: Timing, temporal use, sugar, protein, fiber, energy density, medications, supplements

Additional model adjustments:
- History of preterm delivery, nausea in 2nd trimester, passive smoking, nicotine from non-cigarette sources, alcohol during pregnancy, energy intake, caffeine from other sources

Limitations:
- Racial/ethnic minorities underrepresented in the survey sample
- Exposure assessment at 17wk & 30wk not valid

Funding sources:
Norwegian Ministry of Health; Norwegian Ministry of Education and Research; NIEHS; NINDS; Norwegian Research Council/FUGE; European Commission 6th Framework Program; Swedish Medical Society; Swedish Government

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations
Prospective cohort studies—Coffee			
<u>Bae, 2010</u>[15] **Prospective Cohort Study, Korea** Baseline N= 114 Analytic N=112 (Attrition: 2%) **Maternal characteristics:** • Maternal age: Mean=33.65y, SD=3.46 • Race/ethnicity: NR • SES: Educational level, High School 6.25%, University 72.32%, Graduate 21.43%; Household income (10,000 won/mo), ≤299 15.18%, 300-399 22.32%, ≥400 62.50% • Pre-pregnancy BMI: Mean=20.81 kg/m^2, SD=2.85 • Smoking: Non-smoker 89.29%, Ex-smoker 10.71% • Parity: Primiparas 46.43%, Multiparas 53.57% • Diabetes: NR • Total energy intake: Mean=1840.81 kcal/d, SD=774.46 **Child characteristics:** • Female child: %NR • Gestational age: Mean~39.0wk Birth weight: Mean~3.23 kg	**Exposure of interest:** Maternal coffee intake during pregnancy <u>Assessment method</u>: 24-hr dietary recall <u>Assessment timing</u>: 1st, 2nd, or 3rd trimester (number of assessments NR) <u>Represents</u>: previous day's intake **Comparators:** • Coffee intake: Non-consumer, 1-3 times/mo, 1-2 times/wk, 3-4 times/wk, Almost every day **Study beverage intake:** • Coffee intake: Non-consumer 41.07%, 1-3 times/mo 16.07%, 1-2 times/wk 16.96%, 3-4 times/wk 8.04%, Almost every day 17.86% **Outcomes and assessment methods:** • Birth weight in kg obtained from clinical records	*BW not adjusted* *TEI adjusted: No* **<u>Birth weight</u>**, Generalized linear model, Mean (SD) Non-consumer (n=46): 3.15 kg (0.10) 1-3 times/mo (n=18): 3.15 kg (0.15) 1-2 times/wk (n=19): 3.25 kg (0.13) 3-4 times/wk (n=9): 3.34 kg (0.19) Almost every day: 3.23 kg (0.12) P=0.566	**Confounders accounted for:** • Key confounders: None • Other factors considered: Parity **Confounders NOT accounted for:** • Key confounders: Child sex, gestational age, maternal age, race/ethnicity, SES, pre-pregnancy BMI, pre-pregnancy beverage intake, smoking, diagnosis of diabetes • Other factors considered: Total energy intake, timing, temporal use, sugar, protein, fiber, energy density, medications, supplements **Additional model adjustments:** N/A **Limitations:** • Critical risk of bias due to confounding • Serious risk of bias in classification of exposures • Birth weight not standardized by gestational age or sex **Funding source:** Korea Research Foundation Grant

Bech, 2015[7]
Prospective Cohort Study, Danish National Birth Cohort (DNBC), Denmark

Baseline N= 92,672 Analytic N=71,000 (Attrition: 23%)

Maternal characteristics:

- Maternal age: <25y 13.0%, 25-29y 41.7%, 30-34y 33.9%, ≥35y 11.4%
- Race/ethnicity: NR
- SES: Socio-occupational status, High 50.4%, Middle 36.1%, Low 9.1%, Missing 4.4%
- Pre-pregnancy BMI: <18.5 4.3%, 18.5-24.9 64.0%, 25-29.9 18.3%, ≥30 7.7%, Missing 5.6%
- Smoking: 2nd trimester, Non-smoker 72.9%, 1-10 cigarettes/d 11.0%, ≥11 cigarettes/d 3.4%, Missing 12.8%
- Parity: Primiparous 45.2%, Multiparous 50.8%, Missing 4.0%
- Diabetes: NR
- Total energy intake: NR

Child characteristics:

- Female child: 48.8%
- Gestational age: Mean=280d, SD=13
- Birth weight: Mean=3582 g, SD=563

Exposure of interest:
Maternal coffee intake (No information was available on the type or brewing method for coffee)

Assessment method: telephone interviews (single question)
Assessment timing: ~31wk gestation (IQR: 29-33wk)
Represents: usual daily intake—2nd trimester

Other exposures measured: tea, cola

Comparators:

- Coffee intake (cups/d): 0, 0.5-3, 4-7, ≥8
- Coffee intake (cups/d) modeled continuously

Study beverage intake:

- 2nd trimester coffee intake: 0 cups/d 54.9%, 0.3-3 cups/d 31.9%, 4-7 cups/d 9.8%, ≥8 cups/d 3.3%

Outcomes and assessment methods:

- Birth weight and gestational age abstracted from the Danish Medical Birth Register
- SGA defined as birth weight greater than two SD below the mean birth weight for gestational age and sex according to Scandinavian reference curves

BW/SGA adjusted: GA & sex
Adjust for TEI: No

Coffee intake, categorical—2nd trimester:
Birth weight,
Linear regression, B (95% CI)
0 cups/d (Ref) (n=38,983)
0.5-3 cups/d (n=22,683): -17 g (-24, -10)
4-7 cups/d (n=6,956): -46 g (-57, -35)
≥8 cups/d (n=2,378): -82 g (-100, -63)
P trend <0.001

SGA,
Logistic regression, OR (95% CI)
0 cups/d (Ref)
0.5-3 cups/d: 1.09 (0.97, 1.22)
4-7 cups/d: 1.31 (1.12, 1.54)
≥8 cups/d: 1.51 (1.21, 1.88)

Coffee intake, continuous—2nd trimester:
Birth weight,
Linear regression, B (95% CI)
Change per cup/d increase: -8.8 g (-10.2, -7.3)
SGA, Logistic regression, OR (95% CI)
Per cup/d increase: 1.04 (1.02, 1.06)

Interaction: Coffee intake (categorical) x *smoking*
Birth weight,
Linear regression, B (95% CI)
[Non-smokers] (n = 65,233)
0 cups/d (Ref)
0.5-3 cups/d: -20 g (-28, -13)
4-7 cups/d: -47 g (-60, -34)
≥8 cups/d: -65 g (-92, -39)
[1-10 cigarettes/d] (n = 9,869)
0 cups/d (Ref)
0.5-3 cups/d: -7 g (-28, 14)
4-7 cups/d: -48 g (-73, -23)
≥8 cups/d: -85 g (-119, -51)

[≥11 cigarettes/d] (n = 3,020) 0 (Ref)
0.5-3 cups/d: 42 g (-4, 88)
4-7 cups/d: -5 g (-49, 39)

Confounders accounted for:

- Key confounders: Child sex, gestational age, maternal age, SES, pre-pregnancy BMI, smoking, diagnosis of diabetes
- Other factors considered: Parity

Confounders NOT accounted for:

- Key confounders: Race/ethnicity, pre-pregnancy beverage intake
- Other factors considered: Total energy intake, timing, temporal use, sugar, protein, fiber, energy density, medications, supplements

Additional model adjustments:

- Alcohol, maternal height, nausea

Limitations:

- Serious risk of bias due to confounding
- Serious risk of bias in classification of exposures

Funding sources:
Danish National Research Foundation; Pharmacy Foundation; Egmont Foundation; March of Dimes Birth Defects Foundation; Health Foundation; Augustinus Foundation

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations
		≥8 cups/d: -79 g (-124, -34) P(interaction)=0.05 **SGA**, Logistic regression, OR (95% CI) [Non-smokers] (n = 65,233) 0 cups/d (Ref) 0.5-3 cups/d: 1.1 (1.0, 1.3) 4-7 cups/d: 1.3 (1.0, 1.2) **≥8 cups/d: 1.6 (1.1, 2.5)** [1-10 cigarettes/d] (n = 9,869) 0 cups/d (Ref) 0.5-3 cups/d: 1.2 (0.9, 1.5) **4-7 cups/d: 1.5 (1.1, 2.0)** **≥8 cups/d: 1.9 (1.3, 2.6)** [≥11 cigarettes/d] (n = 3,020) 0 cups/d (Ref) 0.5-3 cups/d: 0.7 (0.5, 1.1) 4-7 cups/d: 1.0 (0.6, 1.4) ≥8 cups/d: 1.0 (0.6, 1.5) P(interaction)=0.24 *Interaction: Coffee intake (continuous)* x *smoking* **Birth weight**, linear regression Change per cup/d increase **[Non-smokers] -8.6 g (-10.4, -6.7)** **[1-10 cigarettes/d] -9.3 g (-12.2, -6.5** **[≥11 cigarettes/d] -8.8 g (-12.1, -5.5)** P(interaction)=0.91 **SGA**, logistic regression Per cup/d increase **[Non-smokers] 1.05 (1.02, 1.07)** **[1-10 cigarettes/d] 1.05 (1.03, 1.08)** [≥11 cigarettes/d] 1.02 (0.99, 1.05) P(interaction)=0.30	

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations
Chen, 2018[8] **Prospective Cohort Study, Lifeways Cross Generation Cohort Study, Ireland** Baseline N=1,114 Analytic N=941 (Attrition 16%) **Maternal characteristics:** • Maternal age: Mean=30.1y, SD=5.8y • Race/ethnicity; NR • SES: Eligibility to join the General Medical Services, Yes 17%; Education status, Tertiary or above 50% • Pre-pregnancy BMI: Mean=23.8 kg/m^2, SD=4.1 • Smoking during pregnancy: Yes 27% • Pregnancy complications (gestational diabetes and/or preeclampsia) 3.7% • Parity: Nulliparous 45% • Total energy intake: NR **Child characteristics:** • Female child: 49% • Gestational age: NR • Birth weight: NR	**Exposure of interest:** Maternal coffee intake Assessment method: modified, self-completed 149-item semi quantitative FFQ based on the European Prospective Investigation into Cancer and Nutrition instrument, which has been validated for use in the Irish population (not necessarily pregnant women). Assessment timing: 1st antenatal visit (14-16wk) Represents: 1st trimester intake **Other exposures measured:** tea **Comparators:** • Caffeine intake from coffee: nonconsumers, <200 mg/d, ≥200 mg/d **Study beverage intake:** • Caffeine intake from coffee: nonconsumer (54.5%); <200mg/d (34.8%10); and ≥200 mg/d (10.7%) • Predominant sources of caffeine: tea (48%), coffee (39%), soft drinks (8%) **Outcomes and assessment methods:** • Birth weight abstracted from hospital record • LBW defined as <2500g	*BW not adjusted* *TEI adjusted: (likely) No* *Caffeine from coffee (sample size only provided for overall caffeine intake groups, not coffee specifically)* **Birth weight**, Linear regression, B (95% CI) Nonconsumer (Ref) <200 mg/d: -9.5 g (-85.3, 66.2) **≥200 mg/d -165.6 g (-283.8, −47.4)** **P-trend=0.043** **LBW** (<2500g), logistic regression Nonconsumer (Ref) <200 mg/d: NS (Data only reported graphically) **≥200 mg/d: 3.10 (1.08, 8.89)**	**Confounders accounted for:** • Key confounders: Child sex, maternal age, SES, pre-pregnancy BMI, smoking, diagnosis of diabetes • Other factors considered: Parity **Confounders NOT accounted for:** • Key confounders: Gestational age, race/ethnicity, pre-pregnancy beverage intake, diagnosis of diabetes • Other factors considered: Total energy intake, timing, temporal use, sugar, protein, fiber, energy density, medications, supplements **Additional model adjustments:** • Alcohol during pregnancy **Limitations:** • Serious risk of bias due to confounding • Birth weight not standardized by gestational age **Funding sources:** Irish Health Research Board, ERA-Net; Science Foundation Ireland; European Union

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations
Grosso, 2001[10] **Prospective Cohort Study, Yale Health in Pregnancy Study, United States** Baseline N= 2,967 Analytic N=2,714 (Attrition: 9%) **Maternal characteristics:** • Maternal age: ≤24y 7.2%, 25-29y 30.7%, 30-34y 41.5%, ≥35y 20.5% • Race/ethnicity: White 90.3%, Other 9.7% • SES: Education, ≤11y 1.5%, 12y 17.0%, 13-15y 26.1%, 16y 29.5%, ≥17y 26.0% • Pre-pregnancy BMI: NR • Smoking: # Cigarettes/d during month 1 of pregnancy, 0/d 86.2%, 1-10/d 7.8%, >10 6.0% • Diabetes: GDM 5.1% • Parity: None 44.2%, ≥One 55.8% • Total energy intake: NR **Child characteristics:** • Female child: 50.3% • Gestational age: NR • Birth weight: NR	**Exposure of interest:** Caffeinated coffee intake Assessment method: structured questionnaires administered by trained interviewers in the women's home\ Assessment timing: during first 16wk of pregnancy Represents: conception through <16wk intake **Other exposures measured:** tea, soda **Comparator:** • Coffee intake: 0 cups/d, 1-6 cups/wk, 2 cups/d, >2 cups/d **Study beverage intake:** • Frequency of coffee intake ○ During month 1 of pregnancy: 0 cups/d: 63.8%, 1-6 cups/wk: 12.5%, 1-2 cups/d: 20.2%, >2 cups/d: 3.5% **Outcomes and assessment methods:** • IUGR (≤10th percentile of birth weight for gestational age) according to standards developed by Babson, 1970. Birth weight measured within 24 hours after hospital delivery using standardized protocols for use of scales and scale calibration; gestational age assessed via Ballard examination within 6-24hr of delivery by study nurses trained to administer Ballard examination, or LMP for those that did not have a Ballard examination (5.7%)	*IUGR adjusted: GA only* *TEI adjusted: No* **IUGR**, Logistic regression, OR (95% CI) *Coffee intake during month 1 of pregnancy* 0 cups/d (Ref) (n=1,728) 1-6 cups/wk (n=338): 0.93 (0.56, 1.53) 1-2 cups/d (n=548): 0.99 (0.65, 1.49) >2 cups/d (n=95): 0.98 (0.45, 2.12) *Coffee intake by smoking status during month 1* **IUGR**, Logistic regression, OR (95% CI) *Nonsmokers* 0 cups/d (Ref) 1-6 cups/wk: 1.11 (0.64, 1.93) 1-2 cups/d: 1.13 (0.70, 1.82) >2 cups/d: 0.66 (0.14, 3.12) *Smokers* 0 cups/d (Ref) 1-6 cups/wk: 0.41 (0.12, 1.41) 1-2 cups/d: 0.67 (0.28, 1.59) >2 cups/d: 0.92 (0.34, 2.51)	**Confounders accounted for:** • Key confounders: Child sex, gestational age, maternal age, race/ethnicity, SES, smoking, diagnosis of diabetes • Other factors considered: Parity **Confounders NOT accounted for:** • Key confounders: Pre-pregnancy BMI, pre-pregnancy beverage intake • Other factors considered: Total energy intake, timing, temporal use, sugar, protein, fiber, energy density, medications, supplements **Additional model adjustments:** • Maternal height, GWG, preeclampsia, bleeding during 3rd trimester, other month 1 caffeinated beverage intake **Limitations:** • Serious risk of bias due to confounding • Birth weight (IUGR) not standardized by sex • Racial/ethnic minorities were underrepresented in the survey sample • Small percentage of sample had high caffeine intake **Funding source:** NR

