



Tracking of Maternal Diet from Pregnancy to Postpregnancy: A Systematic Review of Observational Studies

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ABSTRACT

We systematically reviewed studies to examine changes in women's diets from pregnancy to the postpregnancy period and sought to understand the characteristics of women making these changes. From a search of 4 databases and up to November 2019, 17 studies met our inclusion criteria. They reported changes in various dietary aspects. Mixed findings were reported for changes in energy and micronutrient intakes. Most studies reported significant decreases in fruit and vegetable consumption, diet quality, and adherence to a healthier dietary pattern during the transition from pregnancy to postpregnancy, whereas increases in discretionary food and fat intakes were observed. Women with lower education level, lower income, and/or who worked full-time tended to have poorer dietary behaviors postpregnancy. Further research, with better aligned dietary measurement time points during pregnancy and postpartum and standardization of dietary assessment tools, is needed for future studies to be comparable. The systematic review protocol was registered in the PROSPERO International Prospective Register of Systematic Reviews as CRD42020158033. *Curr Dev Nutr* 2020;4:nzaa118.

Keywords: tracking, maternal diet, pregnancy, postpartum, systematic review

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Abbreviations used: NOS, Newcastle–Ottawa quality-assessment scale; PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses; PROSPERO, Prospective Register of Systematic Reviews.

Introduction

Pregnancy and the first few years after delivery are critical periods for maternal and child health. There is clear evidence supporting the short- and long-term health benefits for women to adopt a healthy diet and lifestyle during and following pregnancy (1–3). Nutritional requirements increase during pregnancy to support maternal new tissue growth and metabolism, as well as fetal growth and development. Furthermore, a healthy, energy-balanced diet during pregnancy is essential for achieving appropriate gestational weight gain in order to lower the risk of adverse pregnancy outcomes. Inadequate gestational weight gain increases the risk for low birth weight, whereas excessive gestational weight gain increases the risk for cesarean deliveries, gestational diabetes, and pre-eclampsia for the mother and the risk of large-for-gestational-age, macrosomia, and childhood obesity for the offspring (4).

Following pregnancy, optimal dietary intake during postpartum continues to be important to support the additional nutrient requirements for breastfeeding (5), as well as to reduce postpartum weight retention. Postpregnancy weight retention between pregnancies has been associated with short- and long-term maternal and child health risks,

such as obesity and type 2 diabetes in women with previous gestational diabetes (6, 7), stillbirth, and large-for-gestational-age infants in subsequent pregnancies (8). Maternal diet quality during pregnancy and lactation is inversely associated with infant relative weight and fat mass in early life (9), hence the importance for mothers to maintain healthy dietary behaviors both during and after pregnancy.

Although women's dietary changes before and during pregnancy have been systematically reviewed (10), studies investigating dietary changes during the transition from pregnancy to post-pregnancy have yet to be critically reviewed and synthesized. Motherhood places increasing demands on a mother's time, physique, mental health, and financial resources, all of which may have a significant impact on her eating behaviors (11). Mothers report facing more barriers in maintaining healthy eating patterns during the post-pregnancy period, which can place them at higher risk of being overweight or obese at post-pregnancy and during subsequent pregnancies (12–14).

A review of the literature regarding dietary transitions from pregnancy to postpregnancy can improve our understanding of the dietary changes women make during this period, thus enabling researchers and health professionals to design more effective strategies and public health programs to support women in adhering to healthier dietary

behaviors during the perinatal period and beyond. In this systematic review, we examined the studies that have investigated dietary changes during the transition from pregnancy to postpregnancy from various dietary aspects.

Methods

The systematic review protocol was registered in the International Prospective Register of Systematic Reviews (PROSPERO) as CRD42020158033 (15) and adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (16).

Search strategy and study selection

Studies published in the English language through November 2019 from 4 relevant databases (MEDLINE, EMBASE, Cochrane, and Web of Science) were collected using identified keywords and index terms. These keywords and index terms were divided into 3 groups: 1) Pregnancy/or pregnan*.mp. or maternal.mp. or mother.mp. or Mothers/and, 2) diet.mp. or dietary pattern.mp. or dietary intake.mp. or diet quality.mp. or macronutrient.mp. or micronutrient.mp. or food.mp., and 3) postpartum.mp. or motherhood.mp. The Boolean phrase AND was used between groups and OR within groups. The syntax corresponded to the search for articles that had at least 1 word from each of the groups in their titles or abstracts. No restrictions were applied regarding the date of the publications. Systematic reviews and meta-analyses were included in the search strategy so that the reference lists of relevant reviews could be searched for additional relevant articles. The reference lists of the relevant articles were checked for any additional investigations. Publications found were retrieved and exported to the reference management system EndNote version X8 (Thomson Reuters). The first phase of study identification included an assessment of study inclusion based on the title, abstract, and description/MESH headings. All stages were conducted by 2 independent reviewers. Full texts were retrieved for articles that met the inclusion criteria from the title and abstract. The full article was retrieved for review and data extraction. When in disagreement at any step, a third independent reviewer was consulted to make a decision.

Eligibility criteria

Published original articles with the following characteristics were included in the current study: 1) observational study (cross-sectional, cohort, and case-control), 2) conducted on pregnant women only, and 3) investigated the impact of the transition from pregnancy to postpregnancy (no time restriction) on maternal dietary intake. The following studies were excluded: 1) studies that assessed dietary intake without an analysis of the continuity/stability from pregnancy to postpregnancy; 2) intervention studies; 3) review articles, theses, and dissertations; and 4) studies that had relevant methodological issues.

Data extraction and synthesis

Data extraction was conducted by 1 reviewer and cross-checked by a second independent reviewer for accuracy and consistency. Any discrepancies from the assessment of methodological quality were resolved through discussion and/or consultation with a third reviewer. The following data were extracted: publication details (first author's full name,

publication year, and country in which the study was conducted), study characteristics (cohort, number of participants, dietary assessment method, and data collection time points during pregnancy and postpregnancy); aspects of diet examined, and the reported changes in diet.

Due to the heterogeneity of the studies identified, it was inappropriate to conduct a meta-analysis. A narrative method of analysis was conducted to provide a structured summary and discussion of the characteristics and results of included studies. Study details, participant characteristics, and the reported changes in diet were summarized in tables and compared across studies. For consistency in terminologies, maternal diets examined within 6 mo postdelivery were termed "postpartum diets" and those after 6 mo postdelivery were termed "postpregnancy diets."

Quality assessment

Quality assessment of the studies included in the review was performed using the Newcastle-Ottawa quality-assessment scale (NOS) (17, 18), which is recommended by the Cochrane Collaboration (19). The NOS assigns up to a maximum of 9 stars, based on 3 domains: 1) selection of study groups (4 stars), 2) comparability of groups (2 stars), and 3) ascertainment of outcome (for cohort studies) (3 stars). The higher number of stars attained indicates higher study quality. The total scale score ranges from 0 stars (lowest grade) to 9 stars (highest grade). NOS scores of 0–3, 4–6, and ≥ 7 indicate low, medium, and high quality, respectively. Two reviewers rated the study independently, and discrepancies in the quality assessment were resolved through discussion with a third reviewer until an agreement was reached. No studies were excluded based on quality ratings.

