Women and Birth 28 (2015) e70–e79

Contents lists available at ScienceDirect

Women and Birth

journal homepage: www.elsevier.com/locate/wombi

ORIGINAL RESEARCH – QUANTITATIVE

Gestational weight gain in obese women by class of obesity and select maternal/newborn outcomes: A systematic review

Mary Ann Faucher [a,*], Mary K. Barger [b,1]

[a] Baylor University-Louise Herrington School of Nursing, 3700 Worth Street, Dallas, TX 75246, USA
[b] Hahn School of Nursing, University of San Diego, 5998 Alcala Park, San Diego, CA 92110, USA

ARTICLE INFO

Article history:
Received 12 December 2014
Received in revised form 25 March 2015
Accepted 27 March 2015

Keywords:
Obesity
Weight gain
Gestational weight gain
Pregnancy outcomes
Pregnancy complications

ABSTRACT

Background: Obesity and gestational weight gain impact maternal and fetal risks. Gestational weight gain guidelines are not stratified by severity of obesity.
Aim: Conduct a systematic review of original research with sufficient information about gestational weight gain in obese women stratified by obesity class that could be compared to current Institute of Medicine guidelines. Evaluate variance in risk for selected outcomes of pregnancy with differing gestational weight gain in obese women by class of obesity.
Methods: A keyword advanced search was conducted of English-language, peer-reviewed journal articles using 3 electronic databases, article reference lists and table of content notifications through January 2015. Data were synthesized to show changes in risk by prevalence.
Findings: Ten articles met inclusion criteria. Outcomes assessed were large for gestational age, small for gestational age, and cesarean delivery. Results represent nearly 740,000 obese women from four different countries. Findings consistently demonstrated gestational weight gain varies by obesity class and most obese women gain more than recommended by Institute of Medicine guidelines. Obese women are at low risk for small for gestational age and high risk for large for gestational age and risk varies with class of obesity and gestational weight gain. Research suggests the lowest combined risk of selected outcomes with weight gain of 5–9 kg in women with class I obesity, 1 to less than 5 kg for class II obesity and no gestational weight gain for women with class III obesity.
Conclusions: Gestational weight gain guidelines may need modification for severity of obesity.

1. Introduction

The rising prevalence of obesity is a global problem.[1] Pre-pregnant obesity is associated with risks for gestational hypertension, gestational diabetes, instrumental vaginal delivery, cesarean delivery,[2–4] and higher birth weight.[3,5] The odds ratios for these outcomes directly increase with pre-pregnant body mass index (BMI).[2,3]

Data indicate that women are gaining more weight in pregnancy than recommended by the Institute of Medicine (IOM).[6] The 2009 IOM report *Weight Gain During Pregnancy: Reexamining the Guidelines* (hereafter referred to as IOM recommendations)[7] included revision of the BMI categories consistent with World Health Organization (WHO)[8] definitions, shown in Table 1, and revision of the recommended gestational weight gain (GWG) in obese women from a suggested absolute of 6.8 kg (kg;15 pounds) to a range 5–9 kg (11–20 pounds). However, these 2009 guidelines, that aim to optimize outcomes of pregnancy, do not provide GWG recommendations for the different classes of obesity (I, II, and III) as defined by the National Institutes of Health[9] and WHO because there was a paucity of data available to inform guidelines by severity of obesity.[7]

The purpose of this systematic review was to identify and analyze previous research that gave sufficient information to be compared to the current IOM recommendations for obese women stratified by class of obesity and by varying GWG or gestational weight loss (GWL). A specific aim was to determine through

* Corresponding author. Tel.: +1 214 367 3751; fax: +1 214 820 3375.
E-mail addresses: maryann_faucher@baylor.edu (M.A. Faucher), mbarger@sandiego.edu (M.K. Barger).
[1] Tel.: +1 619 260 7797/619 260 6814.

http://dx.doi.org/10.1016/j.wombi.2015.03.006
1871-5192/

Table 1
World Health Organization body mass index classification and 2009 Institute of Medicine gestational weight gain recommendations.

Classification	BMI (kg/m^2)	IOM recommended GWG, lbs (kg)
Underweight	<18.5	28–40 (12.5–18)
Normal weight	18.5–24.9	25–35 (11.5–16)
Overweight	25–29.9	15–25 (7–11.5)
Obese	≥30	11–20 (5–9)
Class I	30–34.9	
Class II	35–39.9	
Class III	≥40	

BMI, body mass index; GWG, gestational weight gain; kg, kilograms; IOM, Institute of Medicine; lbs, pounds; m^2, meters squared.

evidence synthesis, if different GWG recommendations for women with different classes of obesity are supported. Publications prior to 2009 were included if the data could be compared to the current IOM recommendations.[7] Our review focuses on consistently reported three key pregnancy outcomes across the studies: small for gestational age (SGA), large for gestational age (LGA), cesarean delivery.