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations
<u>Patelarou, 2011</u>[12] **Prospective Cohort Study, Rhea study, Greece** Baseline N= 1,606 Analytic N=1,359 (Attrition: 15%) **Maternal characteristics:** • Maternal age: <25y 17.4%; 25-35y 66.9%; >35y 15.7% • Race/ethnicity: Greek 90.1%; Non-Greek 9.9% • SES: Maternal education, ≤6y of school 21.1%, ≤12y of school 50.4%, University or technical college degree 28.5%; Paternal education, ≤6y of school 37.1%, ≤12y of school 42.2%, University or technical college degree 20.7% • Pre-pregnancy BMI: NR • Smoking: non-smoker 64.2%; ex-smoker 16.5%; smoker 19.3% • Parity: Primipara 37.8%; Multipara 62.2% • Diabetes: NR • Total energy intake: NR **Child characteristics:** • Female child: %NR • Gestational age: 11.5% Preterm • Birth weight: Mean=3179 g, SD=457	**Exposure of interest:** Coffee intake (g/d) <u>Assessment method</u>: FFQ <u>Assessment timing</u>: ~3mo <u>Represents</u>: current intake **Other exposures measured:** tea/herb infusion, water **Comparator:** • Coffee intake modeled continuously **Study beverage intake:** • 1st trimester coffee intake (g/d): Mean=56.1, SD=103.0 **Outcomes and assessment methods:** • Birth weight assessed via face-to-face interview 1-2d after birth in the maternity ward; gestational age primarily assessed from LMP and date of delivery (quadratic regression formula if LMP inconsistent with ultrasound) • LBW defined as birth weight <2500g • SGA defined as <10th percentile of birth weight for gestational age based on Spanish referent population	*BW adjusted: GA & sex* *TEI adjusted: No* *Coffee intake* **<u>Birth weight</u>**: B: 0.01 g, 95% CI: -0.2, 0.3 **<u>LBW and SGA</u>**: NS (Data NR)	**Confounders accounted for:** • Key confounders: Child sex, gestational age, maternal age, race/ethnicity, SES, smoking • Other factors considered: Parity **Confounders NOT accounted for:** • Key confounders: Pre-pregnancy BMI, pre-pregnancy beverage intake, diagnosis of diabetes • Other factors considered: Total energy intake, timing, temporal use, sugar, protein, fiber, energy density, medications, supplements **Additional model adjustments:** N/A **Limitations:** • Serious risk of bias due to confounding **Funding source:** EU 6th Framework Programme

Okubo, 2015[13]
Prospective cohort study, Osaka Maternal and Child Health Study (OMCHS), Japan

Baseline N= 1,002 Analytic N=858 (Attrition: 14%)

Maternal characteristics:

- Maternal age: Median=30.0y, IQR=27.0-32.0
- Race/ethnicity: 100% Japanese
- SES: Education, <13y 29.8%, 13-14y 42.4%, ≥15y 27.7%; Maternal employment: full or part-time, 28.9%
- Baseline BMI at enrollment: Median=21.1 kg/m^2, IQR=19.6-22.8
- Smoking: during pregnancy, none 86.8%, 1st trimester only 4.9%, 2nd and/or 3rd trimester but not throughout 1.9%, throughout 6.4%
- Parity: Primiparous 49.1%
- Diabetes: NR
- Total energy intake: Median=1785 kcal/d, IQR=1540-2072

Child characteristics:

- Female child: 47.7%
- Gestational age: Median=39.0wk, IQR: 38.0-40.0
- Birth weight: Median=3069 g, IQR: 2815-3342

Exposure of interest:
Maternal coffee intake

Assessment method: self-administered dietary history questionnaire (previously validated using dietary record, 24-hr urine excretion, and serum biomarkers)
Assessment timing: at enrollment (ranged from 5-39 wk)
Represents: previous month's intake

Other exposures measured: tea, soft drink

Comparators:

- Coffee intake: none, 1 cup/d, 2 cups/d, and ≥3 cups/d

Study beverage intake:

- Contributors of caffeine in the diet during pregnancy were Japanese and Chinese tea (73.5%), coffee (14.3%), black tea (6.6%), and soft drinks (3.5%).

Outcomes and assessment methods:

- Birth weight and gestational age at birth obtained from self-report survey at 2-9mo postpartum; mothers referenced measurements recorded by obstetrician or midwife at birth
- LBW: <2500g
- SGA: <10th percentile of the Japanese neonatal anthropometric norms for babies of the same gestational age, sex, and parity

LBW & SGA adjusted: GA & sex
TEI adjusted: Yes

Coffee intake
LBW, (<2500g)
Logistic regression, OR (95% CI)
None (Ref) (n=344)
1 cup/d (n=405): 0.81 (0.42, 1.57)
2 cups/d (n=27): 1.43 (0.28, 7.18)
≥3 cups/d (n=82): 0.86 (0.34, 2.74)

Per 1 cup/d increase: 1.06 (0.76, 1.49)
P for trend: 0.72

SGA,
Logistic regression, None (Ref)
1 cup/d: 0.63 (0.35, 1.13)
2 cups/d: 0.62 (0.13, 2.97)
≥3 cups/d: 0.73 (0.28, 1.91)

Per 1 cup/d increase: 0.99 (0.74, 1.32)
P for trend: 0.93

Confounders accounted for:

- Key confounders: Child sex, gestational age, maternal age, race/ethnicity, SES, smoking
- Other factors considered: Parity, total energy intake, supplements

Confounders NOT accounted for:

- Key confounders: Pre-pregnancy BMI, pre-pregnancy beverage intake, diagnosis of diabetes
- Other factors considered: Parity, total energy intake, timing, temporal use, sugar, protein, fiber, energy density, medications, supplements

Additional model adjustments:

- Maternal height, GA at enrollment, alcohol, energy intake, folic acid, vitamin B, medical problems during pregnancy, dietary changes compared to pre-pregnancy

Limitations:

- Serious risk of bias due to confounding
- Serious risk of bias in selection of participants into the study
- Exact type and preparation technique for the beverages of interest cannot be determined
- Baseline measurement spanned from 5 to 39 weeks gestation, bringing into question the utility of BMI measurements and making it difficult to determine when during pregnancy beverages intake is most impactful
- Findings may not be generalizable to other racial/ethnic groups

Funding sources:
Ministry of Education, Culture, Sports, Science and Technology; Ministry of Health, Labour, and Welfare.

Sengpiel, 2013[14]
Prospective Cohort Study, Norwegian Mother and Child Cohort (MoBa), Norway

Baseline N= 103,835 Analytic N=59,123 (Attrition: 43%)

Maternal characteristics:

- Maternal age: <25y 11%, 25-29y 34%, 30-34y 43%, >34y 12%
- Race/ethnicity: NR
- SES: Education, ≤12y 30%, 13-16y 42%, ≥17y 26%; Partners with income >300,000 NOK/y, None 28%, One 41%, Two 28%
- Pre-pregnancy BMI: <18.5 3%, 18.5-24.9 67%, 25-29.9 21%, ≥30 8%
- Smoking: Habits, Never 92%, Occasionally 3%, Daily 5%, Missing 1%; Passive smoking, No 88%, Yes 10%, Missing 2%
- Diabetes: 100% without diabetes or GDM
- Parity: Zero 51%, One 32%, Two 14%, ≥Three 3%
- Total energy intake: <7.90 MJ/d 25%, 7.90-9.35 MJ/d 25%, 9.36-11.14 MJ/d 25%, >11.14 MJ/d 25%

Child characteristics:

- Female child: 49%
- Gestational age: Median=282d, IQR (276-287d) (Spontaneous deliveries, N=49102)
- Birth weight: Median=3620 g

Exposure of interest:
Caffeine intake from coffee (including filtered, instant, boiled/pressed, decaffeinated, cafe latte/cappuccino, espresso, fig/barley coffee)

Assessment method: 22wk: semi-quantitative FFQ designed to assess diet during pregnancy and validated in a MoBa subpopulation using 4d weighed food diaries and blood and urine biomarkers; 17wk & 30wk: single question to assess intake
Assessment timing: 17wk, 22wk (FFQ), 30wk
Represents: 0-22wk gestation intake (FFQ) or current intake (17wk & 30wk)

Other exposures measured: black tea, caffeinated soft drinks

Comparator:

- Caffeine intake from coffee (per 100 mg caffeine/d) modeled continuously

Study beverage intake:

- Caffeine intake from coffee: Median=7 mg/d, IQR (0-69 mg/d)

Outcomes and assessment methods:

- Birth weight extracted from the Medical Birth Registry of Norway and converted to percentage of expected birth weight for gestational age using 3 different growth curves from Northern European populations (Marsal 1996 ultrasound-based, Skjaerven 2000 population-based, and Gardosi 1992 customized);
- SGA defined using same 3 growth curves (Marsal 1996, birth weight < -2 SD for GA; Skjaerven 2000 and Gardosi 1992, <10th percentile for GA) and relied on GA determined primarily through 2nd trimester ultrasound (98.3%) and LMP

BW/SGA adjusted: GA & sex
TEI adjusted: Yes

Coffee intake, 0-22wk gestation
Birth weight:
Linear regression, B, (95% CI)
Marsal: -24 g, (-28, -19), P<10^-26
Skjaerven: -20 g, (24, -15), P<10^-18
Gardosi: -19 g, (-24, -15), P<10^-19

SGA,
Logistic regression, OR (95% CI)
Marsal: 1.14, (1.06, 1.23), P<10^-3
Skjaerven: 1.13, (1.09, 1.17), P<10^-10
Gardosi: 1.11, (1.07, 1.16), P<10^-7

Prepregnancy coffee intake
Birth weight
Linear regression, B, (95% CI)
Marsal: 1 g, (-1, 3), P=0.2
Skjaerven: 2 g, (0, 4), P=0.02
Gardosi: 3 g, (1, 4), P<3x10^-3

Coffee intake, 17wk
Birth weight
Linear regression, B, (95% CI)
Marsal: -8 g, (-11, -4), P<10^-5
Skjaerven: -8 g, (-11, -4), P<10^-5
Gardosi: -7 g, (-10, -4), P<10^-4

Coffee intake, 30wk
Birth weight
Linear regression, B, (95% CI)
Marsal: -6 g, (-9, -3), P<10^-3
Skjaerven: -5 g, (-9, -2), P<2x10^-3
Gardosi: -6 g, (-9, -3), P<10^-4

Confounders accounted for:

- Key confounders: Child sex, gestational age, maternal age, race/ethnicity, SES, pre-pregnancy BMI, smoking, diagnosis of diabetes
- Other factors considered: Parity, total energy intake

Confounders NOT accounted for:

- Key confounders: Pre-pregnancy beverage intake
- Other factors considered: Timing, temporal use, sugar, protein, fiber, energy density, medications, supplements

Additional model adjustments:

- History of preterm delivery, nausea in 2nd trimester, passive smoking, nicotine from non-cigarette sources, alcohol during pregnancy, energy intake, caffeine from other sources

Limitations:

- Racial/ethnic minorities underrepresented in the survey sample
- Exposure assessment at 17wk & 30wk not valid

Funding sources:
Norwegian Ministry of Health; Norwegian Ministry of Education and Research; NIEHS; NINDS; Norwegian Research Council/FUGE; European Commission 6th Framework Program; Swedish Medical Society; Swedish Government

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations
Prospective cohort studies—SSB only			

<u>Azad, 2016</u>[16]
Prospective Cohort Study, Canadian Healthy Infant Longitudinal Development (CHILD) Study, Canada
 	
Baseline N= 3,542 Analytic N=2,413 (Attrition: 32%)
 	
Maternal characteristics:
• Total energy intake: Mean=2007 kcal/d, SD=711
• Maternal age: Mean=32.5y, SD=4.6
• Race/ethnicity: NR
• SES: Postsecondary degree 78.2%
• Pre-pregnancy BMI: Mean=24.8 kg/m^2, SD=5.4
• Smoking: During pregnancy 7.9%
• Parity: NR
• Diabetes: GDM 4.4%; Preexisting diabetes 1.4%
 	
Child characteristics:
• Female child: 47.2%
• Gestational age: Mean=39.2wk, SD=1.4
• Birth weight: Mean=3447 g, SD=486
	Exposure of interest:
	Maternal sugar sweetened beverage (SSB) intake—2nd or 3rd trimester
	<u>SSB</u>: regular soft drinks or pop (1 serv = 12 oz or 1 can) & sugar or honey added to tea or coffee (1 serv = 1 tsp or 1 packet)
	
	Other exposures measured:
	Maternal artificially sweetened beverage (ASB) intake (servings/mo or wk)
	
	Comparators:
	• SSB intake:
	  ○ <1 serving/mo,
	  ○ ≤1 serving/wk,
	  ○ 2-6 servings/wk,
	  ○ ≥1 serving/d
	
	<u>Assessment method</u>: Validated FFQ
	<u>Assessment timing</u>: 2nd or (usually) 3rd trimester; Represents: usual intake during current pregnancy
	
	Study beverage intake:
	• Frequency of SSB intake:
	  ○ <1/mo: 22.8%,
	  ○ ≤1/wk: 26.1%,
	  ○ 2-6/wk: 27.8%,
	  ○ ≥1/d: 23.4%
	
	Outcomes and assessment methods:
	• Birth weight in g extracted from hospital records
		TEI adjusted: No
		BW: Not adjusted
		
		SSB (categorical)
		<u>Birth weight</u>, Mean (SD) g
		<1 serving/mo: 3439 (462) g
		≤1 serving/wk: 3449 (472) g
		2-6 servings/wk: 3479 (499) g
		≥1 serving/d: Mean=3460 (487) g
		P=0.49
			Confounders accounted for:
			• Key confounders: None
			• Other factors to be considered: None
			
			Confounders NOT accounted for:
			• Key confounders: Child sex, gestational age, race/ethnicity, maternal age, pre-pregnancy BMI, pre-pregnancy beverage intake, socioeconomic status, smoking, diagnosis of diabetes
			• Other factors to be considered: Parity, total energy intake, timing, temporal use, sugar, protein, fiber, energy density, medications, supplements
			
			Additional model adjustments: None
			
			Limitations:
			• Critical risk of bias due to confounding
			• Birth weight not standardized for gestational age or sex
			
			Funding sources:
			Children's Hospital Research Institute of Manitoba; Canadian Institutes of Health Research; Allergy, Genes and Environment Network of Centres of Excellence

Grundt, 2017[17]
Prospective Cohort Study, Norwegian Mother and Child Cohort (MoBa), Norway
 	
Baseline N= 75,075 Analytic N=50,712 (Attrition: 33%)
 	
Maternal characteristics:
• Total energy intake: Mean~2303 kcal/d
• Maternal age: Mean~30y
• Race/ethnicity: Predominately White Caucasian
• SES: Maternal education >12 years ~71%; High income ~39%
• Pre-pregnancy BMI: Mean~24 kg/m^2
• Smoking: ~12%
• Diabetes: GDM 0.9%; 100% without preexisting diabetes
• Parity: Primipara 45.0%
Child characteristics:
• Female child: %NR
• Gestational age: Mean~280d
• Birth weight: Mean~3629 g
	Exposure of interest:
	Maternal sugar sweetened carbonated beverage (SSC)—0-22wk gestation
	
	Other exposures measured:
	Maternal artificially sweetened carbonated beverage (ASC) intake and overall artificially sweetened beverage intake (mL/d)
	
	Comparators:
	• SSC intake modeled continuously (per 100 ml/d increase)
	• Stratified by gestational diabetes (GDM) status, pre-pregnancy BMI, and smoking status
	
	Assessment method: three questionnaires, including one semi-quantitative FFQ (22wk) developed and validated for pregnant women in MoBa
	Assessment timing: 15wk, 22wk (FFQ), and 30wk
	Represents: current & 0-22wk intake
	
	Study beverage intake:
	• Frequency of SSC intake:
	  ○ <100 ml/d: 76.3%,
	  ○ 100-500 ml/d: 20.9%,
	  ○ ≥500 ml/d: 2.8%
	
	Outcomes and assessment methods:
	• Birth weight in g measured immediately after birth by midwives
	• LBW (<2500 g) and HBW (>4500 g)
	• LGA (>90th percentile) and SGA (<10th percentile) determined using Norwegian percentiles for gestational age (determined via ultrasound, 98.3%) and sex
	• Ponderal index calculated as birth $weight/length^3$
		TEI adjusted: Sensitivity analysis only
		BW/LBW/HBW: not adjusted
		SGA/LGA adjusted: GA & sex
		
		Sugar-sweetened carbonated beverages
		Birth weight,
		Linear regression, B (95% CI)
		Non-GDM (n = 50,280): -7.8g (-10.3, -5.3)
		(Additional adj. for GA, B: -6.6 g)
		Pre-pregnancy BMI Category
		<18.5: -3.9 g (-16.9, 9.1)
		18.5-25: -5.3 g (-8.5, -2.1)
		>25: -10.1 g (-14.0, -6.1)
		Smoking Category
		Nonsmokers: -5.5 g (-8.6, -2.3)
		Smokers: -11.0 g (-15.1, -6.9)
		GDM: 25.1 g (-2.0, 52.2)
		