Results

The search results

Our initial search through databases identified 11,147 articles. After the removal of duplicates, 9585 articles remained for the screening of titles and abstracts by 2 independent reviewers. Of these, 9565 articles did not meet the inclusion criteria. Full text was retrieved for the remaining 20 articles, of which 3 were further excluded. Finally, 17 studies met our inclusion criteria and were included in our systematic review. A flow diagram of the search result is illustrated in [Figure 1](#).

Overview of included studies

The included studies ($n = 17$) were published between 1993 and 2019 ([Table 1](#)). Based on the country, 6 articles were from the United States (20–24), 2 were from the United Kingdom (25, 26), 2 were from Sweden (27, 28), 1 was from Canada (29), 2 were from Spain (30, 31), 1 was from Ireland (32), 1 was from Germany (33), 1 was from Australia (34), and 1 was from Singapore (35). Six studies examined changes in energy intakes (21, 24, 29, 32–34), 5 studies examined macronutrient changes (21, 29, 32–34), 5 studies examined changes in micronutrient intakes (26, 28, 29, 34, 36), 4 studies examined changes in intakes of food groups (21, 22, 27, 31), 3 studies examined diet quality (27, 29, 34), 3 studies examined dietary patterns (23, 25, 30), and 2 studies examined maternal food habits (20, 35). Varied dietary assessment methods were used: 10 studies used the FFQ (20–23, 25, 27, 28, 31, 32, 34), 1 used an interview-administered questionnaire (35), 4 used a weighed food

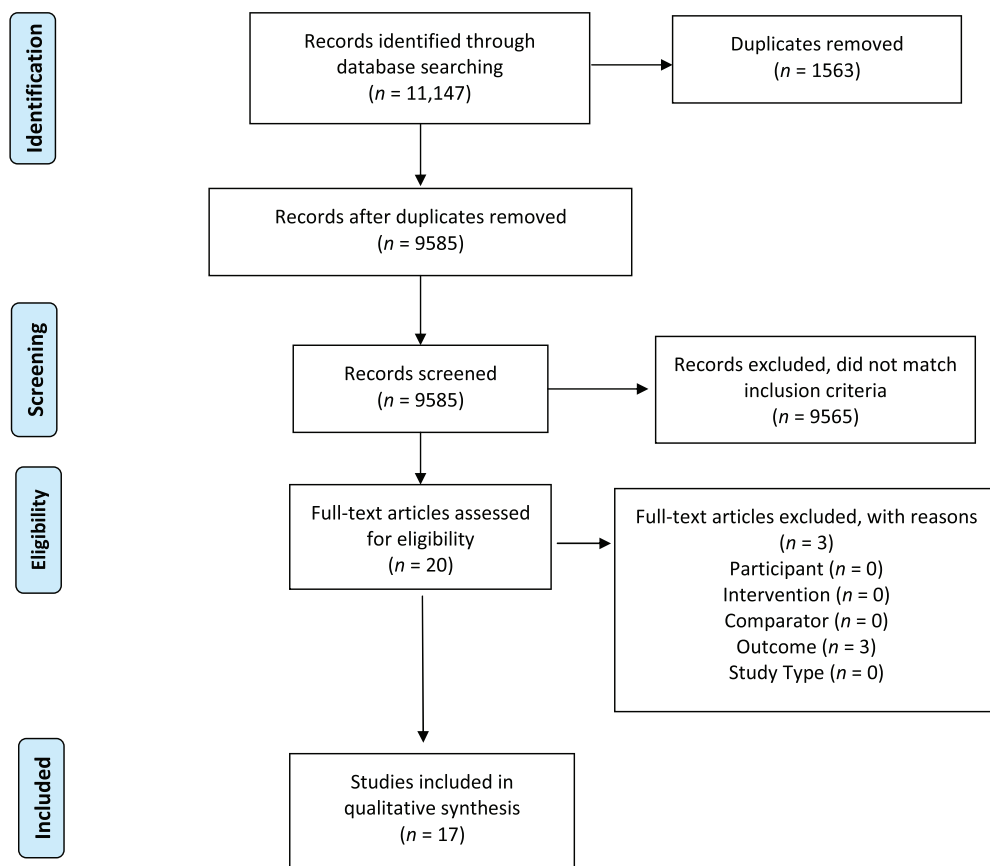


FIGURE 1 PRISMA flow diagram of the study selection process. PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-analyses.

diary (26, 30, 33, 36), and 2 used multiple 24-h recalls (24, 29). The cohort populations ranged from 28 to 8935 women. Variations in dietary intake measurement time points during pregnancy or postpregnancy were observed. Eight studies evaluated maternal diet 3 times (once each trimester) (24, 26–28, 30, 31, 33, 34), 2 studies evaluated maternal diet once throughout the entire pregnancy (21, 22), 2 studies evaluated it during the first trimester (20, 32), 2 studies evaluated it during the second trimester (23, 35), 2 studies evaluated it during the third trimester (25, 29), and 1 study evaluated it during the second and third trimesters (36). Follow-up time points also varied between studies, ranging from 3 wk to 5 y after delivery.

Findings from the systematic review

Changes in dietary intake are reported under the following subheadings: energy intakes, macronutrients, micronutrients, food groups, diet quality, dietary patterns, and food habits. This is to facilitate comparison of findings from individual studies. Characteristics of women making the respective dietary changes are also reported under the relevant subheadings.

Dietary intake changes from pregnancy to postpregnancy

Energy intakes.

Changes in total energy intake from pregnancy to postpregnancy were measured in 6 studies and were found to vary considerably. Talai Rad

et al. (33) reported no significant energy change measured using a 2-d food diary from 32 normal-weight mothers in Germany throughout the course of the pregnancy (2223 ± 356 kcal/d) and at 6 wk postpartum (2017 ± 516 kcal/d). Similarly, Lebrun et al. (29) reported no significant energy change measured using 24-h recalls from 29 Canadian women from the third trimester of pregnancy (2321 ± 429 kcal/d) to 6 mo postpartum (2227 ± 474 kcal/d). Most women were found to have energy intakes below the estimated energy requirement in the third trimester of pregnancy as well as in the postpartum period (29).

Two other studies found decreases in energy intakes in the whole cohort sample from pregnancy to postpregnancy. Murrin et al. (32) observed a decrease in mean energy intake at 5 y postpregnancy (2084.2 kcal/d) compared with the first trimester of pregnancy (2548.1 kcal/d). George et al. (21) reported a decrease in mean energy intake in both lactating and nonlactating low-income women at 6 mo postpartum (2160 kcal/d) compared with during pregnancy (2571 kcal/d). Both studies assessed diet using the FFQ. In contrast, Murphy and Abrams (24) and Moran et al. (34) found increases in energy intake in lactating women from the third trimester to 3–4 mo postpartum, but in nonlactating women, a decrease or no change in energy intake was found, respectively. Dietary assessment methods were different for these 2 studies—1 used 24-h recall (24), whereas the other used FFQ (34).