2. Methods

Our systematic review addressed the following questions in relationship to women with pre-pregnancy obesity stratified by class I, II and III:

1. *What is the range of gestational weight gain in obese women, and does it vary with severity of obesity?*
2. *What is the risk for LGA and SGA in obese women, and does it vary with severity of obesity or GWG?*
3. *What is the risk for cesarean delivery and does it vary with severity of obesity and GWG?*

A literature search was conducted of English-language, peer-reviewed journal articles with an undefined beginning year through January 2015 using the keywords of obese or obesity, gestational weight gain, and outcomes of pregnancy. A combination of these keywords was used in subject headings including the advanced search criteria. Articles were identified via extensive electronic searches of standardized computer databases, including the Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, EMBASE, reviews of reference lists in retrieved publications and through table of content notifications from a variety of peer-reviewed journals. The inclusion criteria were original research articles in which GWG or GWL was associated with LGA, SGA or cesarean delivery outcomes in obese women and results could be evaluated by severity of obesity and compared to the 2009 IOM recommendations for GWG. The search from the standardized computer databases yielded 824 articles. Twenty articles were retained for full review (see Fig. 1). We eliminated studies if results for the selected outcomes of pregnancy were not reported by the current parameters that define class I, II and III obesity, for each obesity class and if results could not be interpreted in relationship to the current IOM recommendations for GWG and GWL. If it appeared that data from a study might exist to fit our criteria, authors were directly contacted for such data. We were unable to retrieve usable data from this method.

Fig. 1 shows the flowchart depicting the search strategy and details of inclusion and exclusion. For the 20 articles retained for a full review, published guidelines for assessing risk in observational studies were used to systematically assess study bias[10,11] and each author independently appraised the studies. When discrepancies in evaluation occurred, the differences were discussed until consensus was reached. Each co-author provided interpretation and summary conclusions. Reference lists of each of the 20 articles retained for full review were examined but no additional articles were identified that met our inclusion criteria.

All articles provided GWG information in kilograms with three exceptions. For these articles, weight was originally reported in pounds and converted by the authors to kilograms.[12–14] If GWG was reported as a range, GWG figures used the median points of range. Data on prevalence for each outcome by obesity class and by varying amounts of GWG and GWL were extracted from the retained articles. These data were graphed to provide a summary of the relationships between GWG and outcomes of interest as reported by each of the reviewed articles.

3. Results

3.1. Characteristics of studies reviewed (Table 2)

Ten relevant articles met the search and inclusion criteria and represent nearly 740,000 obese women from four different countries as summarized in Table 2. Because all studies were observational, risk for bias was similar across all studies. Five studies derived data from a state or regional cohort,[12–16] four from national cohorts,[17,18,20,21] and one from a single academic hospital database.[19] Seven studies used women's self-reported pre-pregnancy weight to calculate total GWG.[12–15,17–19] The most common covariates in study analyses were maternal age, parity,

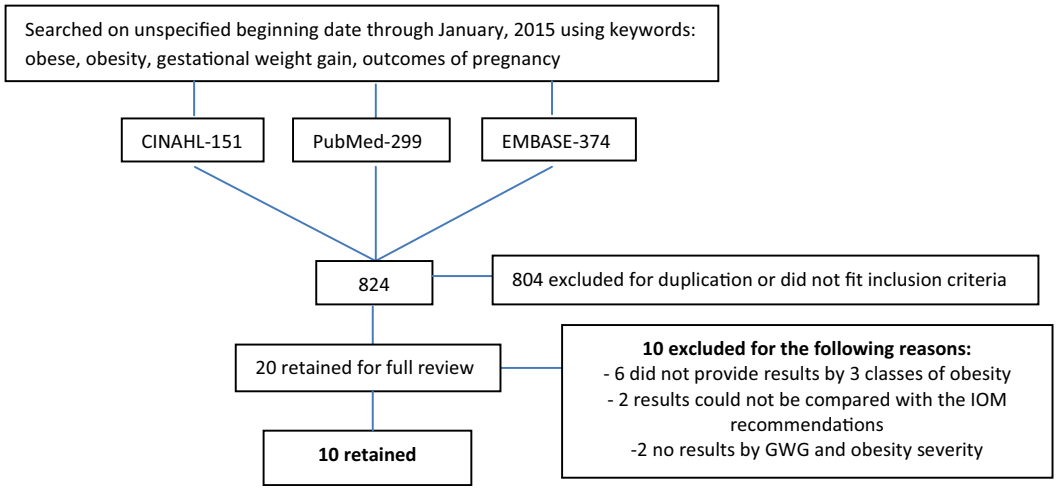

Fig. 1. Search summary.