		LBW (<2500 g),
		Logistic regression, OR (95% CI)
		Non-GDM: 1.05 (*0.99, 1.10)
		Pre-pregnancy BMI Category
		<18.5: 1.10 (0.95, 1.27)
		18.5-25: 1.02 (0.95, 1.09)
		>25: 1.08 (1.00, 1.17)
		Smoking Category,
		Nonsmokers: 1.02 (0.95, 1.11)
		Smokers: 1.07 (1.01, 1.13)
		HBW (>4500g),
		Non-GDM: 0.94, (0.90, 0.97)
		Pre-pregnancy BMI Category
		<18.5: 1.13 (0.86, 1.49)
		18.5-25: 0.96 (0.91, 1.01)
		>25: 0.93 (0.88, 0.97)
		Smoking Category
		Nonsmokers: 0.94 (0.90, 0.98)
		Smokers: 0.93 (0.87, 1.00)
		GDM: 1.18 (1.00 1.39)
		Ponderal index ($weight/length^3$),
		Group differences, B (95% CI)
		-0.02 kg/m^3 (-0.04, -0.01)
		SGA and LGA, Logistic regression
		Similar results to BW (NR)
			Confounders accounted for:
			• Key confounders: Child sex, gestational age, maternal age, pre-pregnancy BMI, socioeconomic status, smoking, diagnosis of diabetes
			• Other factors to be considered: Parity, total energy intake
			
			Confounders NOT accounted for:
			• Key confounders: race/ethnicity, pre-pregnancy beverage intake
			• Other factors to be considered: timing, temporal use, sugar, protein, fiber, energy density, medications, supplements
			
			Additional model adjustments:
			Maternal height, diet patterns, exercise, pre-pregnancy alcohol per occasion, ASB intake, spontaneous labor, offspring year of birth
			
			Limitations:
			• Serious risk of bias due to confounding
			• Birth weight not standardized by gestational age or sex in several analyses
			
			Funding sources:
			Norwegian Ministry of Health and the Ministry of Education and Research; Innlandet Hospital Trust; Southern and Eastern Norway Regional Health Authority; NIEHS; NINDS; Norwegian Research Council/FUGE

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations
<u>**Phelan, 2011**</u>[18] **Prospective Cohort Study, Fit for Delivery, United States** Baseline N= 363 Analytic N=285 (Attrition: 21%) **Maternal characteristics:** • Total energy intake: NR • Maternal age: Mean~28.5y • Race/ethnicity: Non-Hispanic White ~67.4% • SES: >high school education ~85.7%; income <$25,000/y ~21.2% • Pre-pregnancy BMI: Women with overweight/obesity (n=132), Mean=30.5 kg/m^2, SD=5.3; Normal weight women (N=153), Mean=22.3 kg/m^2, SD=1.8 • Smoking: 100% nonsmokers • Diabetes: 100% without diabetes; GDM excluded • Parity: Primiparous, Women with overweight/obesity 66.7%, Normal weight women 85.5% **Child characteristics:** • Female child: ~51.7% • Gestational age: Mean~38.7wk • Birth weight: Weight for age at birth z-score, Mean~0.31	**Exposure of interest:** Calories from SSB—1st trimester **Comparator:** Sugar-sweetened soft drink intake (kcal/d) modeled continuously (separate analyses for normal weight women and women with overweight/obesity) <u>Assessment method</u>: Block FFQ (validated in pregnancy) <u>Assessment timing</u>: 10-16wk gestation <u>Represents</u>: previous month's intake **Study beverage intake:** Sugar-sweetened soft drink intake (kcal/d): NR **Outcomes and assessment methods:** • Weight for age (WFA) z-scores; birth weight abstracted from obstetric and pediatric records used to calculate birth weight for gestational age z-scores using US Natality reference data • LGA (>90th percentile) • Macrosomia (birth weight >4000 g)	**TEI adjusted:** Eliminated during stepwise analyses **BW/LGA adjusted:** GA & sex *SSB intake in normal weight (BMI: 19.8-26.0 kg/m^2)* (n=153) <u>**Birth weight-for-age (WFA) Z-score**</u> Linear regression, B (95% CI) **B: 0.002 (0.0001, 0.004), Beta: 0.16, P (without adj. for GWG)=0.04,** P(with adj. for GWG)=0.10 <u>**LGA and Macrosomia**</u> Omnibus test of model coefficients were non-significant (Data NR) *SSB intake in overweight/obese (BMI: 26.1-40.0 kg/m^2)* (n=132) <u>**WFA z-score, LGA, and Macrosomia**</u> Calories from soft drinks was not a significant predictor of infant outcomes and was not retained in the final model.	**Confounders accounted for:** • Key confounders: Child sex, gestational age, race/ethnicity, maternal age, pre-pregnancy BMI, socioeconomic status, smoking, diagnosis of diabetes • Other factors to be considered: parity, TEI **Confounders NOT accounted for:** • Key confounders: Pre-pregnancy beverage intake • Other factors to be considered: Timing, temporal use, sugar, protein, fiber, energy density, medications, supplements **Additional model adjustments:** Treatment group, recruitment site, **Limitations:** • Analyses of prenatal predictors of birth weight were conducted separately for normal weight women and women with overweight/obesity, possibly limiting statistical power **Funding source:** NIH

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations
Unclear: Potentially SSB & LNCSB combined			
<u>Bech, 2015</u>[7] **Prospective Cohort Study, Danish National Birth Cohort (DNBC), Denmark** Baseline N= 92,672 Analytic N=71,000 (Attrition: 23%) **Maternal characteristics:** • Total energy intake: NR • Maternal age: <25y 13.0%, 25-29y 41.7%, 30-34y 33.9%, ≥35y 11.4% • Race/ethnicity: NR • SES: Socio-occupational status, High 50.4%, Middle 36.1%, Low 9.1%, Missing 4.4% • Pre-pregnancy BMI: <18.5 4.3%, 18.5-24.9 64.0%, 25-29.9 18.3%, ≥30 7.7%, Missing 5.6% • Smoking: 2nd trimester, Non-smoker 72.9%, 1-10 cigarettes/d 11.0%, ≥11 cigarettes/d 3.4%, Missing 12.8% • Parity: Primiparous 45.2%, Multiparous 50.8%, Missing 4.0% • Diabetes: NR **Child characteristics:** • Female child: 48.8% • Gestational age: Mean=280d, SD=13 • Birth weight: Mean=3582 g, SD=563	**Exposure of interest:** Maternal cola intake—2nd trimester (No information was available on the definition of cola.) **Other exposures measured:** Maternal tea & coffee intake **Comparators:** • Cola intake (L/wk): ○ 0 (Ref), ○ <1, ○ ≥1 <u>Assessment method</u>: telephone interviews (single question) <u>Assessment timing</u>: ~31wk gestation (IQR: 29-33wk) <u>Represents</u>: usual daily intake—2nd trimester **Study beverage intake:** • Cola: NR **Outcomes and assessment methods:** • Birth weight and gestational age abstracted from the Danish Medical Birth Register • SGA: birth weight >2 SD below the mean birth weight for gestational age and sex according to Scandinavian reference curves	**TEI adjusted**: No **BW/SGA adjusted**: GA & sex *Cola intake, categorical—2nd trimester* **<u>Birth weight</u>**, Linear regression 0 (Ref) <1 L/wk: Data NR **≥1 L/wk: B: 10 g, 95% CI: 0.3, 19** **<u>SGA</u>**, Logistic regression, 0 (Ref) <1 L/wk: Data NR **≥1 L/wk: OR: 1.25, 95% CI: 1.09, 1.43**	**Confounders accounted for:** • Key confounders: child sex, gestational age, maternal age, pre-pregnancy BMI, SES, smoking, diagnosis of diabetes • Other factors to be considered: parity **Confounders NOT accounted for:** • Key confounders: race/ethnicity, pre-pregnancy beverage intake • Other factors to be considered: total energy intake, timing, temporal use, sugar, protein, fiber, energy density, medications, supplements **Additional model adjustments:** Alcohol, maternal height, nausea **Limitations:** • Serious risk of bias due to confounding • Serious risk of bias in classification of exposures **Funding sources:** Danish National Research Foundation; Pharmacy Foundation; Egmont Foundation; March of Dimes Birth Defects Foundation; Health Foundation; Augustinus Foundation

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations

Grosso, 2001[10]
Prospective Cohort Study, Yale Health in Pregnancy Study, United States
 	
Baseline N= 2,967 Analytic N=2,714 (Attrition: 9%)
 	
Maternal characteristics:
• Total energy intake: NR
• Maternal age: ≤24y 7.2%, 25-29y 30.7%, 30-34y 41.5%, ≥35y 20.5%
• Race/ethnicity: White 90.3%, Other 9.7%
• SES: Education, ≤11y 1.5%, 12y 17.0%, 13-15y 26.1%, 16y 29.5%, ≥17y 26.0%
• Pre-pregnancy BMI: NR
• Smoking: # Cigarettes/d during month 1 of pregnancy, 0/d 86.2%, 1-10/d 7.8%, >10 6.0%
• Diabetes: GDM 5.1%
• Parity: None 44.2%, ≥One 55.8%
 	
Child characteristics:
• Female child: 50.3%
• Gestational age: NR
• Birth weight: NR
	Exposure of interest:
	Caffeinated soda intake—0-16wk gestation
	
	Other exposures measured:
	Caffeinated coffee and tea intake
	
	Comparator:
	• Soda intake:
	  ○ 0 glasses/d (Ref),
	  ○ 1-6 glasses/wk,
	  ○ 2 glasses/d,
	  ○ >2 glasses/d
	
	Assessment method: structured questionnaires administered by trained interviewers in the women's home
	Assessment timing: during first 16wk of pregnancy
	Represents: conception through <16wk intake
	
	Study beverage intake:
	• During month 1 of pregnancy:
	  ○ 0 cups/d: 71.1%,
	  ○ 1-6 cups/wk: 18.5%,
	  ○ 1-2 cups/d: 8.4%,
	  ○ >2 cups/d: 2.0%
	
	Outcomes and assessment methods:
	• IUGR (≤10th percentile of birth weight for gestational age) according to standards developed by Babson, 1970. Birth weight measured within 24 hours after hospital delivery using standardized protocols for use of scales and scale calibration; gestational age assessed via Ballard examination within 6-24hr of delivery by study nurses trained to administer Ballard examination, or LMP for those that did not have a Ballard examination (5.7%)
		TEI adjusted: No
		IUGR adjusted: GA only
		
		IUGR, Logistic regression, OR (95% CI)
		Soda intake during month 1 of pregnancy
		0 glasses/d (Ref) (n=1,926)
		1-6 glasses/wk (n=500): 1.36 (0.91, 2.04)
		1-2 glasses/d (n=228): 1.10 (0.63, 1.93)
		>2 glasses/d (n=55): 1.41 (0.53, 3.77)
		
		IUGR
		Nonsmokers
		0 cups/d (Ref)
		1-6 glasses/wk: 1.12 (0.69, 1.81)
		1-2 glasses/d: 1.04 (0.52, 2.09)
		>2 glasses/d: 0.49 (0.06, 3.72)
		
		Smokers 0 cups/d (Ref)
		1-6 glasses/wk: 2.02 (0.89, 4.55)
		1-2 glasses/d: 1.14 (0.41, 3.15)
		>2 glasses/d: 3.61 (0.95, 13.69)
			Confounders accounted for:
			• Key confounders: Child sex, gestational age, race/ethnicity, maternal age, SES, smoking, diagnosis of diabetes
			• Other factors to be considered: parity
			
			Confounders NOT accounted for:
			• Key confounders: pre-pregnancy BMI, pre-pregnancy beverage intake
			• Other factors to be considered: Total energy intake, timing, temporal use, sugar, protein, fiber, energy density, medications, supplements
			
			Additional model adjustments:
			Maternal height, GWG, preeclampsia, bleeding during 3rd trimester, other month 1 caffeinated beverage intake
			
			Limitations:
			• Serious risk of bias due to confounding
			• Birth weight (IUGR) not standardized by sex
			• Racial/ethnic minorities were underrepresented in the survey sample
			• Small percentage of sample had high caffeine intake
			
			Funding source:
			NR

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations
SSB + LNCSB combined			

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations

<u>**Okubo, 2015**</u>[13]
Prospective cohort study, Osaka Maternal and Child Health Study (OMCHS), Japan
 	
Baseline N= 1,002 Analytic N=858 (Attrition: 14%)
 	
Maternal characteristics:
• Total energy intake: Median=1785 kcal/d, IQR=1540-2072
• Maternal age: Median=30.0y, IQR=27.0-32.0
• Race/ethnicity: 100% Japanese
• SES: Education, <13y 29.8%, 13-14y 42.4%, ≥15y 27.7%; Maternal employment: full or part-time, 28.9%
• Baseline BMI at enrollment: Median=21.1 kg/m^2, IQR=19.6-22.8
• Smoking: during pregnancy, none 86.8%, 1st trimester only 4.9%, 2nd and/or 3rd trimester but not throughout 1.9%, throughout 6.4%
• Parity: Primiparous 49.1%
• Diabetes: NR
 	
Child characteristics:
• Female child: 47.7%
• Gestational age: Median=39.0wk, IQR: 38.0-40.0
• Birth weight: Median=3069 g, IQR: 2815-3342
	Exposure of interest:
	Maternal soft drink intake (consisting of hot chocolate, cola, and diet cola)—pregnancy
	
	Other exposures measured:
	Maternal tea and coffee intake including Japanese and Chinese tea (e.g., green tea, oolong tea), black tea, and coffee.
	
	Comparators:
	• Soft drink intake:
	  ○ None (Ref),
	  ○ 1 cup/d,
	  ○ 2 cups/d, and
	  ○ ≥3 cups/d
	
	<u>Assessment method</u>: self-administered dietary history questionnaire (previously validated using dietary record, 24-hr urine excretion, and serum biomarkers)
	<u>Assessment timing</u>: at enrollment (ranged from 5-39 wk)
	<u>Represents</u>: previous month's intake
	
	Study beverage intake:
	• Soft drink intake: none (n=340), 1 cup/d (n=446), 2 cups/d (n=45), and ≥3 cups/d (n=27); Median (IQR): 0.14 (0-0.45)
	• Contributors of caffeine in the diet during pregnancy were Japanese and Chinese tea (73.5%), coffee (14.3%), black tea (6.6%), and soft drinks (3.5%)
	
	Outcomes and assessment methods:
	• BW & GA obtained from self-report survey at 2-9mo postpartum; mothers referenced measurements recorded by obstetrician or midwife
	• LBW: <2500g
	• SGA: <10th percentile of the Japanese norms for babies of the same gestational age, sex, and parity
		TEI adjusted: Yes
		SGA/LBW adjusted: GA & sex
		
		Soft drink intake
		<u>**SGA**</u>, Logistic regression, OR (95% CI)
		None (Ref)
		1 cup/d: 1.43 (0.81, 2.55)
		2 cups/d: 3.49 (1.21, 10.04)
		≥3 cups/d: 1.54 (0.30, 7.92)
		
		Per 1 cup/d increase: 1.08 (0.79, 1.47)
		P for trend: 0.62
		
		<u>**LBW**</u>, none (Ref)
		1 cup/d: 1.34 (0.70, 2.59)
		2 cups/d: 1.66 (0.42, 6.58)
		≥3 cups/d: 1.11 (0.19, 6.37)
		
		Per 1 cup/d increase: 1.12 (0.80, 1.58)
		P for trend: 0.51
			Confounders accounted for:
			• Key confounders: child sex, gestational age, race/ethnicity, maternal age, SES, smoking
			• Other factors to be considered: Parity, total energy intake, supplements
			Confounders NOT accounted for:
			• Key confounders: pre-pregnancy BMI, pre-pregnancy beverage intake, diagnosis of diabetes
			• Other factors to be considered: timing, temporal use, sugar, protein, fiber, energy density, medications
			Additional model adjustments:
			Maternal height, GA at enrollment, alcohol, energy intake, folic acid, vitamin B, medical problems during pregnancy, dietary changes vs pre-pregnancy
			Limitations:
			• Serious risk of bias due to confounding
			• Serious risk of bias in selection of participants into the study
			• Exact type and preparation technique for exposure cannot be determined
			• Baseline measurement spanned from 5 to 39 weeks gestation, bringing into question the utility of BMI measurements and making it difficult to determine when during pregnancy beverages intake is most impactful
			• Findings may not be generalizable to other racial/ethnic groups
			Funding sources:
			Ministry of Education, Culture, Sports, Science and Technology; Ministry of Health, Labour, and Welfare.