The variations in energy intake reported between studies from pregnancy to postpartum might be due to sample size differences, the lack

TABLE 1 Summary of studies included in review¹

Study, year (country)	Sample characteristics	Dietary assessment method	When was diet measured during pregnancy?	When was diet measured postpregnancy?	What was measured?	Changes in diet related to energy, macronutrients, and micronutrients	Changes in diet related to food groups, diet quality, dietary pattern, and dietary habits
Berg et al. (36), 2001 (United States)	Sample size, n: 15 Age, y: 21–37 Ethnicity: All Caucasian Education: All completed 12–16 y of education	7-d weighed food diary	2nd, 3rd trimester	4 mo, 6 mo	Micronutrients	During pregnancy vs. postpregnancy ↓ Folate, μg Food (mean \pm SD): 350 \pm 154 vs. 320 \pm 164 Supplements, median (25th, 75th): 905 (400, 1000) vs. 314 (0, 500) ↔ Zinc, mg (food) Mean \pm SD: 13.5 \pm 5.3 vs. 13.1 \pm 5.7 ↓ Zinc, mg (supplements) Median (25th, 75th): 15 (0, 25) vs. 4.3 (0, 13.9) ↓ Vitamin B-12, μg (food) Mean \pm SD: 5.8 \pm 2.3 vs. 4.6 \pm 2.5 ↔ Vitamin B-12, μg (supplements) Median (25th, 75th): 4 (0, 6) vs. 1.7 (0, 6)	—
Chen et al. (35), 2014 (Singapore)	Sample size, n: 1027 Mean age, y: 30.4 (SD = 5.2) Ethnicity: Chinese: 56.5% Malay: 25.5% Indian: 18.0% Education ≤ Primary: 4.3% Secondary or vocational training: 37.1% Pre-university: 24.9% University: 33.7% Prepregnancy BMI, kg/m^2 : <18.5: 12.7% 18.5–24.9: 63.5% 25–29.9: 16.9% ≥30.0: 6.9% SES or similar Monthly household income \$0–1,999: 15.8% \$2,000–3,999: 30.5% \$4,000–5,999: 25.0% ≥\$6,000: 25.7%	Interviewer-administered questionnaire	2nd trimester	3 wk	Dietary habits	Changes in food consumption during pregnancy were quite similar for the 3 ethnic groups. There were more substantial ethnic differences in dietary changes during the postpartum period: 1. More Chinese participants increased their ginger consumption vs. Indian and Malay participants. 2. Half of the Malay participants decreased their eggs and beef consumption vs. less than one-third of the Chinese and Indian participants	Changes in food consumption during pregnancy were quite similar for the 3 ethnic groups. There were more substantial ethnic differences in dietary changes during the postpartum period: 1. More Chinese participants increased their ginger consumption vs. Indian and Malay participants. 2. Half of the Malay participants decreased their eggs and beef consumption vs. less than one-third of the Chinese and Indian participants

(Continued)

TABLE 1 (Continued)

Study, year (country)	Sample characteristics	Dietary assessment method	When was diet measured during pregnancy?	When was diet measured postpregnancy?	What was measured?	Changes in diet related to energy, macronutrients, and micronutrients	Changes in diet related to food groups, diet quality, dietary pattern, and dietary habits
Cuco et al. (30), 2006 (Spain)	Sample size, n: 80 Mean age, y: 29 (range: 24–35) Education Primary: 22.5% Secondary and vocational training: 40% University: 37.5% Pre-pregnancy BMI, kg/m ² <20: 6.3% 20–25: 70% 25–30: 20% >30: 3.8%	7-d weighed food diary	1st, 2nd, 3rd trimester	6 mo	Dietary pattern	—	The “sweetened beverages and sugars” pattern was consistently observed from preconception to 6 mo postpartum, and the “vegetables and meat” pattern was only observed during pregnancy. Patterns did not alter significantly over time
Derbyshire et al. (26), 2009 (United Kingdom)	Sample size, n: 42 Mean age, y: 33.2 (SD = 4.55; range: 19–40) Ethnicity: All Caucasian Pre-pregnancy BMI, kg/m ² Mean ± SD = 23.5 ± 3.99 SES or similar :88% in Social Economic Classification groups 1–3	4- to 7-d weighed food diary	1st, 2nd, 3rd trimester	6 wk	Micronutrients	↔ For all micronutrients Sodium intakes above recommended level throughout study period Folate, iron, vitamin D, potassium, iodine, and selenium significantly below recommended level throughout study period	—
George et al. (21), 2005 (United States)	Sample size, n: 149 Age, y Range: 18–37, Median: 22 Ethnicity African American: 23.5% Caucasian: 30.2% Hispanic: 46.3% Education ≤Partial high school: 40.3% High school graduate: 35.6% ≥Partial college: 24.2% Prepregnancy BMI, kg/m ² : Mean ± SD = 26.1 ± 0.5 SES or similar Income ≤185% of the Federal Poverty Guidelines Parity :≤2–75.2% >2–24.8%	FFQ	Once throughout entire pregnancy	6 mo	Energy, macronutrients, food groups	During pregnancy vs. postpregnancy ↓ Energy, kcal: 2571 vs. 2160 ↑ Fat, E%: 37.3 vs. 38.4 ↑ Added sugar, E%: 14.4 vs. 16.4	During pregnancy vs. postpregnancy ↓ Mean daily servings for grains: 7.4 vs. 6.2 ↓ Mean daily servings for vegetables: 2.5 vs. 2.0 ↓ Mean daily servings for fruit: 3.4 vs. 1.7 ↔ Dairy intake (servings unknown)

(Continued)

TABLE 1 (Continued)