Sengpiel, 2013[14]
Prospective Cohort Study, Norwegian Mother and Child Cohort (MoBa), Norway

Baseline N= 103,835 Analytic N=59,123 (Attrition: 43%)

Maternal characteristics:

- Total energy intake: <7.90 MJ/d 25%, 7.90-9.35 MJ/d 25%, 9.36-11.14 MJ/d 25%, >11.14 MJ/d 25%
- Maternal age: <25y 11%, 25-29y 34%, 30-34y 43%, >34y 12%
- Race/ethnicity: NR
- SES: Education, ≤12y 30%, 13-16y 42%, ≥17y 26%; Partners with income >300,000 NOK/y, None 28%, One 41%, Two 28%
- Pre-pregnancy BMI: <18.5 3%, 18.5-24.9 67%, 25-29.9 21%, ≥30 8%
- Smoking: Habits, Never 92%, Occasionally 3%, Daily 5%, Missing 1%; Passive smoking, No 88%, Yes 10%, Missing 2%
- Diabetes: 100% without diabetes or GDM
- Parity: Zero 51%, One 32%, Two 14%, ≥Three 3%

Child characteristics:

- Female child: 49%
- Gestational age: Median=282d, IQR (276-287d) (Spontaneous deliveries, N=49,102)
- Birth weight: Median=3620 g

Exposure of interest:
Caffeine intake from caffeinated soft drinks (including Coca Cola/Pepsi with sugar, Coca Cola/Pepsi Light)—0-22wk, 17wk, 30wk

Other exposures measured:
Caffeine intake from coffee and black tea

Comparator:

- Caffeine intake from caffeinated soft drinks (per 100 mg caffeine/d) modeled continuously

Assessment method: 22wk: semi-quantitative FFQ designed to assess diet during pregnancy and validated in a MoBa subpopulation using 4d weighed food diaries and blood and urine biomarkers; 17wk & 30wk: single question to assess intake
Assessment timing: 17wk, 22wk (FFQ), 30wk
Represents: 0-22wk gestation intake (FFQ) or current intake (17wk & 30wk, single q)

Study beverage intake:

- Caffeine intake from cola: NR

Outcomes and assessment methods:

- Birth weight extracted from the Medical Birth Registry of Norway and converted to percentage of expected birth weight for gestational age using three different growth curves from Northern European populations (Marsal 1996 ultrasound-based, Skjaerven 2000 population-based, and Gardosi 1992 customized); for presentation, percentage of expected birth weight for gestational age converted to birth weight for an infant with an expected birth weight of 3600g
- SGA defined using the 3 different growth curves (Marsal 1996, birth weight <-2 SD for gestational age; Skjaerven 2000 and Gardosi 1992, birth weight <10th percentile for GA) and relied on GA determined primarily through 2nd trimester ultrasound (98.3%) and LMP

TEI adjusted: Yes
BW/SGA adjusted: GA & sex

Caffeinated soda intake, 0-22wk gestation
Birth weight,
Linear regression, B (95% CI)
Marsal: -34 g (-47, -22), P<10^-7
Skjaerven: -38 g (-50, -25), P<10^-8
Gardosi: -23 g (-35, -11), P<3x10^-4

SGA, Logistic regression, OR (95% CI)
Marsal: 1.22 (0.97, 1.53), P=0.08
Skjaerven: 1.29, (1.16, 1.43), P<10^-5
Gardosi: 1.19 (1.06, 1.33), P=0.002

Prepregnancy caffeinated soda intake
Birth weight
Marsal: 4 g (-3, 10), P=0.3
Skjaerven: 3 g (-3, 10), P=0.3
Gardosi: 5 g (-1, 11), P=0.1

Caffeinated soda intake, 17wk
Birth weight
Marsal: -13 g (-22, -5), P<3x10^-3
Skjaerven: -13 g (-22, -4), P<4x10^-3
Gardosi: -12 g (-20, -3), P<7x10^-3

Caffeinated soda intake, 30wk
Birth weight
Marsal: -1 g (-6, 5), P=0.8
Skjaerven: -1 g (-6, 4), P=0.7
Gardosi: 0 g (-5, 5), P=0.9

Confounders accounted for:

- Key confounders: Child sex, gestational age, race/ethnicity, maternal age, pre-pregnancy BMI, socioeconomic status, smoking, diagnosis of diabetes
- Other factors to be considered: parity, total energy intake

Confounders NOT accounted for:

- Key confounders: Pre-pregnancy beverage intake
- Other factors to be considered: timing, temporal use, sugar, protein, fiber, energy density, medications, supplements

Additional model adjustments:
History of preterm delivery, nausea in 2nd trimester, passive smoking, nicotine from non-cigarette sources, alcohol during pregnancy, energy intake, caffeine from other sources

Limitations:

- Racial/ethnic minorities underrepresented in the survey sample
- Exposure assessment at 17wk & 30wk not valid

Funding sources:
Norwegian Ministry of Health; Norwegian Ministry of Education and Research; NIEHS; NINDS; Norwegian Research Council/FUGE; European Commission 6th Framework Program; Swedish Medical Society; Swedish Government

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations
Prospective cohort studies—LNCSB only			

Azad, 2016[16]
Prospective Cohort Study, Canadian Healthy Infant Longitudinal Development (CHILD) Study, Canada
 	
Baseline N=3,542
Analytic N=2,413 (Attrition: 32%)
 	
Maternal characteristics:
• Total energy intake: Mean=2007 kcal/d, SD=711
• Maternal age: Mean=32.5y, SD=4.6
• Race/ethnicity: NR
• SES: Postsecondary degree 78.2%
• Pre-pregnancy BMI: Mean=24.8 kg/m^2, SD=5.4
• Smoking: During pregnancy 7.9%
• Parity: NR
• Diabetes: GDM 4.4%; Preexisting diabetes 1.4%
 	
Child characteristics:
• Female child: 47.2%
• Gestational age: Mean=39.2wk, SD=1.4
• Birth weight: Mean=3447 g, SD=486
	Exposure of interest:
	Maternal artificially sweetened beverage (ASB) and sugar sweetened beverage (SSB) intake (servings/mo or wk)—2nd or 3rd trimester
	
	Other exposures measured:
	ASB: diet soft drinks or pop (1 serv = 12 oz or 1 can) & artificial sweetener added to tea or coffee (1 serv = 1 packet)
	
	Comparators:
	• ASB intake:
	  ○ <1 serving/mo,
	  ○ ≤1 serving/wk,
	  ○ 2-6 servings/wk,
	  ○ ≥1 serving/d
	
	Assessment method: Validated FFQ
	Assessment timing: 2nd or 3rd (usually) trimester
	Represents: usual intake during current pregnancy
	
	Study beverage intake:
	• Frequency of ASB intake:
	  ○ <1/mo: 70.5%,
	  ○ ≤1/wk: 16.7%,
	  ○ 2-6/wk: 7.7%,
	  ○ ≥1/d: 5.1%
	
	Outcomes and assessment methods:
	• Birth weight in g extracted from hospital records
		TEI adjusted: No
		BW: not adjusted
		
		Artificially sweetened beverages
		Birth weight, ANOVA, Mean (SD)
		<1 serving/mo: 3461 g (480)
		≤1 serving/wk: 3463 g (468)
		2-6 servings/wk: 3395 g (553)
		≥1 serving/d: 3482 g (409), P=0.33
			Confounders accounted for:
			• Key confounders: None
			• Other factors to be considered: None
			
			Confounders NOT accounted for:
			• Key confounders: Child sex, gestational age, race/ethnicity, maternal age, pre-pregnancy BMI, pre-pregnancy beverage intake, SES, smoking, diagnosis of diabetes
			• Other factors to be considered: Parity, total energy intake, timing, temporal use, sugar, protein, fiber, energy density, medications, supplements
			
			Additional model adjustments: None
			
			Limitations:
			• Critical risk of bias due to confounding
			• Birth weight not standardized for gestational age or sex
			
			Funding sources:
			Children's Hospital Research Institute of Manitoba; Canadian Institutes of Health Research; Allergy, Genes and Environment Network of Centres of Excellence

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations
<u>Grundt, 2017</u>[17] **Prospective Cohort Study, Norwegian Mother and Child Cohort (MoBa), Norway** Baseline N= 75,075 Analytic N=50,280 (Attrition: 33%) **Maternal characteristics:** • Total energy intake: Mean~2303 kcal/d • Maternal age: Mean~30y • Race/ethnicity: Predominately White Caucasian • SES: Maternal education >12 years ~71%; High income ~39% • Pre-pregnancy BMI: Mean~24 kg/m^2 • Smoking: ~12% • Diabetes: GDM 0.9%; 100% without preexisting diabetes • Parity: Primipara 45.0% **Child characteristics:** • Female child: %NR • Gestational age: Mean~280d • Birth weight: Mean~3629 g	**Exposure of interest:** Maternal and artificially sweetened carbonated beverage (ASC) intake (ml/d) **Other exposures measured:** Maternal sugar sweetened carbonated beverage (SSC) intake **Comparators:** • ASC intake modeled continuously (per 100 ml/d increase) • Artificially sweetened beverage intake modeled continuously (per 100 ml/d increase) <u>Assessment method</u>: three questionnaires, including one semi-quantitative FFQ (22wk) developed and validated for pregnant women in MoBa <u>Assessment timing</u>: 15wk, 22wk, and 30wk <u>Represents</u>: current & 0-22wk intake **Study beverage intake:** • ASC intake: NR • Artificially sweetened beverage intake: NR **Outcomes and assessment methods:** • Birth weight in g measured immediately after birth by midwives • LBW (<2500 g) and HBW (>4500 g) • LGA (>90th percentile) and SGA (<10th percentile) determined using Norwegian percentiles for gestational age (determined via ultrasound, 98.3%) and sex • Ponderal index calculated as birth weight/length^3	**TEI adjusted:** No **BW:** not adjusted *Artificially-sweetened carbonated beverages* **<u>Birth weight</u>:** **B: -3.8 g, 95% CI: -5.9, -1.7** *Artificially-sweetened beverages* **<u>Birth weight</u>:** **B: -2.0 g, 95% CI: -3.6, -0.4**	**Confounders accounted for:** • Key confounders: Child sex, gestational age, maternal age, pre-pregnancy BMI, socioeconomic status, smoking, diagnosis of diabetes • Other factors to be considered: parity, total energy intake **Confounders NOT accounted for:** • Key confounders: race/ethnicity, pre-pregnancy beverage intake • Other factors to be considered: timing, temporal use, sugar, protein, fiber, energy density, medications, supplements **Additional model adjustments:** Maternal height, diet patterns, exercise, pre-pregnancy alcohol per occasion, ASB intake, spontaneous labor, offspring year of birth **Limitations:** • Serious risk of bias due to confounding • Birth weight not standardized by gestational age or sex in several analyses **Funding sources:** Norwegian Ministry of Health and the Ministry of Education and Research; Innlandet Hospital Trust; Southern and Eastern Norway Regional Health Authority; NIEHS; NINDS; Norwegian Research Council/FUGE

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations
Prospective cohort studies—Plain water			
<u>**Patelarou, 2011**</u>[12] **Prospective Cohort Study, Rhea study, Greece** Baseline N= 1,606 Analytic N=1,359 (Attrition: 15%) **Maternal characteristics:** • Total energy intake: NR • Maternal age: <25y 17.4%; 25-35y 66.9%; >35y 15.7% • Race/ethnicity: Greek 90.1%; Non-Greek 9.9% • SES: Maternal education, ≤6y of school 21.1%, ≤12y of school 50.4%, University or technical college degree 28.5%; Paternal education, ≤6y of school 37.1%, ≤12y of school 42.2%, University or technical college degree 20.7% • Pre-pregnancy BMI: NR • Smoking: non-smoker 64.2%; ex-smoker 16.5%; smoker 19.3% • Parity: Primipara 37.8%; Multipara 62.2% • Diabetes: NR **Child characteristics:** • Female child: %NR • Gestational age: 11.5% Preterm • Birth weight: Mean=3179 g, SD=457	**Exposure of interest:** Maternal plain water consumption & source of drinking water at home (tap/bottled/spring water; glasses/d), 1st & 3rd trimesters—1st & 3rd trimesters **Other exposures measured:** Coffee and tea intake, 1st trimester **Comparator:** • Water intake: ≤0.5 glasses/d, 0.75-1, 1.25-1.5, >1.5 • Water intake source at home: Spring/bottled water, Tap water <u>Assessment method</u>: interview, FFQ <u>Assessment timing</u>: during the 1st (~3mo) and 3rd trimesters (timing NR) <u>Represents</u>: current intake **Study beverage intake:** • 1st trimester water intake: ≤0.5 glasses/d: 13.9%, 0.75-1 gls/d: 26.2%, 1.25-1.5 gls/d: 26.2%, >1.5 gls/d: 33.7%; • 3rd trimester water intake: ≤0.5 glasses/d: 5.5%, 0.75-1 gls/d: 22.4%, 1.25-1.5 gls/d: 34.6%, >1.5 gls/d: 37.5%; **Outcomes and assessment methods:** • Birth weight assessed via face-to-face interview 1-2d after birth in the maternity ward; gestational age primarily assessed from LMP and date of delivery (quadratic regression formula if LMP inconsistent with ultrasound) • LBW defined as birth weight <2500 g • SGA defined as <10th percentile of birth weight for gestational age based on Spanish referent population	**TEI adjusted:** No **BW/LBW/SGA adjusted:** GA & sex *Plain water (1st trimester)* <u>**Birth weight**</u>, Linear regression, B (95% CI) ≤0.5 (Ref) 0.75-1 glasses/d: -5.3 g (-77.6, 67.0) 1.25-1.5 glasses/d: 10.4 g (-61.9, 82.6) >1.5 glasses/d: -45.5 g (-78.1, 93.9) <u>**LBW and SGA**</u>: NS (Data NR) *Plain water (3rd trimester)* <u>**Birth weight**</u> ≤0.5 (Ref) 0.75-1 glasses/d: -64.5 g (-175.5, 46.5) 1.25-1.5 glasses/d: -38.5 g (-146.2, 69.2) >1.5 glasses/d: -52.4 g (-159.9, 55.2) <u>**LBW and SGA**</u>: NS (Data NR) *Plain water (water type)* <u>**Birth weight**</u> Spring/bottled (Ref) Tap water: -43.7 g (-110.3, 22.9) <u>**LBW and SGA**</u>: NS (Data NR)	**Confounders accounted for:** • Key confounders: child sex, gestational age, maternal age, race/ethnicity, SES, smoking **Confounders NOT accounted for:** • Key confounders: pre-pregnancy BMI, pre-pregnancy beverage intake, diagnosis of diabetes • Other factors to be considered: total energy intake, timing, temporal use, sugar, protein, fiber, energy density, medications, supplements **Additional model adjustments:** None **Limitations:** • Serious risk of bias due to confounding **Funding source:** EU 6th Framework Programme

<u>Wright, 2010</u>[19]
Prospective Cohort Study, Right from the Start Study, United States

Baseline N= 2,766 Analytic N=1,854 (Attrition: 33%)

Maternal characteristics:
- Total energy intake: NR
- Maternal age: <25y 29%, 25-29y 32%, 30-34y 28%, ≥35 11%
- Race/ethnicity: Non-Hispanic White 57%, Non-Hispanic black 30%, Hispanic 9%, Other 4%
- SES: Highest education level, High school or less 28%, Some college 22%, College degree or higher 50%; Annual household income, <$30,000 31%, $30,001-60,000 26%, $60,001-80,000 16%, >$80,000 23%, Missing 4%
- Pre-pregnancy BMI: <19.8 11%, 19.8-25.9 50%, 26.0-29.9 16%, >29.9 20%, Missing 3%
- Smoking: Yes 5%, No 95%
- Parity: Nulliparous 49%, Parous 51%
- Diabetes: NR

Child characteristics:
- Female child: 49%
- Gestational age: Preterm 9%
- Birth weight: Mean=3382 g, SD=586

Exposure of interest:
Water intake (including bottled water, cold/hot tap water, total tap water, tap water-based drinks (e.g. juice, coffee, tea), and total water)—1st & 2nd trimesters

Bottled water included spring water, mineral water, distilled water, sparkling water or any water purchased in bottles or plastic jugs or obtained from a water cooler.

<u>Assessment method</u>: telephone interview
<u>Assessment timing</u>: <16wk & 20-24wk
<u>Represents</u>: daily intake during a typical week

Comparator:
- Bottled water intake: None, Any
- Cold tap water intake: 0-27 oz/d, >27-53 oz/d, >53-91 oz/d, >91 oz/d
- Total tap water intake: 0-30 oz/d, >30-61 oz/d, >61-96 oz/d, >96 oz/d
- Total water intake: 0-51 oz/d, >51-78 oz/d, >78-114 oz/d, >114 oz/d
- Total tap water intake modeled continuously (per 20 oz/d)
- Cold tap water intake modeled continuously (per 20 oz/d)

Study beverage intake:
- Bottled water intake: None 25%, Any 75%
- Cold tap water (oz/d): 0-27 24%, >27-53 25%, >53-91 25%, >91 26%
- Total tap water (oz/d): 0-30 25%, >30-61 25%, >61-96 28%, >96 22%
- Total water (oz/d): 0-51 25%, >51-78 25%, >78-114 25%, >114 25%

Outcomes and assessment methods:
- Birth weight obtained from medical records, vital records, and participant self report (<1%); gestational age derived based on self-reported LMP unless differed from ultrasound-based estimate

TEI adjusted: No
BW adjusted: Sex only
SGA adjusted: GA & sex

Bottled water
<u>Birth weight</u>,
Linear regression B (95% CI)
None (Ref)
Any: 31 g (-20, 82)

<u>SGA</u>, Risk ratio (95% CI)
None (Ref)
Any: 0.9 (0.5, 1.4)

Cold tap water (categorical)
<u>Birth weight</u>, 0-27 (Ref)
>27-53 oz/d: 9 g (-53, 72)
>53-91 oz/d: 52 g (-11, 116)
>91 oz/d: 49 g (-14, 111)

<u>SGA</u>, Risk ratio, 0-27 (Ref)
>27-53 oz/d: 1.2 (0.6, 2.3)
>53-91 oz/d: 1.3 (0.7, 2.4)
>91 oz/d: 0.9 (0.5, 1.9)

Total tap water (categorical)
<u>Birth weight</u>, 0-30 (Ref)
>30-61 oz/d: 44 g (-18, 106)
>61-96 oz/d: 78 g (17, 139)
>96 oz/d: 43 g (-21, 107)

<u>SGA</u>, Risk ratio, 0-30 (Ref)
>30-61 oz/d: 0.9 (0.5, 1.7)
>61-96 oz/d: 0.8 (0.5, 1.6)
>96 oz/d: 0.9 (0.5, 1.9)

Total water (categorical)
<u>Birth weight</u>, 0-51 (Ref)
>51-78 oz/d: 27 g (-34, 87)
>78-114 oz/d: 39 g (-22, 99)
>114 oz/d: 50 g (-11, 111)

<u>SGA</u>, Risk ratio, 0-51 (Ref)
>51-78 oz/d: 0.8 (0.4, 1.4)
>78-114 oz/d: 0.6 (0.3, 1.0)
>114 oz/d: 0.9 (0.5, 1.6)

Confounders accounted for:
- Key confounders: Child sex, gestational age, race/ethnicity, maternal age, pre-pregnancy BMI, socioeconomic status, smoking, diagnosis of diabetes
- Other factors to be considered: parity, supplements

Confounders NOT accounted for:
- Key confounders: Pre-pregnancy beverage intake
- Other factors to be considered: total energy intake, timing, temporal use, sugar, protein, fiber, energy density, medications

Additional model adjustments: vitamin use, study site

Limitations:
- Serious risk of bias due to confounding for birth weight analysis
- Serious risk of bias in selection of the reported result
- Water intake was measured using a method of unknown validity/reliability
- Authors acknowledge water intake is difficult to measure and may be subject to non-differential measurement error

Funding sources:
AWWA Research Foundation; EPA; Center for Environmental Health and Susceptibility at UNC; NIEHS; NHEERL-DESE

of gestational age by 7 days

- SGA (below 10th percentile for gestational age, sex, maternal race/ethnicity, and parity) determined based on United States population estimates

Bottled water (early+mid pregnancy, categorical)
Birth weight,
None (Ref) vs Any: 43g (-27, 113)
SGA, Risk ratio,
None (Ref) vs Any: 1.4 (0.6, 3.0)

Cold tap water (early+mid pregnancy, categorical)
Birth weight, 0-27 (Ref)
>27-53 oz/d: 25 g (-38, 88)
>53-91 oz/d: 44 g (-19, 107)
>91 oz/d: 65 g (2, 128)

SGA, Risk ratio, 0-27 (Ref)
>27-53 oz/d: 1.1 (0.6, 2.2)
>53-91 oz/d: 1.4 (0.7, 2.6)
>91 oz/d: 1.1 (0.5, 2.1)

Total tap water (early+mid pregnancy, categorical)

Birth weight, 0-30 (Ref)
>30-61 oz/d: 10 g (-52, 73)
0-30 (Ref) vs >61-96 oz/d: 34 g (-30, 97)
0-30 (Ref) vs >96 oz/d: 46 g (-17, 109)

SGA, Risk ratio, 0-30 (Ref)
>30-61 oz/d: 1.2 (0.6, 2.2)
>61-96 oz/d: 1.3 (0.7, 2.6)
>96 oz/d: 1.1 (0.6, 2.2)

Total water (early+mid pregnancy, categorical)
Birth weight, 0-51 (Ref)
>51-78 oz/d: 10 g (-50, 71)
>78-114 oz/d: 55 g (-6, 116)
>114 oz/d: 37 g (-25, 98)

SGA, Risk ratio, 0-51 (Ref)
>51-78 oz/d: 0.9 (0.5, 1.6)
>78-114 oz/d: 0.5 (0.2, 1.0)
>114 oz/d: 1.0 (0.6, 1.8)

Study and population characteristics	Intervention/Exposure, Comparator and Outcome(s)	Results	Key Confounders and Study Limitations
		Cold tap water (continuous) **<u>Birth weight</u>**: 8.5 g (0.1, 16.9) **<u>SGA</u>**: RR: 1.0 (0.9, 1.1) *Total tap water (continuous)* **<u>Birth weight</u>**: 6.8 g (-1.3, 15.0) **<u>SGA</u>**: RR: 1.0 (0.9, 1.1) *Total water (continuous)* **<u>Birth weight</u>**: 7.3 g (-0.8, 15.5) **<u>SGA</u>**: RR: 1.0 (0.9, 1.1) *Cold tap water (early+mid pregnancy, continuous)* **<u>Birth weight</u>**: 8.5 g (-1.5, 18.5) **<u>SGA</u>**: RR: 1.0 (0.9, 1.1) *Total tap water (early+mid pregnancy, continuous)* **<u>Birth weight</u>**: 5.3 g (-4.3, 15.1) **<u>SGA</u>**: RR: 1.0 (0.9, 1.1) *Total water (early+mid pregnancy, continuous)* **<u>Birth weight</u>**: 5.2 g (-4.7, 15.2) **<u>SGA</u>**: RR: 1.0 (0.9, 1.1)	

Table 3: Risk of bias for the randomized controlled trial examining beverage consumption during pregnancy and birth weight[iv,v]

	Randomization	Deviations from intended interventions	Missing outcome data	Outcome measurement	Selection of the reported result
Li, 2014[1]	Some Concerns	Some Concerns	Some Concerns	Low	Some Concerns

[iv] A detailed description of the methodology used for assessing risk of bias is available on the NESR website: https://nesr.usda.gov/2020-dietary-guidelines-advisory-committee-systematic-reviews and in Part C of the following reference: Dietary Guidelines Advisory Committee. 2020. *Scientific Report of the 2020 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Agriculture and the Secretary of Health and Human Services*. U.S. Department of Agriculture, Agricultural Research Service, Washington, DC.

[v] Possible ratings of low, some concerns, or high determined using the "Cochrane Risk-of-bias 2.0" (RoB 2.0) (August 2016 version)" (Higgins JPT, Sterne JAC, Savović J, Page MJ, Hróbjartsson A, Boutron I, Reeves B, Eldridge S. A revised tool for assessing risk of bias in randomized trials In: Chandler J, McKenzie J, Boutron I, Welch V (editors). Cochrane Methods. *Cochrane Database of Systematic Reviews* 2016, Issue 10 (Suppl 1). dx.doi.org/10.1002/14651858.CD201601.)

Table 4: Risk of bias for observational studies examining beverage consumption during pregnancy and birth weight[vi]

	Confounding	Selection of participants	Classification of exposures	Deviations from intended exposures	Missing data	Outcome measurement	Selection of the reported result
Azad, 2016[16]	Critical	Low	Low	Low	Low	Low	Moderate
Bae, 2010[15]	Critical	Low	Serious	Low	Low	Low	Moderate
Bech, 2015[7]	Serious	Low	Serious	Low	Moderate	Low	Moderate
Chen, 2018[8]	Serious	Low	Low	Moderate	Low	Low	Moderate
Colapinto, 2015[9]	Serious	Low	Moderate	Low	Low	Low	Moderate
Grosso, 2001[10]	Serious	Low	Moderate	Low	Low	Low	Moderate
Grundt, 2017[17]	Serious	Low	Moderate	Low	Moderate	Low	Moderate
Heppe, 2011[4]	Serious	Low	Low	Low	Low	Low	Moderate
Hrolfsdottir, 2013[5]	Serious	Low	Low	Low	Low	Low	Moderate
Lu, 2017[11]	Serious	Low	Moderate	Low	Moderate	Low	Moderate
Mannion, 2006[2]	Serious	Low	Low	Low	Low	Low	Moderate
Miyake, 2016[3]	Serious	Low	Low	Low	Moderate	Moderate	Moderate
Okubo, 2015[13]	Serious	Serious	Low	Moderate	Low	Moderate	Moderate
Olmedo-Requena, 2016[6]	Serious	Low	Low	Low	Low	Low	Moderate
Patelarou, 2011[12]	Serious	Low	Moderate	Low	Moderate	Moderate	Moderate
Phelan, 2011[18]	Moderate	Low	Moderate	Moderate	Moderate	Low	Moderate
Sengpiel, 2013[14] (Questionnaire)	Moderate	Low	Moderate	Low	Moderate	Low	Moderate
(FFQ)	Moderate	Low	Low	Low	Moderate	Low	Moderate
Wright, 2010[19] (Birth weight)	Serious	Low	Moderate	Low	Moderate	Low	Serious
(SGA)	Moderate	Low	Moderate	Low	Moderate	Low	Serious

[vi] Possible ratings of low, moderate, serious, critical, or no information determined using the "Risk of Bias for Nutrition Observational Studies" tool (RoB-NObs) (Dietary Guidelines Advisory Committee. 2020. *Scientific Report of the 2020 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Agriculture and the Secretary of Health and Human Services*. U.S. Department of Agriculture, Agricultural Research Service, Washington, DC.)

METHODOLOGY

The NESR team used its rigorous, protocol-driven methodology to support the 2020 Dietary Guidelines Advisory Committee in conducting this systematic review.

NESR's systematic review methodology involves:

- Developing a protocol,
- Searching for and selecting studies,
- Extracting data from and assessing the risk of bias of each included study,
- Synthesizing the evidence,
- Developing conclusion statements,
- Grading the evidence underlying the conclusion statements, and
- Recommending future research.

A detailed description of the methodology used in conducting this systematic review is available on the NESR website: https://nesr.usda.gov/2020-dietary-guidelines-advisory-committee-systematic-reviews, and can be found in the 2020 Dietary Guidelines Advisory Committee Report, Part C: Methodology.[vii] This systematic review was peer reviewed by Federal scientists, and information about the peer review process can also be found in the Committee's Report, Part C. Methodology. Additional information about this systematic review, including a description of and rationale for any modifications made to the protocol can be found in the 2020 Dietary Guidelines Advisory Committee Report, Chapter 2. Food, Beverage, and Nutrient Consumption During Pregnancy.

Below are details of the final protocol for the systematic review described herein, including the:

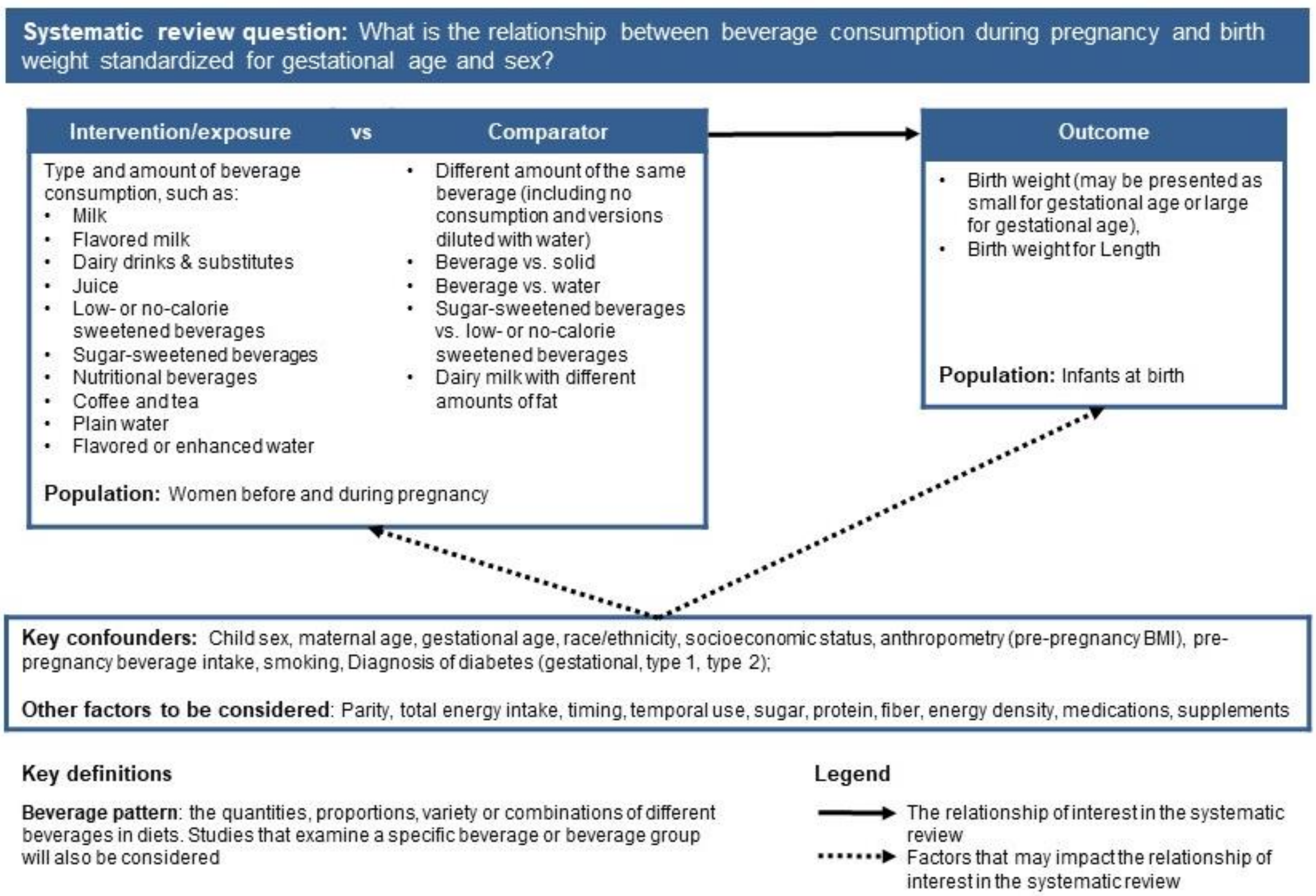
- Analytic framework
- Literature search and screening plan
- Literature search and screening results

[vii] Dietary Guidelines Advisory Committee. 2020. *Scientific Report of the 2020 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Agriculture and the Secretary of Health and Human Services*. U.S. Department of Agriculture, Agricultural Research Service, Washington, DC.

ANALYTIC FRAMEWORK

The analytic framework (**Figure 1**) illustrates the overall scope of the systematic review, including the population, the interventions and/or exposures, comparators, and outcomes of interest. It also includes definitions of key terms and identifies key confounders considered in the systematic review. The inclusion and exclusion criteria that follow provide additional information about how parts of the analytic framework were defined and operationalized for the review.

Figure 1: Analytic framework



LITERATURE SEARCH AND SCREENING PLAN

Inclusion and exclusion criteria

Table 5 provides the inclusion and exclusion criteria for the systematic review. The inclusion and exclusion criteria are a set of characteristics used to determine which articles identified in the literature search were included in or excluded from the systematic review.