Study, year (country)	Sample characteristics	Dietary assessment method	When was diet measured during pregnancy?	When was diet measured postpregnancy?	What was measured?	Changes in diet related to energy, macronutrients, and micronutrients	Changes in diet related to food groups, diet quality, dietary pattern, and dietary habits
Jardi et al. (31), 2019 (Spain)	Sample size, n: 793 Mean age, y: 30.5 (SD = 4.9) Ethnicity: Country of origin, Spain 84.1% Education Primary: 31.4% Secondary: 40.9% University: 27.7% Pregnancy BMI, kg/m ² Mean ± SD = 24.8 ± 4.5 SES or similar Social class Low: 16% Middle: 68.3% High: 15.6% Parity Primipara: 37.5%	FFQ	1st, 2nd, 3rd trimester	40 d	Food groups	—	During pregnancy vs. postpregnancy ↓ Fruits, g/d Median (IQR): 221.4 (159.5) vs. 189 (189.3) ↓ Vegetables, g/d Median (IQR): 75.7 (46.9) vs. 71.4 (45.4) ↓ Salted and sweet cereals, g/d Median (IQR): 117.4 (27) vs. 116.4 (58.5)
Lebrun et al. (29), 2019 (Canada)	Sample size, n: 28 Mean age, y: 32.7 (SD = 3.6) Ethnicity: All Caucasian Education College: 7% University: 93% Pregnancy BMI, kg/m ² Mean ± SD = 24.9 ± 5.1 Normal weight: 64% Overweight: 21% Obese: 14% SES or similar Household income <\$60,000: 14% \$60,000–\$79,999: 18% \$80,000–\$99,999: 36% >\$100,000: 32% Parity Primiparous: 43%	24-h recall	3rd trimester	3 mo, 6 mo	Energy, macronutrients, micronutrients, diet quality	3rd trimester vs. 3 mo postpregnancy vs. 6 mo postpregnancy ↔ Energy, kcal/d Mean ± SD: 2321 ± 429 vs. 2305 ± 506 vs. 2227 ± 474 ↔ Carbohydrate (E%) Mean ± SD: 47 ± 5.9 vs. 44.8 ± 6.1 vs. 45.3 ± 5.9 ↔ Protein (E%) Mean ± SD: 17.5 ± 2.8 vs. 17.1 ± 2.8 vs. 16.9 ± 3.2 ↔ Total fat (E%) Mean ± SD: 35.5 ± 5 vs. 36.6 ± 4.6 vs. 36.3 ± 4.7 ↔ Saturated fatty acids (E%) Mean ± SD: 13.6 ± 2.1 vs. 12.9 ± 1.6 vs. 13.0 ± 2.7 ↑ Number of participants exceeding AMDR for fat at 6 m postpartum (64%) vs. 3rd trimester (57%)	↓ Total diet quality score over time, mean ± SD: 64.1 ± 12.2 to 60.5 ± 8.3 ↓ Total vegetables and fruits subscore over time, mean ± SD: 8.2 ± 2.0 to 6.9 ± 2.4
							↓ Intake for important micronutrients, vitamin A, vitamin C, vitamin D, calcium, iron, zinc, thiamin, riboflavin, niacin, and pantothenic acid (food and supplement sources) at 3 and 6 mo postpregnancy vs. 3rd trimester > 79% of women had intake of sodium above the upper limit throughout study period

(Continued)

TABLE 1 (Continued)

Study, year (country)	Sample characteristics	Dietary assessment method	When was diet measured during pregnancy?	When was diet measured postpregnancy?	What was measured?	Changes in diet related to energy, macronutrients, and micronutrients	Changes in diet related to food groups, diet quality, dietary pattern, and dietary habits
Lundqvist et al. (28), 2016 (Sweden)	Sample size, n: 184 Mean age, y: 31 (SD = 4.4); range: 21–42 Ethnicity Swedish: 93.5% Education University: 59.4% Prepregnancy BMI, kg/m ² : Mean ± SD 24.1 ± 3.8 Parity Nullipara: 62.2% Multipara: 37.8%	FFQ	1st, 2nd, 3rd trimester	3 mo, 7 mo	Micronutrients	↔ Vitamin D from food, µg/d (mean ± SD) 12 weeks of gestation: 5.1 ± 1.9 21 weeks of gestation: 5.0 ± 2.0 35 weeks of gestation: 4.9 ± 1.8 3 mo postpregnancy: 5.4 ± 2.1 7 mo postpregnancy: 5.3 ± 2.4 ↔ Vitamin D from supplements, µg/d (mean ± SD) 12 weeks of gestation: 12.5 ± 1.7 21 weeks of gestation: 12.5 ± 1.9 35 weeks of gestation: 12.6 ± 1.6 3 mo postpregnancy: 13.3 ± 1.9 7 mo postpregnancy: 13.7 ± 3.1 (Values not reported)	—
Moran et al. (34), 2013 (Australia)	Sample size, n: 291 Mean age, y: 30.5 (SD = 5.0) <20: 1% 20–30: 42.6% 30–40: 52.9% ≥40: 3.4% Ethnicity Caucasian: 92.5% Asian: 3.7% African: 1% Aboriginal: 1.4% Others: 1.4% Prepregnancy BMI, kg/m ² Overweight: 46.7% Obesity I: 29.9% Obesity II: 14.4% Obesity III: 8.9% SES or similar Socioeconomic indexes for areas 27.5% of cohort at bottom 20%	FFQ	1st, 2nd, 3rd trimester	4 mo	Energy, macronutrients, micronutrients, diet quality	↔ Energy at 4 mo postpregnancy vs. 3rd trimester (nonlactating women) ↔ Protein and fat intake at 4 mo postpregnancy vs. 3rd trimester (nonlactating women) ↑ Energy at 4 mo postpregnancy vs. 3rd trimester (lactating women) ↑ Protein and fat intake at 4 mo postpregnancy vs. 3rd trimester (lactating women) ↓ Calcium, iron, zinc, vitamin A equivalents, vitamin B-6, and vitamin C (food and supplement sources) at 4 mo postpregnancy vs. 3rd trimester	↓ Diet quality significantly across pregnancy and postpregnancy Decreasing trend, mean ± SD: 56.7 ± 10.1 to 53.3 ± 12.7
Murphy and Abrams (24), 1993 (United States)	Sample size, n: 528 Age, y Range 19–50	24-h recall	1st, 2nd, 3rd trimester	3 mo, >3 mo	Energy	3rd trimester vs. 3 mo postpregnancy ↓ Energy, kcal/d (nonlactating): 1818 vs. 1558 ↑ Energy, kcal/d (lactating): 1818 vs. 1914	—

(Continued)

TABLE 1 (Continued)

Study, year (country)	Sample characteristics	Dietary assessment method	When was diet measured during pregnancy?	When was diet measured postpregnancy?	What was measured?	Changes in diet related to energy, macronutrients, and micronutrients	Changes in diet related to food groups, diet quality, dietary pattern, and dietary habits
Murrin et al. (32), 2013 (Ireland)	Sample size, n: 585	FFQ	1st trimester	5 y	Energy, macronutrients	1st trimester vs. 5 y postpregnancy, mean \pm SD ↓ Energy, kcal/d 2548.1 \pm 1239.3 vs. 2084.2 \pm 717.7 ↓ Carbohydrate, E% 50.4 \pm 7.9 vs. 49 \pm 6.9 ↓ Saturated fatty acid, E% 13.8 \pm 13.8 vs. 11.7 \pm 11.7 ↑ Protein, E% 17.1 \pm 3.9 vs. 18.1 \pm 3.4 ↑ Starch, E% 26.9 \pm 26.9 vs. 28.0 \pm 28.0	
Northstone and Emmett (25), 2008 (United Kingdom)	Sample size, n: 8935 Age, y <20: 2.6% 20–29: 54.8% ≥30: 42.6% Ethnicity Caucasian: 98.3% Education beyond 16y: 39.2% SES or similar Owned or mortgaged: 80.2% Parity 0: 45.9% ≥1: 54.1%	FFQ	3rd trimester	4 y	Dietary pattern	—	Four dietary patterns, both at 32 weeks of gestation and at 4 y postpregnancy: “health conscious,” “processed,” “confectionery,” and “vegetarian.” The “traditional” dietary pattern only at 3rd trimester, but not at postpartum A decreased adherence to the “health conscious” dietary pattern and greater adherence to the “processed” and “vegetarian” dietary pattern ↓ Proportion consuming \geq 3 fruits and vegetables, eating breakfast every day, and drinking \geq 2 cups of milk per day at 6 mo postpregnancy vs. during pregnancy and then \downarrow gradually after 6 mo postpregnancy
Olson (20), 2005 (United States)	Sample size, n: 360 Age, y <20: 2.2% 20–29: 49.2% 30–39: 46.4% ≥40: 2.2% Ethnicity Caucasian: 96% Education <High school: 3.1% High school graduate: 25.6% Post high school and above: 71.4% SES or similar Higher family income: 65.9% Parity 0: 44.6% ≥1: 55.4%	FFQ	1st trimester	6 mo, 1 and 2 y	Dietary habits	—	