Table 5: Inclusion and exclusion criteria

Category	Inclusion Criteria	Exclusion Criteria
Study design	• Randomized controlled trials • Non-randomized controlled trials (including quasi experimental and controlled before-and-after studies) • Prospective cohort studies • Retrospective cohort studies • Nested case-control studies	• Uncontrolled trials • Case-control studies • Cross-sectional studies • Uncontrolled before-and-after studies • Narrative reviews • Systematic reviews • Meta-analyses
Intervention/ exposure	Type and amount of beverage consumption—all beverage types will be considered Example beverage categories include: • Milk • Flavored milk • Dairy drinks & substitutes • Juice • Low- or no-calorie-sweetened beverages • Sugar-sweetened beverages • Nutritional beverages (e.g., protein shakes, smoothies, and meal replacements included if in a commercially available liquid form and labeled as a beverage, not a supplement) • Coffee and tea • Plain water • Flavored or enhanced water	• Studies focusing on specific nutrients added to beverages instead of a beverage as a whole (i.e., studies where beverages are the delivery mechanism for a nutrient) • Beverages that are not commercially available (e.g., experimentally manipulated beverages) • Supplements • Alcohol (alone, not part of a beverage pattern)* • Soups • *Alcohol is being examined in a separate set of questions

Category	Inclusion Criteria	Exclusion Criteria
Comparator	• Different amount of the same beverage (including no consumption and versions diluted with water) • Beverage vs. solid • Beverage vs. water • Sugar-sweetened beverages vs. low- or no-calorie sweetened beverages • Dairy milk with different amounts of fat	• No comparator • Studies comparing different types of beverages (with the exception of studies comparing a beverage to plain water, dairy milk with different amounts of fat, and sugar-sweetened beverages to low- or no-calorie sweetened beverages)
Outcomes	• Birth weight standardized for gestational age and sex (may be presented as SGA or LGA), • Birth weight for Length for gestational age and sex	• Birth weight or birth weight for length not standardized for gestational age and sex
Temporality	• Studies when the exposure was assessed prior to the outcome	• Studies when the outcome was assessed prior to the exposure
Date of publication	• January 2000 – June 2019	• Articles published prior to 2000
Publication status	• Articles published in peer-reviewed journals	• Articles that have not been peer reviewed and are not published in peer-reviewed journals, including unpublished data, manuscripts, reports, pre-prints, abstracts, and conference proceedings
Language of publication	• Articles published in English	• Articles published in languages other than English
Country[viii]	• Studies conducted in Very High or High Human Development Countries	• Studies conducted in Medium or lower Human Development Countries

[viii] The Human Development classification was based on the Human Development Index (HDI) ranking from the year the study intervention occurred or data were collected (UN Development Program. HDI 1990-2017 HDRO calculations based on data from UNDESA (2017a), UNESCO Institute for Statistics (2018), United Nations Statistics Division (2018b), World Bank (2018b), Barro and Lee (2016) and IMF (2018). Available from: http://hdr.undp.org/en/data). If the study did not report the year in which the intervention occurred or data were collected, the HDI classification for the year of publication was applied. HDI values are available from 1980, and then from 1990 to present. If a study was conducted prior to 1990, the HDI classification from 1990 was applied. If a study was conducted in 2018 or 2019, the most current HDI classification was applied. When a country was not included in the HDI ranking, the current country classification from the World Bank was used instead (The World Bank. World Bank country and lending groups. Available from: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519 -world- country-and-lending-groups).

Category	Inclusion Criteria	Exclusion Criteria
Study participants	• Human participants • Females who are pregnant • Females capable of becoming pregnant • Neonates	• Animal and in vitro models • Hospitalized patients, when hospitalization is not related to pregnancy, birth and immediate postpartum • Pregnancies conceived ONLY using Assisted Reproductive Technologies • Studies that exclusively enroll multiple gestation pregnancies • Studies that enroll both singleton and multiple pregnancies and do not account for singleton and multiple gestation in the design or analyses and only present aggregate findings
Health status of study participants	• Studies that enroll mothers who are healthy and/or at risk for chronic disease, including those with obesity • Studies that enroll *some* mothers diagnosed with a disease • Studies that enroll mothers with infants born full-term (≥37 and 0/7 weeks gestational age) • Studies that enroll *some* mothers with infants who are born preterm (gestational age <37 and 0/7 weeks), with low birth weight (2500g), and/or small for gestational age	• Studies that exclusively enroll preterm infants (gestational age <37 and 0/7 weeks) • Studies that exclusively enroll mothers diagnosed with a disease, or hospitalized with an illness or injury (For this criterion, studies that exclusively enroll mothers with obesity will **not** be excluded)

Electronic databases and search terms

PubMed

- Provider: U.S. National Library of Medicine
- Date(s) searched: June 10, 2019
- Date range searched: January 1, 2000-June 10, 2019
- Search Terms:

#1 - "Beverages"[Mesh:noexp] OR beverage[tiab] OR beverages[tiab] OR sports drink* OR protein drink* OR fortified drink* OR sweetened drink* OR sweet drink* OR sugary drink* OR dairy drink* OR chocolate drink* OR nutritional drink* OR smoothie*[tiab] OR protein shake* OR meal replacement*[tiab] OR carbonated drink*[tiab] OR soft drink*[tiab] OR soda[tiab] OR sodas[tiab] OR caffeinated drink*[tiab] OR "Drinking Water"[Mesh] OR drinking water[tiab] OR bottled water[tiab] OR "Carbonated Beverages"[Mesh] OR carbonated water[tiab] OR sparkling water[tiab] OR flavored water[tiab] OR flavoured water[tiab] OR flavoured drink[tiab] OR flavored drink* OR "Energy Drinks"[Mesh] OR energy drink*[tiab] OR sugar sweetened drink* OR "Fruit and Vegetable Juices"[Mesh] OR juice[tiab] OR juices[tiab] OR fruit drink* OR fizzy drink* OR "Coffee"[Mesh] OR coffee[tiab] OR "Tea"[Mesh] OR tea[tiab] OR "Milk"[Mesh:noexp] OR milk[tiab] OR "Soy Milk"[Mesh] OR soymilk[tiab] OR "Buttermilk"[Mesh] OR buttermilk[tiab] OR "Whey"[Mesh] OR whey[tiab] OR liquid[tiab] OR liquids[tiab]

#2 - "Pregnancy"[Mesh] OR "Pregnancy Complications"[Mesh] OR "Prenatal Exposure Delayed Effects"[Mesh] OR "Maternal Exposure"[Mesh] OR "Pregnant Women"[Mesh] OR pregnan*[tiab] OR pre-pregnancy[tiab] OR prenatal[tiab] OR antenatal[tiab] OR maternal[tiab] OR "Mothers"[Mesh] OR mother[tiab] OR mothers[tiab] OR postpartum[tiab] OR perinatal[tiab] OR peri-natal[tiab] OR pre-conception[tiab] OR preconception[tiab] OR peri-conception[tiab] OR periconception[tiab] OR "Peripartum Period"[Mesh] OR peripartum[tiab] OR peri-partum[tiab] OR gestation*[tiab] OR natal[tiab] OR puerperium[tiab] OR "Maternal Nutritional Physiological Phenomena"[Mesh]

#3 - "Birth Weight"[Mesh] OR birth weight*[tiab] OR "Infant, Low Birth Weight"[Mesh] OR body weight[tiab] OR healthy weight[tiab] OR "weight gain"[tiab] OR "weight loss"[tiab] OR "Overweight"[Mesh] OR overweight[tiab] OR obesity[tiab] OR "Thinness"[Mesh] OR underweight[tiab] OR under weight[tiab] OR "Fetal Weight"[Mesh] OR fetal weight* OR "Waist Circumference"[Mesh] OR waist circumference[tiab] OR "body size"[tiab] OR "Fetal Growth Retardation"[Mesh] OR fetal growth[tiab] OR IUGR[tiab] OR "Intrauterine growth restriction" OR "intrauterine growth restriction" OR "Fetal Development"[Mesh:noexp] OR fetal development[tiab] OR "Umbilical Arteries"[Mesh] OR umbilical arter*[tiab] OR "Uterine Artery"[Mesh] OR uterine arter*[tiab] OR "Waist-Height Ratio"[Mesh] OR waist height ratio[tiab] OR "Body Mass Index"[Mesh] OR body mass index[tiab] OR BMI[tiab] OR z-score[tiab] OR "Adiposity"[Mesh] OR adiposity[tiab] OR "body fat"[tiab]

#4 - (#1 AND #2 AND #3) NOT ("Animals"[Mesh] NOT ("Animals"[Mesh] AND "Humans"[Mesh])) NOT (editorial[ptyp] OR comment[ptyp] OR news[ptyp] OR letter[ptyp] OR review[ptyp] OR systematic review[ptyp] OR systematic review[ti] OR meta-analysis[ptyp] OR meta-analysis[ti] OR meta-analyses[ti] OR retracted publication[ptyp] OR retraction of publication[ptyp] OR retraction of publication[tiab] OR retraction notice[ti]) Filters: Publication date from 2014/01/01 to 2019/06/10; English

Cochrane Central Register of Controlled Trials (CENTRAL)

- Provider: John Wiley & Sons
- Date(s) Searched: June 10, 2019
- Date range searched: January 1, 2000-June 10, 2019
- Search Terms:

#1 - [mh ^Beverages] OR [mh "Drinking Water"] OR [mh "Carbonated Beverage"] OR [mh "Energy Drink"] OR [mh "Fruit and Vegetable Juice"] OR [mh Coffee] OR [mh ^Milk]"

#2 - (beverage OR beverages OR “sports drink” OR “protein drink” OR “fortified drink” OR “sweetened drink” OR “sweet drink” OR “sugary drink” OR “dairy drink” OR “chocolate drink” OR “nutritional drink” OR smoothie* OR “protein shake” OR “meal replacement” OR “carbonated drink” OR “soft drink” OR soda OR sodas OR “caffeinated drink” OR “drinking water” OR “bottled water” OR “carbonated water” OR “sparkling water” OR “flavored water” OR “flavoured water” OR “flavoured drink” OR “flavored drink*” OR “energy drink” OR “sugar sweetened drink” OR juice OR juices OR “fruit drink” OR “fizzy drink” OR coffee OR tea OR milk OR soymilk OR buttermilk OR whey OR liquid OR liquids):ti,ab,kw"

#3 - #1 OR #2

#4 - [mh "Pregnancy"] OR [mh "Pregnancy Complications"] OR [mh "Prenatal Exposure Delayed Effects"] OR [mh "Maternal Exposure"] OR [mh "Pregnant Women"] OR [mh "Mothers"] OR [mh "Peripartum Period"] OR [mh "Maternal Nutritional Physiological Phenomena"]

#5 - (pregnancy OR “pre-pregnancy” OR prenatal OR antenatal OR maternal OR mother OR mothers OR postpartum OR perinatal OR peri-natal OR pre-conception OR preconception OR peri-conception OR periconception OR peripartum OR peri-partum OR gestation OR natal OR puerperium):ti,ab,kw

#6 - #4 OR #5

#7 - [mh "Birth Weight"] OR [mh "Infant, Low Birth Weight"] OR [mh "Overweight"] OR [mh "Thinness"] OR [mh "Fetal Weight"] OR [mh "Waist Circumference"] OR [mh "Fetal Growth Retardation"] OR [mh ^"Fetal Development"] OR [mh "Umbilical Arteries"] OR [mh "Uterine Artery"] OR [mh "Waist-Height Ratio"] OR [mh "Body Mass Index"] OR [mh "Adiposity"]

#8 - (“birth weight” OR “body weight” OR “healthy weight” OR "weight gain" OR "weight loss" OR overweight OR obesity OR underweight OR “under weight” OR “fetal weight” OR “waist circumference” OR "body size” OR “fetal growth” OR IUGR OR "Intrauterine growth restriction" OR "intrauterine growth restriction" OR “fetal development” OR “umbilical arter” OR “uterine artery” OR “waist height ratio” OR “body mass index” OR BMI OR z-score OR adiposity OR "body fat"):ti,ab,kw

#9 - #7 OR #8

#10 - #3 AND #6 AND #9" with Publication Year from 2000 to 2019, in Trials (Word variations have been searched)

Embase

- Provider: Elsevier
- Date(s) searched: June 10, 2019
- Date range searched: January 1, 2000-June 10, 2019
- Search Terms:

#1 - 'beverage'/mj OR 'drinking water'/mj OR 'carbonated beverage'/de OR 'energy drink'/de OR 'fruit and vegetable juice'/exp/mj OR 'coffee'/exp/mj OR 'milk'/mj OR 'soybean milk'/de OR 'buttermilk'/de OR 'whey'/de

#2 - beverage:ab,ti OR beverages:ab,ti OR 'sports drink*':ab,ti OR 'protein drink*':ab,ti OR 'fortified drink*':ab,ti OR 'sweetened drink*':ab,ti OR 'sweet drink*':ab,ti OR 'sugary drink*':ab,ti OR 'dairy drink*':ab,ti OR 'chocolate drink*':ab,ti OR 'nutritional drink*':ab,ti OR smoothie*:ab,ti OR 'protein shake*':ab,ti OR 'meal replacement*':ab,ti OR 'carbonated drink*':ab,ti OR 'soft drink*':ab,ti OR soda:ab,ti OR sodas:ab,ti OR 'caffeinated drink*':ab,ti OR 'drinking water':ab,ti OR 'bottled water':ab,ti OR 'carbonated water':ab,ti OR 'sparkling water':ab,ti OR 'flavored water':ab,ti OR 'flavoured water':ab,ti OR 'flavoured drink':ab,ti OR 'flavored drink*':ab,ti OR 'energy drink*':ab,ti OR 'sugar sweetened drink*':ab,ti OR juice:ab,ti OR juices:ab,ti OR 'fruit drink*':ab,ti OR 'fizzy drink*':ab,ti OR coffee:ab,ti OR tea:ab,ti OR milk:ab,ti OR soymilk:ab,ti OR buttermilk:ab,ti OR whey:ab,ti OR liquid:ab,ti OR liquids:ab,ti

#3 - #1 OR #2

#4 - 'pregnancy'/exp/mj OR 'pregnancy complication'/exp/mj OR 'prenatal exposure'/mj OR 'maternal exposure'/mj OR 'pregnant woman'/mj OR 'mother'/mj OR 'puerperium'/mj OR 'maternal nutrition'/mj

#5 - pregnan*:ab,ti OR 'pre pregnancy':ab,ti OR prenatal:ab,ti OR antenatal:ab,ti OR maternal:ab,ti OR mother:ab,ti OR mothers:ab,ti OR postpartum:ab,ti OR perinatal:ab,ti OR 'peri natal':ab,ti OR 'pre conception':ab,ti OR preconception:ab,ti OR 'peri conception':ab,ti OR periconception:ab,ti OR peripartum:ab,ti OR 'peri partum':ab,ti OR gestation*:ab,ti OR natal:ab,ti OR puerperium:ab,ti

#6 - #4 OR #5

#7 - 'birth weight'/exp/mj OR 'obesity'/exp/mj OR 'underweight'/de OR 'fetus weight'/de OR 'waist circumference'/de OR 'intrauterine growth retardation' OR 'fetus development'/exp OR 'umbilical artery' OR 'uterine artery' OR 'waist to height ratio' OR 'body mass index z score' OR 'body fat'

#8 - 'birth weight*':ab,ti OR 'body weight':ab,ti OR 'healthy weight':ab,ti OR 'weight gain':ab,ti OR 'weight loss':ab,ti OR overweight:ab,ti OR obesity:ab,ti OR underweight:ab,ti OR 'under weight':ab,ti OR 'fetal weight':ab,ti OR 'waist circumference':ab,ti OR 'body size':ab,ti OR 'fetal growth':ab,ti OR iugr:ab,ti OR 'intrauterine growth restriction':ab,ti OR 'fetal development':ab,ti OR 'umbilical arter*':ab,ti OR 'uterine arter*':ab,ti OR 'waist height ratio':ab,ti OR 'body mass index':ab,ti OR bmi:ab,ti OR 'z-score':ab,ti OR adiposity:ab,ti OR 'body fat':ab,ti

#9 - #7 OR #8

#10 - #3 AND #6 AND #9

#11 - #3 AND #6 AND #9 AND ([article]/lim OR [article in press]/lim) AND [humans]/lim AND [english]/lim AND [2000-2019]/py

Cumulative Index of Nursing and Allied Health Literature (CINAHL Plus)

- Provider: EBSCOhost
- Date(s) Searched: June 10, 2019
- Date range searched: January 1, 2000-June 10, 2019
- Search Terms:

#***S1 -*** (MH "Beverages+" OR MH "Water Supply")

#***S2 -*** (beverage OR beverages OR “sports drink*” OR “protein drink*” OR “fortified drink*” OR “sweetened drink*” OR “sweet drink*” OR “sugar drink*” OR “sugary drink*” OR “dairy drink*” OR “chocolate drink*” OR “nutritional drink*” OR smoothie* OR “protein shake*” OR “meal replacement*” OR “carbonated drink*” OR “soft drink*” OR soda OR sodas OR “caffeinated drink*” OR “drinking water” OR “bottled water*” OR “carbonated water*” OR “sparkling water*” OR “flavored water*” OR “flavoured water*” OR “flavoured drink*” OR “flavored drink*” OR “energy drink*” OR “sugar sweetened drink*” OR juice OR juices OR “fruit drink*” OR “fizzy drink*” OR coffee OR tea OR milk OR soymilk OR buttermilk OR whey OR liquid*)

#***S3 -*** S1 OR S2

#***S4 -*** (MH "Pregnancy+" OR MH "Pregnancy Complications+" OR MH "Prenatal Exposure Delayed Effects" OR MH "Maternal Exposure" OR MH "Expectant Mothers" OR MH "Mothers" OR MH "Puerperium" OR MH "Maternal Nutritional Physiology")

#***S5 -*** (pregnan* OR “pre pregnancy” OR prenatal OR antenatal OR maternal OR mother OR mothers OR postpartum OR perinatal OR “peri natal” OR “pre conception” OR preconception OR “peri conception” OR periconception OR peripartum OR “peri partum” OR gestation* OR natal OR puerperium)

#***S6 -*** S4 OR S5

#***S7 -*** (MH "Birth Weight" OR MH "Infant, Low Birth Weight" OR MH "Fetal Weight" OR MH "Obesity" OR MH "Thinness" OR MH "Fetal Growth Retardation" OR MH "Fetal Development" OR MH "Umbilical Arteries" OR MH "Waist Circumference" OR MH "Waist-Hip Ratio" OR MH "Body Mass Index" OR MH "Adipose Tissue")

#***S8 -*** ('birth weight'/exp OR 'obesity'/exp OR 'underweight' OR 'fetus weight' OR 'waist circumference' OR 'intrauterine growth retardation' OR 'fetus development'/exp OR 'umbilical artery' OR 'waist to height ratio' OR 'body mass index z score' OR 'body fat')

#***S9 -*** S7 OR S8

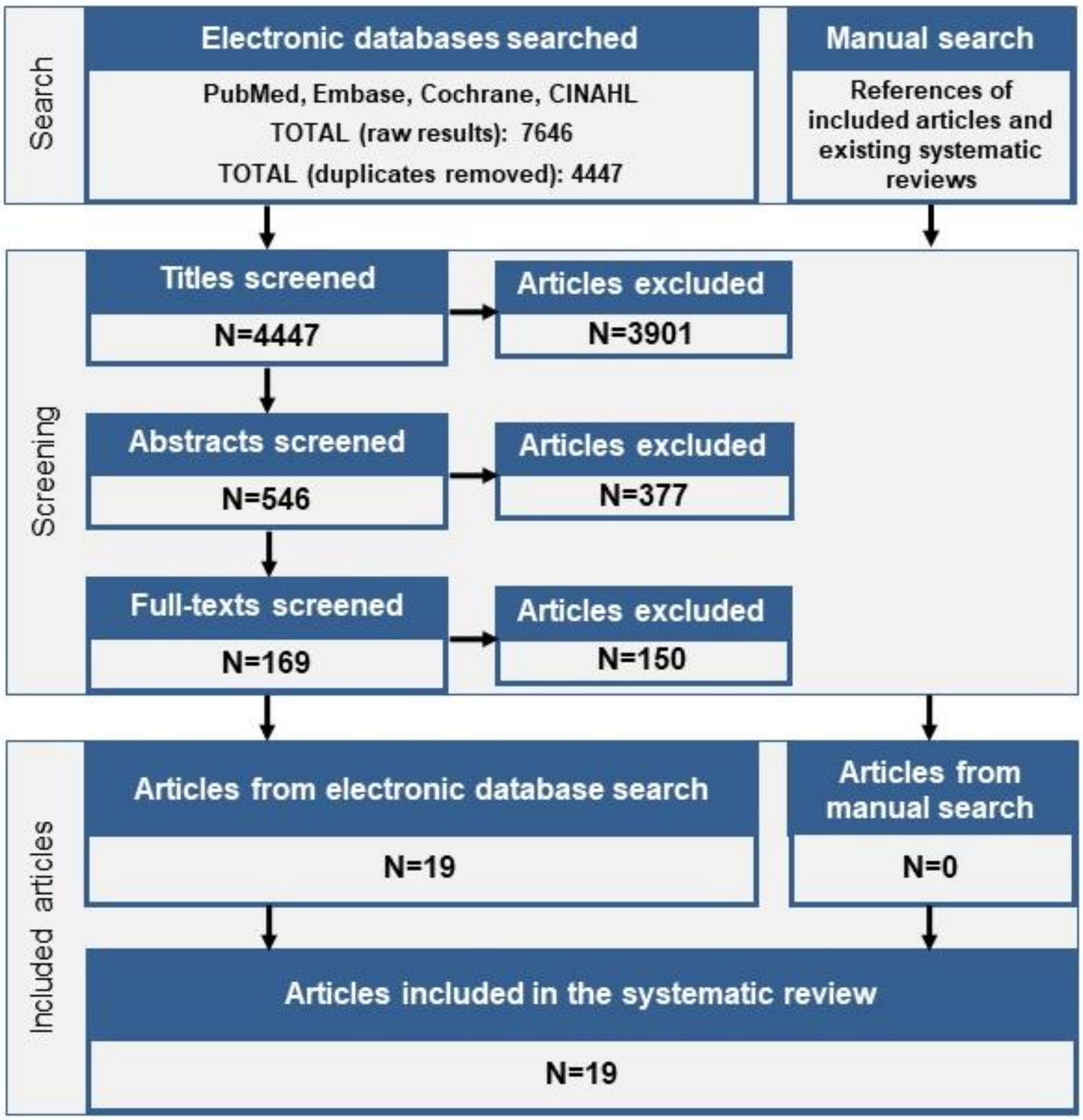
#***S10 -*** S3 AND S6 AND S9

#***S11 -*** (S3 AND S6 AND S9) NOT (MH "Literature Review" OR MH "Meta Analysis" OR MH "Systematic Review" OR MH "News" OR MH "Retracted Publication" OR MH "Retraction of Publication)

LITERATURE SEARCH AND SCREENING RESULTS

The flow chart (**Figure 2**) below illustrates the literature search and screening results for articles examining the systematic review question. The results of the electronic database searches, after removal of duplicates, were screened independently by two NESR analysts using a step-wise process by reviewing titles, abstracts, and full-texts to determine which articles met the inclusion criteria. Refer to Table 6 for the rationale for exclusion for each excluded full-text article. A manual search was done to find articles that were not identified when searching the electronic databases; all manually identified articles are also screened to determine whether they meet criteria for inclusion.

Figure 2: Flow chart of literature search and screening results



Excluded articles

The table below lists the articles excluded after full-text screening, and includes columns for the categories of inclusion and exclusion criteria (see **Table 5**) that studies were excluded based on. At least one reason for exclusion is provided for each article, though this may not reflect all possible reasons for exclusion. Information about articles excluded after title and abstract screening is available upon request.

Table 6: Articles excluded after full text screening with rationale for exclusion

	Citation	Rationale
1	Abouk, R, Adams, S. Birth outcomes in Flint in the early stages of the water crisis. J Public Health Policy. 2018. 39(1):68-85. doi:10.1057/s41271-017-0097-5.	Intervention/Exposure
2	Abraham, A, Mathews, JE, Sebastian, A, Chacko, KP, Sam, D. A nested case-control study to evaluate the association between fetal growth restriction and vitamin B12 deficiency. Aust N Z J Obstet Gynaecol. 2013. 53(4):399-402. doi:10.1111/ajo.12057.	Intervention/Exposure
3	Aggazzotti, G, Righi, E, Fantuzzi, G, Biasotti, B, Ravera, G, Kanitz, S, Barbone, F, Sansebastiano, G, Battaglia, MA, Leoni, V, Fabiani, L, Triassi, M, Sciacca, S. Chlorination by-products (CBPs) in drinking water and adverse pregnancy outcomes in Italy. J Water Health. 2004. 2(4):233-47.	Study design; Intervention/Exposure
4	Aghaei, M, Derakhshani, R, Raoof, M, Dehghani, M, Mahvi, AH. Effect of fluoride in drinking water on birth height and weight: An ecological study in Kerman Province, Zarand county, Iran. Fluoride. 2015. 48(2):160-168.	Intervention/Exposure
5	Almberg, KS, Turyk, ME, Jones, RM, Rankin, K, Freels, S, Graber, JM, Stayner, LT. Arsenic in drinking water and adverse birth outcomes in Ohio. Environ Res. 2017. 157:52-59. doi:10.1016/j.envres.2017.05.010.	Intervention/Exposure
6	Almberg, KS, Turyk, ME, Jones, RM, Rankin, K, Freels, S, Stayner, LT. Atrazine contamination of drinking water and adverse birth outcomes in community water systems with elevated atrazine in Ohio, 2006–2008. International Journal of Environmental Research and Public Health. 2018. 15(9). doi:10.3390/ijerph15091889.	Intervention/Exposure
7	Alomar, MJ. Evaluation of caffeine consumption and effect during pregnancy among women in the UAE. International Journal of Pharmacy and Pharmaceutical Sciences. 2016. 8(6):101-103.	Study design; Intervention/Exposure
8	Anjum, N, Naveen, A, Sheikh, S. Role of nutrition in pregnancy and its effect on fetal birth weight. Pakistan Journal of Medical and Health Sciences. 2013. 7(2).	Country
9	Aschengrau, A, Weinberg, J, Rogers, S, Gallagher, L, Winter, M, Vieira, V, Webster, T, Ozonoff, D. Prenatal exposure to tetrachloroethylene-contaminated drinking water and the risk of adverse birth outcomes. Environ Health Perspect. 2008. 116(6):814-20. doi:10.1289/ehp.10414.	Intervention/Exposure
10	Aschengrau, A, Weinberg, J, Rogers, S, Gallagher, L, Winter, M, Vieira, V, Webster, T, Ozonoff, D. Prenatal exposure to tetrachloroethylene-contamination drinking water and the risk of adverse birth outcomes. Environmental Health Perspectives. 2008. 116(6):814-820. doi:10.1289/ehp.10414.	Intervention/Exposure; Duplicate
11	Backstrand, JR, Allen, LH, Martinez, E, Pelto, GH. Maternal consumption of pulque, a traditional central Mexican alcoholic beverage: Relationships to infant growth and development. Public Health Nutrition. 2001. 4(4):883-891.	Intervention/Exposure

	Citation	Rationale
12	Bada, HS, Das, A, Bauer, CR, Shankaran, S, Lester, BM, Gard, CC, Wright, LL, LaGasse, L, Higgins, R. Low birth weight and preterm births: etiologic fraction attributable to prenatal drug exposure. Journal of Perinatology. 2005. 25(10):631-637.	Intervention/Exposure
13	Bakker, R, Steegers, EA, Obradov, A, Raat, H, Hofman, A, Jaddoe, VW. Maternal caffeine intake from coffee and tea, fetal growth, and the risks of adverse birth outcomes: the Generation R Study. Am J Clin Nutr. 2010. 91(6):1691-8. doi:10.3945/ajcn.2009.28792.	Intervention/Exposure
14	Balat, O, Balat, A, Ugur, MG, Pence, S. The effect of smoking and caffeine on the fetus and placenta in pregnancy. Clin Exp Obstet Gynecol. 2003. 30(1):57-9.	Study design; Intervention/Exposure
15	Bech, BH, Obel, C, Henriksen, TB, Olsen, J. Effect of reducing caffeine intake on birth weight and length of gestation: randomised controlled trial. Bmj. 2007. 334(7590):409. doi:10.1136/bmj.39062.520648.BE.	Other
16	Bertelsen, RJ, Brantsaeter, AL, Magnus, MC, Haugen, M, Myhre, R, Jacobsson, B, Longnecker, MP, Meltzer, HM, London, SJ. Probiotic milk consumption in pregnancy and infancy and subsequent childhood allergic diseases. J Allergy Clin Immunol. 2014. 133(1):165-71.e1-8. doi:10.1016/j.jaci.2013.07.032.	Outcome
17	Bloom, MS, Neamtiu, IA, Surdu, S, Pop, C, Anastasiu, D, Appleton, AA, Fitzgerald, EF, Gurzau, ES. Low level arsenic contaminated water consumption and birth outcomes in Romania-An exploratory study. Reprod Toxicol. 2016. 59:8-16. doi:10.1016/j.reprotox.2015.10.012.	Intervention/Exposure
18	Bonou, SG, Levallois, P, Giguere, Y, Rodriguez, M, Bureau, A. Prenatal exposure to drinking-water chlorination by-products, cytochrome P450 gene polymorphisms and small-for-gestational-age neonates. Reprod Toxicol. 2017. 73:75-86. doi:10.1016/j.reprotox.2017.07.019.	Study design; Intervention/Exposure
19	Bracken, MB, Triche, EW, Belanger, K, Hellenbrand, K, Leaderer, BP. Association of maternal caffeine consumption with decrements in fetal growth. Am J Epidemiol. 2003. 157(5):456-66. doi:10.1093/aje/kwf220.	Other
20	Brantsæter, AL, Haugen, M, Myhre, R, Sengpiel, V, Englund-Ögge, L, Nilsen, RM, Borgen, I, Duarte-Salles, T, Papadopoulou, E, Vejrup, K, Von Ruesten, A, Hillesund, ER, Birgisdottir, BE, Magnus, P, Trogstad, L, Jacobsson, B, Bacelis, J, Myking, S, Knutsen, HK, Kvalem, HE, Alexander, J, Mendez, M, Meltzer, HM. Diet matters, particularly in pregnancy – Results from MoBa studies of maternal diet and pregnancy outcomes. Norsk Epidemiologi. 2014. 24(1-2):63-77.	Study design
21	Bukowski, J, Somers, G, Bryanton, J. Agricultural contamination of groundwater as a possible risk factor for growth restriction or prematurity. J Occup Environ Med. 2001. 43(4):377-83.	Study design; Intervention/Exposure
22	Cao, WC, Zeng, Q, Luo, Y, Chen, HX, Miao, DY, Li, L, Cheng, YH, Li, M, Wang, F, You, L, Wang, YX, Yang, P, Lu, WQ. Blood Biomarkers of Late Pregnancy Exposure to Trihalomethanes in Drinking Water and Fetal Growth Measures and Gestational Age in a Chinese Cohort. Environ Health Perspect. 2016. 124(4):536-41. doi:10.1289/ehp.1409234.	Study design
23	Chan, GM, McElligott, K, McNaught, T, Gill, G. Effects of dietary calcium intervention on adolescent mothers and newborns: A randomized controlled trial. Obstet Gynecol. 2006. 108(3 Pt 1):565-71. doi:10.1097/01.AOG.0000231721.42823.9e.	Intervention/Exposure
24	Chen, LW, Murrin, CM, Mehegan, J, Kelleher, CC, Phillips, CM. Maternal, but not paternal or grandparental, caffeine intake is associated with childhood obesity and adiposity: The Lifeways Cross-Generation Cohort Study. Am J Clin Nutr. 2019. 109(6):1648-1655. doi:10.1093/ajcn/nqz019.	Outcome; Population
25	Chiaffarino, F, Parazzini, F, Chatenoud, L, Ricci, E, Tozzi, L, Chiantera, V, Maffioletti, C, Fedele, L. Coffee drinking and risk of preterm birth. Eur J Clin Nutr. 2006. 60(5):610-3. doi:10.1038/sj.ejcn.1602358.	Study design