(Continued)

TABLE 1 (Continued)

Study, year (country)	Sample characteristics	Dietary assessment method	When was diet measured during pregnancy?	When was diet measured postpregnancy?	What was measured?	Changes in diet related to energy, macronutrients, and micronutrients	Changes in diet related to food groups, diet quality, dietary pattern, and dietary habits
Sotres-Alvarez et al. (23), 2013 (United States)	Sample size, n: 571, 545, and 424	FFQ	2nd trimester	3 and 12 mo	Dietary pattern	—	Women were most likely to stay in "prudent" and "Western" than "health conscious Western" from 2nd trimester to 1 y postpregnancy
Talaj Rad et al. (33), 2011 (Germany)	Sample size, n: 32 Mean age, y: 29.6 (SD = 4.5) Education University: 38% Completed apprenticeship: 53% Not finished or not reported: 9% Pregnancy BMI, kg/m ² Mean ± SD = 22.4 ± 2.5 Parity Primiparae: 69% Secundi- or multiparae: 31%	2-d weighed food diary	1st, 2nd, 3rd trimester	6 wk	Energy, macronutrients	3rd trimester vs. 6 wk postpregnancy, mean ± SD ↔ Energy, kcal/d 2223 ± 356 vs. 2017 ± 516 ↓ Carbohydrate, g/d 286 ± 68 vs. 239 ± 72 ↔ Protein (values not reported) ↔ Fat (values not reported) Fat intake (35.8%) throughout study period slightly above the recommended 30–35%	—
Tovar et al. (22), 2019 (United States)	Sample size, n: 847 Mean age, y: 29.4 Ethnicity Caucasian: 84.5% Education College graduate or more: 83.1%	FFQ	Once throughout entire pregnancy	4 mo	Food groups	—	15% of women reduced vegetable intake. 44% of women did not meet recommendations during pregnancy and the postpregnancy period; 28% met recommendations at both time points
Wennberg et al. (27), 2016 (Sweden)	Sample size, n: 161 Mean age, y: 30.5 (SD = 4.2) Ethnicity Swedish: 100% Education Basic: 0.6% High school: 39.4% University: 60% Pregnancy BMI, kg/m ² Mean ± SD = 24.1 ± 3.8 SES or similar Employment Housewife or student: 7.4% Unemployed: 4.3% Temporary post: 15.6% Permanent post: 7.7%	FFQ	1st, 2nd, 3rd trimester	3 mo, 6 mo	Food groups, diet quality	—	During pregnancy to postpregnancy ↑ Frequency of discretionary food intake, median (Q1–Q3) 1.14 (0.84–1.78) to 1.56 (1.06–2.05) ↓ Frequency of fruit and vegetables intake, median (Q1–Q3) 2.93 (1.92–3.86) to 2.21 (1.36–3.07) ↓ Total index score at 3 mo postpregnancy vs. 3rd trimester (score not reported)

¹Information not reported is not tabulated. AMDR, acceptable macronutrient distribution range; SES, socioeconomic status; ↑, increase; ↓, decrease; ↔, no change.

of consistency in the dietary assessment methods, and different population demographics. The studies by Talai Rad et al. (33) and Lebrun et al. (29) had small sample sizes ($n = 28\text{--}32$) and consisted of healthy women of normal weight. In contrast, the studies by George et al. (21) and Moran et al. (34) consisted of women of lower socioeconomic status and had a larger proportion of overweight/obese women. Because individuals who are overweight/obese, older, and belong to lower socioeconomic groups are more likely to underreport their energy intakes or report implausible energy intakes (37–40), these may also have influenced the mean energy intake reported in the studies.

The difference in dietary assessment methods may have contributed to the difference in findings. Talai Rad et al. (33) and Lebrun et al. (29) used methods that measured short-term intakes and did not take into account the day-to-day variation. Therefore, energy intake could be underestimated. Murrin et al. (32) and George et al. (21) used FFQ, which was used to estimate long-term usual intakes of food retrospectively. These may explain the discrepancies in findings to some extent, although this was not always consistent, as demonstrated by the findings of Murphy and Abrams (24) and Moran et al. (34).

Macronutrients.

Macronutrient intake was reported in 5 studies, with minimal similar changes in intake reported. Talai Rad et al. (33) reported a decrease in absolute carbohydrate intake at 6 wk postpartum compared with the 3rd trimester, whereas absolute total fat and protein intakes remained constant throughout pregnancy and postpartum. However, when expressed as a proportion of energy, total fat intake (35.8%) was slightly above the recommended level given by the German Nutrition Society (30–35%) from early pregnancy to 6 wk after delivery. Similarly, Lebrun et al. (29) also reported an increased number of participants exceeding the acceptable macronutrient distribution range for total fat intake as percentages of energy intake at 6 mo postpartum (64%) compared with the third trimester (57%). Also, Moran et al. (34) reported an increase in absolute protein and fat intake at 4 mo postpartum compared with the third trimester, but only for lactating women. George et al. (21) reported an increase in the percentage of energy from total fat (38.4% compared with 37.3%) and added sugar (16.4% compared with 14.4%) at 6 mo postpartum compared with pregnancy in low-income women. In contrast to the previously mentioned studies, Murrin et al. (32) reported a decrease in absolute carbohydrate and saturated fatty acid intake with an increase in absolute protein intake at 5 y postpregnancy compared with the first trimester.

In general, there appeared to be a common trend of higher total fat intake, measured as absolute intake or as percentage of energy, within 6 mo postpartum compared with during pregnancy, regardless of socioeconomic status. The majority of women in the studies by George et al. (21) and Moran et al. (34) were from socioeconomically disadvantaged groups, whereas those in the study by Lebrun et al. (29) were from high socioeconomic groups. However, no consistent patterns in protein and carbohydrate intakes were observed.