	Citation	Rationale
26	Clark, DC. Association of Dairy Protein Intake During Pregnancy with Birth Weight. Food Nutr Bull. 2018. 39(2_suppl):S54-s59. doi:10.1177/0379572118775824.	Study design
27	Coelho Nde, L, Cunha, DB, Esteves, AP, Lacerda, EM, Theme Filha, MM. Dietary patterns in pregnancy and birth weight. Rev Saude Publica. 2015. 49:62. doi:10.1590/s0034-8910.2015049005403.	Intervention/Exposure
28	Conde, A, Teves, C, Figueiredo, B. Maternal coffee intake and associated risk factors: effects on fetal growth and activity. Acta Med Port. 2011. 24(2):241-8.	Outcome
29	Costet, N, Garlantezec, R, Monfort, C, Rouget, F, Gagniere, B, Chevrier, C, Cordier, S. Environmental and urinary markers of prenatal exposure to drinking water disinfection by-products, fetal growth, and duration of gestation in the PELAGIE birth cohort (Brittany, France, 2002-2006). Am J Epidemiol. 2012. 175(4):263-75. doi:10.1093/aje/kwr419.	Intervention/Exposure
30	Costet, Nathalie, Garlantézec, Ronan, Monfort, Christine, Rouget, Florence, Gagnière, Bertrand, Chevrier, Cécile, Cordier, Sylvaine. Environmental and Urinary Markers of Prenatal Exposure to Drinking Water Disinfection By-Products, Fetal Growth, and Duration of Gestation in the PELAGIE Birth Cohort (Brittany, France, 2002–2006). American Journal of Epidemiology. 2012. 175(4):263-275.	Intervention/Exposure; Duplicate
31	Cuco, G, Fernandez-Ballart, J, Sala, J, Viladrich, C, Iranzo, R, Vila, J, Arija, V. Dietary patterns and associated lifestyles in preconception, pregnancy and postpartum. Eur J Clin Nutr. 2006. 60(3):364-71. doi:10.1038/sj.ejcn.1602324.	Intervention/Exposure; Outcome
32	Currie, J, Zivin, JG, Meckel, K, Neidell, M, Schlenker, W. Something in the water: contaminated drinking water and infant health. Can J Econ. 2013. 46(3):791-810. doi:10.1111/caje.12039.	Intervention/Exposure
33	Danileviciute, A, Grazuleviciene, R, Vencloviene, J, Paulauskas, A, Nieuwenhuijsen, MJ. Exposure to drinking water trihalomethanes and their association with low birth weight and small for gestational age in genetically susceptible women. Int J Environ Res Public Health. 2012. 9(12):4470-85. doi:10.3390/ijerph9124470.	Intervention/Exposure
34	Dharmalingam, A, Navaneetham, K, Krishnakumar, CS. Nutritional status of mothers and low birth weight in India. Matern Child Health J. 2010. 14(2):290-8. doi:10.1007/s10995-009-0451-8.	Country
35	Diet & nutrition. Good news: caffeine in pregnancy doesn't affect the baby's growth...and folic acid seems to prevent cleft lip. Child Health Alert. 2007. 25:5-6.	Publication status
36	Donazar-Ezcurra, M, Lopez-Del Burgo, C, Martinez-Gonzalez, MA, Basterra-Gortari, FJ, de Irala, J, Bes-Rastrollo, M. Soft drink consumption and gestational diabetes risk in the SUN project. Clin Nutr. 2018. 37(2):638-645. doi:10.1016/j.clnu.2017.02.005.	Outcome
37	Ehrlich, SF, Rosas, LG, Ferrara, A, King, JC, Abrams, B, Harley, KG, Hedderson, MM, Eskenazi, B. Pregnancy glucose levels in women without diabetes or gestational diabetes and childhood cardiometabolic risk at 7 years of age. J Pediatr. 2012. 161(6):1016-21. doi:10.1016/j.jpeds.2012.05.049.	Outcome; Population
38	Englund-Ogge, L, Brantsaeter, AL, Haugen, M, Sengpiel, V, Khatibi, A, Myhre, R, Myking, S, Meltzer, HM, Kacerovsky, M, Nilsen, RM, Jacobsson, B. Association between intake of artificially sweetened and sugar-sweetened beverages and preterm delivery: a large prospective cohort study. Am J Clin Nutr. 2012. 96(3):552-9. doi:10.3945/ajcn.111.031567.	Outcome
39	Figueiredo, Acmg, Gomes-Filho, IS, Batista, JET, Orrico, GS, Porto, ECL, Cruz Pimenta, RM, Dos Santos Conceicao, S, Brito, SM, Ramos, MSX, Sena, MCF, Vilasboas, Swsl, Seixas da Cruz, S, Pereira, MG. Maternal anemia and birth weight: A prospective cohort study. PLoS One. 2019. 14(3):e0212817. doi:10.1371/journal.pone.0212817.	Intervention/Exposure

	Citation	Rationale
40	Forand, SP, Lewis-Michl, EL, Gomez, MI. Adverse birth outcomes and maternal exposure to trichloroethylene and tetrachloroethylene through soil vapor intrusion in New York State. Environ Health Perspect. 2012. 120(4):616-21. doi:10.1289/ehp.1103884.	Intervention/Exposure
41	Gilbert-Diamond, D, Emond, JA, Baker, ER, Korrick, SA, Karagas, MR. Relation between in Utero Arsenic Exposure and Birth Outcomes in a Cohort of Mothers and Their Newborns from New Hampshire. Environ Health Perspect. 2016. 124(8):1299-307. doi:10.1289/ehp.1510065.	Intervention/Exposure
42	Gillman, MW, Rifas-Shiman, SL, Fernandez-Barres, S, Kleinman, K, Taveras, EM, Oken, E. Beverage Intake During Pregnancy and Childhood Adiposity. Pediatrics. 2017. 140(2). doi:10.1542/peds.2017-0031.	Outcome; Population
43	Giroux, I, Inglis, SD, Lander, S, Gerrie, S, Mottola, MF. Dietary intake, weight gain, and birth outcomes of physically active pregnant women: a pilot study. Appl Physiol Nutr Metab. 2006. 31(5):483-9. doi:10.1139/h06-024.	Intervention/Exposure
44	Gripp Bicalho, G, de Azevedo Barros Filho, A. Birthweight and caffeine consumption. Revista de Saude Publica. 2002. 36(2):180-187.	Language
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69	Kanade, AN, Rao, S, Kelkar, RS, Gupte, S. Maternal nutrition and birth size among urban affluent and rural women in India. J Am Coll Nutr. 2008. 27(1):137-45.	Country
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	Citation	Rationale
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72	Kledmanee, K, Liabsuetrakul, T, Sretrirutchai, S. Risk of adverse pregnancy outcomes and seroprevalence for brucellosis in pregnant women exposed to goats or raw goat products in southern Thailand: a prospective cohort study. BMC Pregnancy Childbirth. 2019. 19(1):118. doi:10.1186/s12884-019-2267-x.	Outcome
73	Kogevinas, M, Bustamante, M, Gracia-Lavedan, E, Ballester, F, Cordier, S, Costet, N, Espinosa, A, Grazuleviciene, R, Danileviciute, A, Ibarluzea, J, Karadanelli, M, Krasner, S, Patelarou, E, Stephanou, E, Tardon, A, Toledano, MB, Wright, J, Villanueva, CM, Nieuwenhuijsen, M. Drinking Water Disinfection By-products, Genetic Polymorphisms, and Birth Outcomes in a European Mother-Child Cohort Study. Epidemiology. 2016. 27(6):903-11. doi:10.1097/ede.0000000000000544.	Intervention/Exposure
74	Koletzko, B, Cremer, M, Flothkotter, M, Graf, C, Hauner, H, Hellmers, C, Kersting, M, Krawinkel, M, Przyrembel, H, Robl-Mathieu, M, Schiffner, U, Vetter, K, Weissenborn, A, Wockel, A. Diet and Lifestyle Before and During Pregnancy - Practical Recommendations of the Germany-wide Healthy Start - Young Family Network. Geburtshilfe Frauenheilkd. 2018. 78(12):1262-1282. doi:10.1055/a-0713-1058.	Study design
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76	Lawande, A, Gravio, CD, Potdar, RD, Sahariah, SA, Gandhi, M, Chopra, H, Sane, H, Kehoe, SH, Marley-Zagar, E, Fall, CHD. Effect of a micronutrient-rich snack taken pre-conceptionally and throughout pregnancy on ultrasound measures of fetal growth: the Mumbai Maternal Nutrition Project (MMNP). Maternal & child nutrition. 2018. 14. doi:10.1111/mcn.12587.	Country
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80	Limousi, F, Albouy-Llaty, M, Carles, C, Dupuis, A, Rabouan, S, Migeot, V. Does area deprivation modify the association between exposure to a nitrate and low-dose atrazine metabolite mixture in drinking water and small for gestational age? A historic cohort study. Environ Sci Pollut Res Int. 2014. 21(7):4964-73. doi:10.1007/s11356-013-1893-5.	Intervention/Exposure
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84	Malhotra, N, Upadhyay, RP, Bhilwar, M, Choy, N, Green, T. The role of maternal diet and iron-folic acid supplements in influencing birth weight: evidence from India's National Family Health Survey. J Trop Pediatr. 2014. 60(6):454-60. doi:10.1093/tropej/fmu051.	Country
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93	Moro, GE, Bertino, E, Bravi, F, Tonetto, P, Gatta, A, Quitadamo, PA, Salvatori, G, Profeti, C, Di Nicola, P, Decarli, A, Ferraroni, M, Tavani, A, Stahl, B, Wiens, F. Adherence to the Traditional Mediterranean Diet and Human Milk Composition: Rationale, Design, and Subject Characteristics of the MEDIDIET Study. Front Pediatr. 2019. 7:66. doi:10.3389/fped.2019.00066.	Study design; Outcome; Population
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99	Nolan, LA, Nolan, JM, Shofer, FS, Rodway, NV, Emmett, EA. Congenital anomalies, labor/delivery complications, maternal risk factors and their relationship with perfluorooctanoic acid (PFOA)-contaminated public drinking water. Reprod Toxicol. 2010. 29(2):147-55. doi:10.1016/j.reprotox.2009.10.012.	Intervention/Exposure
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101	Ochoa-Acuna, H, Frankenberger, J, Hahn, L, Carbajo, C. Drinking-water herbicide exposure in Indiana and prevalence of small-for-gestational-age and preterm delivery. Environ Health Perspect. 2009. 117(10):1619-24. doi:10.1289/ehp.0900784.	Intervention/Exposure
102	Okubo, H, Miyake, Y, Sasaki, S, Tanaka, K, Murakami, K, Hirota, Y, Kanzaki, H, Kitada, M, Horikoshi, Y, Ishiko, O, Nakai, Y, Nishio, J, Yamamasu, S, Yasuda, J, Kawai, S, Yanagihara, K, Wakuda, K, Kawashima, T, Narimoto, K, Iwasa, Y, Orino, K, Tsunetoh, I, Yoshida, J, Iito, J, Kaneko, T, Kamiya, T, Kuribayashi, H, Taniguchi, T, Takemura, H, Morimoto, Y, Matsunaga, I, Oda, H, Ohya, Y. Maternal dietary patterns in pregnancy and fetal growth in Japan: the Osaka Maternal and Child Health Study. Br J Nutr. 2012. 107(10):1526-33. doi:10.1017/s0007114511004636.	Intervention/Exposure
103	Olafsdottir, AS, Magnusardottir, AR, Thorgeirsdottir, H, Hauksson, A, Skuladottir, GV, Steingrimsdottir, L. Relationship between dietary intake of cod liver oil in early pregnancy and birthweight. Bjog. 2005. 112(4):424-9. doi:10.1111/j.1471-0528.2005.00477.x.	Intervention/Exposure
104	Olafsdottir, AS, Skuladottir, GV, Thorsdottir, I, Hauksson, A, Steingrimsdottir, L. Maternal diet in early and late pregnancy in relation to weight gain. Int J Obes (Lond). 2006. 30(3):492-9. doi:10.1038/sj.ijo.0803184.	Outcome
105	Olsen, SF, Halldorsson, TI, Willett, WC, Knudsen, VK, Gillman, MW, Mikkelsen, TB, Olsen, J. Milk consumption during pregnancy is associated with increased infant size at birth: prospective cohort study. Am J Clin Nutr. 2007. 86(4):1104-10. doi:10.1093/ajcn/86.4.1104.	Other
106	Papadopoulou, E, Botton, J, Brantsæter, AL, Haugen, M, Alexander, J, Meltzer, HM, Bacelis, J, Elfvin, A, Jacobsson, B, Sengpiel, V. Maternal caffeine intake during pregnancy and childhood growth and overweight: Results from a large Norwegian prospective observational cohort study. BMJ Open. 2018. 8(3). doi:10.1136/bmjopen-2017-018895.	Outcome; Population
107	Parazzini, F, Chiaffarino, F, Chatenoud, L, Tozzi, L, Cipriani, S, Chiantera, V, Fedele, L. Maternal coffee drinking in pregnancy and risk of small for gestational age birth. Eur J Clin Nutr. 2005. 59(2):299-301. doi:10.1038/sj.ejcn.1602052.	Study design
108	Parvez, S, Gerona, RR, Proctor, C, Friesen, M, Ashby, JL, Reiter, JL, Lui, Z, Winchester, PD. Glyphosate exposure in pregnancy and shortened gestational length: a prospective Indiana birth cohort study. Environ Health. 2018. 17(1):23. doi:10.1186/s12940-018-0367-0.	Intervention/Exposure
109	Peacock, A, Hutchinson, D, Wilson, J, McCormack, C, Bruno, R, Olsson, CA, Allsop, S, Elliott, E, Burns, L, Mattick, RP. Adherence to the Caffeine Intake Guideline during Pregnancy and Birth Outcomes: A Prospective Cohort Study. Nutrients. 2018. 10(3). doi:10.3390/nu10030319.	Intervention/Exposure

	Citation	Rationale
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111	Perez-Ferre, N, Fernandez, D, Torrejon, MJ, Del Prado, N, Runkle, I, Rubio, MA, Montanez, C, Bordiu, E, Calle-Pascual, A. Effect of lifestyle on the risk of gestational diabetes and obstetric outcomes in immigrant Hispanic women living in Spain. J Diabetes. 2012. 4(4):432-8. doi:10.1111/j.1753-0407.2012.00221.x.	Intervention/Exposure
112	Pobocik, RS, Heathcote, GM, Spiers, JB, Otto, CT. Nutritional and anthropometric assessment of a sample of pregnant women and young children in Palau. Asia Pac J Clin Nutr. 2000. 9(2):102-14.	Outcome
113	Potdar, RD, Sahariah, SA, Gandhi, M, Kehoe, SH, Brown, N, Sane, H, Dayama, M, Jha, S, Lawande, A, Coakley, PJ, Marley-Zagar, E, Chopra, H, Shivshankaran, D, Chheda-Gala, P, Muley-Lotankar, P, Subbulakshmi, G, Wills, AK, Cox, VA, Taskar, V, Barker, DJP, Jackson, AA, Margetts, BM, Fall, CHD. Improving women's diet quality preconceptionally and during gestation: Effects on birth weight and prevalence of low birth weight - A randomized controlled efficacy trial in India (Mumbai maternal nutrition project). American Journal of Clinical Nutrition. 2014. 100(5):1257-1268. doi:10.3945/ajcn.114.084921.	Country
114	Rahman, ML, Valeri, L, Kile, ML, Mazumdar, M, Mostofa, G, Qamruzzaman, Q, Rahman, M, Baccarelli, A, Liang, L, Hauser, R, Christiani, DC. Investigating causal relation between prenatal arsenic exposure and birthweight: Are smaller infants more susceptible? Environ Int. 2017. 108:32-40. doi:10.1016/j.envint.2017.07.026.	Intervention/Exposure; Country
115	Rahman, SM, Kippler, M, Ahmed, S, Palm, B, El Arifeen, S, Vahter, M. Manganese exposure through drinking water during pregnancy and size at birth: A prospective cohort study. Reprod Toxicol. 2015. 53:68-74. doi:10.1016/j.reprotox.2015.03.008.	Country
116	Rao, S, Yajnik, CS, Kanade, A, Fall, CH, Margetts, BM, Jackson, AA, Shier, R, Joshi, S, Rege, S, Lubree, H, Desai, B. Intake of micronutrient-rich foods in rural Indian mothers is associated with the size of their babies at birth: Pune Maternal Nutrition Study. J Nutr. 2001. 131(4):1217-24. doi:10.1093/jn/131.4.1217.	Country
117	Rasmussen, KM, Habicht, JP. Maternal supplementation differentially affects the mother and newborn. J Nutr. 2010. 140(2):402-6. doi:10.3945/jn.109.114488.	Study design; Intervention/Exposure
118	Santos, IS, Matijasevich, A, Valle, NC. Mate drinking during pregnancy and risk of preterm and small for gestational age birth. J Nutr. 2005. 135(5):1120-3. doi:10.1093/jn/135.5.1120.	Study design
119	Savitz, DA, Stein, CR, Elston, B, Wellenius, GA, Bartell, SM, Shin, HM, Vieira, VM, Fletcher, T. Relationship of perfluorooctanoic acid exposure to pregnancy outcome based on birth records in the mid-Ohio Valley. Environ Health Perspect. 2012. 120(8):1201-7. doi:10.1289/ehp.1104752.	Intervention/Exposure
120	Shi, X, Ayotte, JD, Onda, A, Miller, S, Rees, J, Gilbert-Diamond, D, Onega, T, Gui, J, Karagas, M, Moeschler, J. Geospatial association between adverse birth outcomes and arsenic in groundwater in New Hampshire, USA. Environ Geochem Health. 2015. 37(2):333-51. doi:10.1007/s10653-014-9651-2.	Intervention/Exposure
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	Citation	Rationale
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	Citation	Rationale
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