The comparisons of results across studies is challenging because some studies expressed macronutrient intake as percentage of energy (21, 29, 33), whereas some studies expressed it in absolute values (32, 34). Because energy requirements and intakes vary during pregnancy and postpregnancy (41–43), adjusting for energy and presenting the percentage contribution of energy from macronutrients would allow

macronutrient intakes to be comparable between studies. This may be an important aspect to focus on in future research.

Micronutrients.

Five studies reported data on changes in micronutrient intake with mixed findings. A small cohort study of 42 UK women by Derbyshire et al. (26) measured habitual micronutrient intakes from food sources only at weeks 13, 25, and 35 of pregnancy and 6 wk postpartum using a 4- to 7-d weighed food diary and compared them with the UK dietary guidelines. This study found no statistically significant differences in mean micronutrient intakes across the 3 trimesters of gestation and postpartum. However, it was noted that dietary vitamin D, potassium, iodine, and selenium intakes were below national dietary guidelines.

Similarly, a longitudinal cohort study of 184 Swedish women by Lundqvist et al. (28) found that the estimated intake of vitamin D from food was similar from pregnancy to 7 mo postpartum (mean intakes ranged between 4.9 and 5.4 $\mu\text{g}/\text{d}$). Intakes of vitamin D from supplements did not vary during the study period.

In contrast, 3 studies (29, 34, 36) reported decreases in several important micronutrients found in both dietary and supplement sources, from the third trimester to 4–6 mo postpartum. Moran et al. (34) reported decreases in calcium, iron, zinc, vitamin A, and vitamin C intakes from food and supplement sources in 301 overweight and obese Australian women. Similarly, Lebrun et al. (29) reported decreases in calcium, iron, zinc, vitamin A, and vitamin C intakes from food and supplement sources in 29 Canadian women. Berg et al. (36) found that the total folate intake (food and supplement sources) was lower at postpartum than during pregnancy in 15 well-educated American women. Zinc intake from food was similar during pregnancy and postpartum, but zinc supplemental intake was lower at postpartum (36). Vitamin B-12 intake from food only was lower at postpartum than during pregnancy (36).

Assessment of dietary intakes of nutrients in various populations has highlighted that pregnant women appear to have difficulty meeting their micronutrient requirements through diet (44, 45); thus, supplementation is often recommended during pregnancy. However, few population studies have considered both food sources and supplements in assessing the adequacy of nutrient intake (46). As seen in studies by Derbyshire et al. (26) and Lundqvist et al. (28), micronutrients from food sources alone did not change during pregnancy and postpregnancy. Instead, studies examining micronutrients from food and supplements showed decreases, regardless of dietary assessment methods used. Overall, this demonstrates the importance of examining nutrient intakes from both dietary sources and supplements in this population so as to identify potential problems arising from inadequate or excessive nutrient intake and to evaluate current supplementation guidelines.

The majority of the studies examining micronutrient intakes had small sample sizes (ranging from 15 to 184), and the women were mostly of high socioeconomic status (26, 28, 29, 36). Given the small sample sizes and the fact that participants were generally from higher socioeconomic groups, the results may not be representative of individuals from lower social groups.

Food groups.

Four studies reported data on changes in the intakes of food groups from pregnancy to postpartum via FFQ. In a cohort of 149 low-income

women, George et al. (21) examined food intakes during pregnancy and the first 6 mo postpartum. Compared with pregnancy, there was a decrease in mean daily servings of grains (7.4 compared with 6.2), vegetables (2.5 compared with 2.0), and fruit (3.4 compared with 1.7) at 6 mo postpartum, but no significant change in dairy consumption. Similarly, Wennberg et al. (27) reported a significant decrease in the frequency of fruit and vegetable intake and an increase in frequency of energy-dense, nutrient-poor foods such as salty snacks, sweets, and processed meat products at 6 mo postpartum compared with during pregnancy. A prospective cohort study from Spain by Jardí et al. (31) also reported that fruits and vegetable intake at 40 d postpartum was significantly lower than during pregnancy. Intakes of salted (i.e., flour, pasta, rice, bread, and potatoes) and sweet cereals (i.e., sweetened breakfast cereals, biscuits, and baked goods) were significantly lower postpartum than during pregnancy (31). It was found that less educated women tend to have a lower intake of dairy products and salted cereals and a higher intake of sweetened beverages postpartum compared with during pregnancy (31).

Tovar et al. (22) found that almost half of the women in their study did not meet vegetable recommendations during pregnancy and at 4 mo postpartum. Of the women who consumed recommended servings of vegetables during pregnancy, 15% did not meet the recommendations at 4 mo postpartum. Women who reduced their vegetable intake postpregnancy compared with during pregnancy were more likely to have lower income or work full-time. This study consisted of predominately white and educated individuals. In general, it appeared that fruit and vegetable intakes decreased in the postpartum period compared with during pregnancy regardless of socioeconomic status and education attainment.

Diet quality.

Three studies tracked diet quality from pregnancy to postpartum. All 3 studies used a priori measures of diet quality, which were based on predefined scores for each food relative to nutritional recommendations, and a total score was subsequently calculated (47). Wennberg et al. (27) assessed the diets of 163 Swedish women once per trimester during pregnancy (weeks 10–12, 19–23, and 36–38) and at 3 and 6 mo postpartum using the FFQ. The Swedish National Food Agency food index was used to assess the healthiness of their diets. Overall, for all time points, the median score was 4 out of a maximum score of 12, indicating a poor-quality diet. There was a significant decrease in the total index score at 3 mo postpartum compared with weeks 36–38 of gestation. Similarly, in a prospective cohort study of 301 overweight and obese Australian women by Moran et al. (34), diet quality, assessed using the 2005 Healthy Eating Index, was poor throughout pregnancy (10–20, 28, and 36 weeks of gestation) and decreased further at 4 mo postpartum.

Another prospective cohort study of 29 Canadian women by Lebrun et al. (29) found that although the Canadian Healthy Eating Index mean scores were not statistically different between the third trimester of pregnancy and 6 mo postpartum, a decreasing trend was observed (mean score: 64.1 ± 12.2 to 60.5 ± 8.3). This was likely driven by a significant decrease in the total vegetables and fruits subscore.

These diet-quality indices differ widely with regard to the number of food groups included, cutoff values, and scoring systems according to country-specific national dietary guidelines and contributions of specific components to the overall score (48, 49). However, in general, it

appeared that regardless of the indices used, overall maternal diet quality decreased during the transition from pregnancy to postpartum.

Dietary pattern.

Three studies analyzed dietary patterns longitudinally from pregnancy to postpregnancy. Two studies (25, 30) used principal component analysis to examine tracking of maternal dietary patterns, which is a posteriori or empirical approach driven by the underlying dietary data (50). The third study (23) used the latent transition model to analyze maternal dietary patterns.

Cuco et al. (30) examined maternal dietary intake via 7-d dietary record at preconception, 6, 10, 26, and 36 weeks of gestation, and 6 mo postpartum, whereas Northstone and Emmett (25) examined maternal dietary intake via FFQ at 2 time points—32 weeks of gestation and 4 y postpregnancy. Cuco et al. identified 2 dietary patterns—“sweetened beverages and sugars” and “vegetables and meat”—but only the “sweetened beverages and sugars” pattern was consistently observed from preconception to postpartum (30). Although there were slightly different patterns at each time point, it was concluded that the dietary patterns do not change significantly before, during, and after pregnancy. Northstone and Emmett identified 4 dietary patterns, both at 32 weeks of gestation and at 4 y postpregnancy: “health conscious,” “processed,” “confectionery,” and “vegetarian.” The “traditional” dietary pattern was observed at 32 weeks of gestation but not at postpregnancy. During the 4-y postpregnancy follow-up period, there was a decrease in adherence to the “health conscious” dietary pattern and greater adherence to the “processed” and “vegetarian” dietary pattern.

In the third study, Sotres-Alvarez et al. (23) examined dietary pattern changes in women from the second trimester of pregnancy to 3 and 12 mo postdelivery. Three mutually exclusive dietary pattern classes (“prudent,” “health conscious Western,” and “Western”) were identified. Generally, women were most likely to stay in the “prudent” and “Western” classes than “health conscious Western” from the second trimester to 1 y postdelivery. Breastfeeding women were more likely to switch to a healthier dietary pattern class than were non-breastfeeding mothers from the second trimester to 1 y postdelivery. In general, it appeared that mothers adhered less to a healthier dietary pattern at postpregnancy compared with during pregnancy.

Food habits.

Two studies examined maternal food habits during pregnancy and postpregnancy compared with prepregnancy. In a prospective cohort of 360 healthy adult women from the United States, Olson (20) analyzed the patterns in selected food habits (fruit and vegetable consumption, milk drinking, and eating breakfast daily) of mothers transitioning from prepregnancy to pregnancy and then to 2 y postpregnancy using FFQ. Overall, there was a significant increase in the proportion of women having more positive behaviors during pregnancy compared with prepregnancy—for example, drinking ≥ 2 cups of milk per day, consuming ≥ 3 servings of fruits and vegetables per day, and eating breakfast every day. The proportion of women with these positive behaviors dramatically decreased at 6 mo postpartum and then decreased more gradually after 6 mo postpartum. Mothers with higher income were more likely to consume ≥ 3 servings of fruits and vegetables per day during pregnancy and up to 2 y postpregnancy compared with mothers with lower income (20).

In a large cohort of women ($n = 1027$) of Chinese, Malay, and Indian ethnicity from Singapore who participated in the Growing Up in Singapore Towards Healthy Outcomes study, Chen et al. (35) assessed changes in food consumption during pregnancy (26–28 weeks of gestation) and the postpartum period (3 wk after delivery) compared with the usual prepregnancy diet using interviewer-administered questionnaires. Changes in food consumption during pregnancy were quite similar for the 3 ethnic groups. However, there were more substantial ethnic changes in dietary intake during the postpartum period. During postpartum, more Chinese participants increased their ginger consumption compared with the Indian and Malay participants, and half of the Malay participants decreased their eggs and beef consumption compared with less than one-third of the Chinese and Indian participants. These dietary changes observed in postpartum were likely due to the beliefs and practices of following confinement diets, which have been known to be prevalent in Asian populations (51–53). This suggests that cultural influences may also play an important role in determining changes in postpregnancy diets.

From the study by Chen et al. (35), it was found that overweight women [pregnancy BMI (in kg/m^2) ≥ 25.0] were more likely to reduce their intakes of meat and eggs during pregnancy and to increase their garlic and plain water intake in the postpartum period compared with prepregnancy. On the other hand, non-overweight women were more likely to increase their chicken, eggs, and oil intake in the postpartum period compared with prepregnancy (35).

Risk of bias assessment

The scores ranged from 5 to 7. Out of the 9 possible stars that could be scored with the NOS, 3 studies scored 7 (17.6%), 11 studies scored 6 (64.7%), and 3 studies scored 5 (17.6%). Despite the relatively low number of articles meeting the inclusion criteria, a majority of the articles were of fair quality according to the NOS. Low scores were partly due to missing descriptive information regarding the study cohort; hence, the representativeness of the study cohort in the community was unclear. Other studies with lower scores lacked clear reporting of the number of and/or reasons for dropouts and withdrawals. Description and comparison of the characteristics between those lost to follow-up and those included in the final sample were not clearly stated in low-quality-scoring studies. In addition, none of the studies earned a star for comparability with regard to important factors for adjustment. All of the studies used valid dietary assessment tools, and the outcomes were assessed independently. According to the aim of this systematic review, the follow-up period for all studies was adequate for the outcome assessed. **Table 2** provides a complete breakdown of quality assessment.

Discussion

To our knowledge, this is the first study to systematically review and summarize the current existing literature from published observational studies tracking maternal dietary consumption from pregnancy to postpregnancy through several approaches, including total energy intake, macronutrients, micronutrients, food groups, dietary indices, and a whole-diet approach (54). In addition, this study reviewed the characteristics of women who were more likely to make these changes.

Overall, the review findings suggest that some dietary changes were made during the transition from pregnancy to postpregnancy. Changes in energy intake were found to vary considerably between studies; however, there is a general trend toward a significant increase in energy intake in lactating women 3–4 mo postpartum compared with the third trimester. This was expected because lactation is the period when the mother has increased nutritional requirements to produce milk to feed her infant, as well as to compensate for the nutrient loss during pregnancy and childbirth and to aid in recovery (55).

The small body of evidence for the tracking of micronutrient intake suggests that maternal micronutrient intake does not change in the early weeks of postpartum but starts to decrease after 3 mo postpartum from both food and supplement sources. Similarly, previous studies examining maternal dietary intake throughout pregnancy and in the early weeks of postpartum have reported women not achieving the recommended intake of several key micronutrients, such as folate and vitamin D (56–59). However, longitudinal cohort studies assessing micronutrient intakes with a longer follow-up are lacking. Also, when comparing data between studies, it is important to note that some studies have included supplement sources in their published analyses, which may account for higher micronutrient intakes.

The most consistent finding was a decrease in fruit and vegetable intake as well as an increase in energy-dense, nutrient-poor food in the postpartum period. Consumption was below the levels recommended by the national Dietary Guidelines during pregnancy and remained poor during the postpartum period. Similar results were found in randomized controlled trials and cross-sectional studies, with mothers not meeting recommended intake levels at different time points in the postpartum period, particularly for fruits and vegetables (56, 60–64). From this review, it was found that diet quality was also poor in pregnancy and continued to be suboptimal during the postpartum period. This finding is similar to those of a previous randomized controlled trial (65) and a cross-sectional study (66), which showed diet quality to be suboptimal for women during the postpartum period. In parallel, the transition from pregnancy to postpartum was associated with a shift in maternal dietary patterns from a healthy one to a less healthy one.

The variation in dietary intake changes reported during and after pregnancy in the reviewed studies may be the result of many other factors. Nutrition knowledge and knowledge of dietary guidelines may play a role, with lower educated and younger age groups being less aware of and having less adherence to nutritional recommendations (67–70). Also, country-specific dietary recommendations and normative standards of dietary intake may contribute to this variation.

Taken together, the evidence suggests that transition from pregnancy to motherhood is generally associated with poorer dietary statuses, likely stemming from poor dietary behaviors such as the progressive increase in intake of energy-dense, nutrient-poor food and a decline in the consumption of healthy food. Although an improvement in dietary behaviors during pregnancy was commonly reported, these healthy habits acquired during the prenatal period tend to be less adhered to after delivery (13, 20, 21, 27, 61, 65), highlighting the need to reinforce the importance of postpregnancy nutrition to new mothers.

Strengths and limitations

The current systematic review has several limitations. Generally, the included studies are heterogeneous with regard to the instruments used

TABLE 2 Quality assessment of included observational studies using the Newcastle–Ottawa Scale

Study and year ¹	Selection			Demonstration that outcome of interest was not present at start of study	Comparability of cohorts on the basis of the design or analysis	Outcome		Total score
	Representativeness of the exposed cohort ²	Selection of the non-exposed cohort ³	Ascertainment of exposure ⁴			Assessment of outcome ⁵	Was follow-up long enough for outcomes to occur?	
Berg et al. (36), 2001	—	*	*	*	—	*	*	***** (5)
Chen et al. (35), 2014	*	*	*	*	—	*	*	***** (7)
Cuco et al. 2006 (30)	—	*	*	*	—	*	*	***** (6)
Derbyshire et al. (26), 2009	—	*	*	*	—	*	*	***** (6)
George et al. (21), 2005	—	*	*	*	—	*	*	***** (6)
Jardí et al. (31), 2019	*	*	*	*	—	*	*	***** (6)
Lebrun et al. (29), 2019	—	*	*	*	—	*	*	***** (5)
Lundqvist et al. (28), 2016	*	*	*	*	—	*	*	***** (7)
Moran et al. (34), 2013	—	*	*	*	—	*	*	***** (6)
Murphy and Abrams (24), 1993	*	*	*	*	—	*	*	***** (6)
Murrin et al. (32), 2013	*	*	*	*	—	*	*	***** (6)
Northstone and Emmet (25), 2008	*	*	*	*	—	*	*	***** (6)
Olson (20), 2005	*	*	*	*	—	*	*	***** (7)
Sotres-Alvarez et al. (23), 2013	—	*	*	*	—	*	*	***** (6)
Talari Rad et al. (33), 2011	—	*	*	*	—	*	*	***** (6)
Tovar et al. (22), 2019	*	*	*	*	—	*	*	***** (6)
Wennberg et al. (27), 2016	—	*	*	*	—	*	*	***** (5)

¹A study can be awarded a maximum of 1 star for each category and a maximum of 2 stars for comparability.

²One star was assigned if the cohort was truly or somewhat representative of a community-/population-based study. No star was assigned if the study population was sampled from a special population—that is, a population from a company, hospital patients, data from the health insurance company or health examination organization, nurses, etc.

³One star was assigned if drawn from the same community as the exposed cohort.

⁴Star assigned where diets were assessed using validated FFO, 24-h recalls, or multiple-day food record.

⁵Star assigned where it was an independent-blind assessment.

⁶Star assigned where follow-up rate was > 80% or the description of those lost suggested no different from those followed.

to assess dietary intake, with some studies using dietary recall methods and others using FFQs. These instruments are subject to a number of limitations, including respondents' recall burden and inherent bias related to self-reporting or ability to accurately recall, describe, and quantify their intakes (71, 72). This may play a role and contribute to differences in women's dietary intake changes reported during pregnancy to postpartum. The effect of this measurement error is greatest on macro- and micronutrient intakes but also, to a lesser extent, on food group intakes (73).

There was also great variability in reported time frames and dietary outcome measures. The diversity of dietary collection time points during pregnancy and postpartum may be an issue because it has been shown that women may make changes to their dietary intake at different time points throughout pregnancy (59, 74) and at different periods during postpregnancy (66). Differences in sample size among studies might have influenced the results as well. The previously mentioned factors need to be taken into consideration when making comparisons. These differences meant that the pooling of data for meta-analysis was not possible. Further research is needed to derive conclusive findings. Another limitation is that our search strategy only located published studies in English in peer-reviewed journals.

This study also has several strengths. It is acknowledged that observational studies can be greatly influenced by confounding factors, such as socioeconomic status and lifestyle-related variables, that could vary between different cultures and countries. These factors were taken into account when comparing results between observational studies to minimize confounding bias.

To the best of our knowledge, this is the first systematic review that critically evaluated studies that track dietary intakes from pregnancy to postpregnancy. This study included different measures of dietary intakes from various countries, thus allowing evaluation of diet from different aspects. It also offered a broad perspective by not excluding any specific groups. The protocol of this review was registered in PROSPERO and followed the PRISMA guidelines. The methodological quality of studies was assessed by the NOS tool specific for cohort studies. Another strength is the comprehensive search strategy with 4 databases systematically searched, supplemented by hand searching.

Conclusions

There are a number of research implications from this review. An important knowledge gap identified through this review is the very limited evidence in the current literature on the tracking of maternal dietary patterns from pregnancy to postpregnancy, especially with longer follow-up periods after 1 y postpregnancy. Also, such literature in Asian populations is lacking. Further longitudinal research with a larger sample size ($n > 500$) is needed for an in-depth assessment of tracking of dietary patterns from pregnancy to postpregnancy and the socioeconomic factors involved among women of Asian descent.

It is recommended that future studies build on a uniform set of measures (dietary measurement time points during pregnancy and postpartum, and dietary assessment tools) to be used consistently across studies so that results from future studies can be comparable and heterogeneity in this research area can be reduced. In addition, given that the majority of the included articles were rated as fair, conclusions from this review should be interpreted with caution. Future research should aim to address these gaps to enhance the quality and integrity of data collected.

This systematic review has implications for obstetricians, general practitioners, midwives, antenatal health care workers, and policymakers. Findings from this review corroborate previous studies (13, 75), which recommend that attention from the health care team should extend from pregnancy into postpregnancy to ensure that good dietary habits acquired during pregnancy are continued into postpregnancy. In addition, from this systematic review, it was found that women with low income, less educated women, and/or women with a full-time job comprise a vulnerable population of whom health care workers and policymakers should be mindful. Consideration needs to be given to how dietary guidelines and recommendations are communicated to these subgroups of women at the policy, community, and individual levels. A different approach to managing these groups of women might be worth investigating in future interventions. Future public health-promotion programs should build on existing knowledge (5, 64, 76), take into account socioeconomic inequalities, and aim to implement tailored and population-specific nutritional strategies and lifestyle interventions for women during and after pregnancy to improve nutrition-related health outcomes for mothers and their children.

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