Obesità e Gravidanza

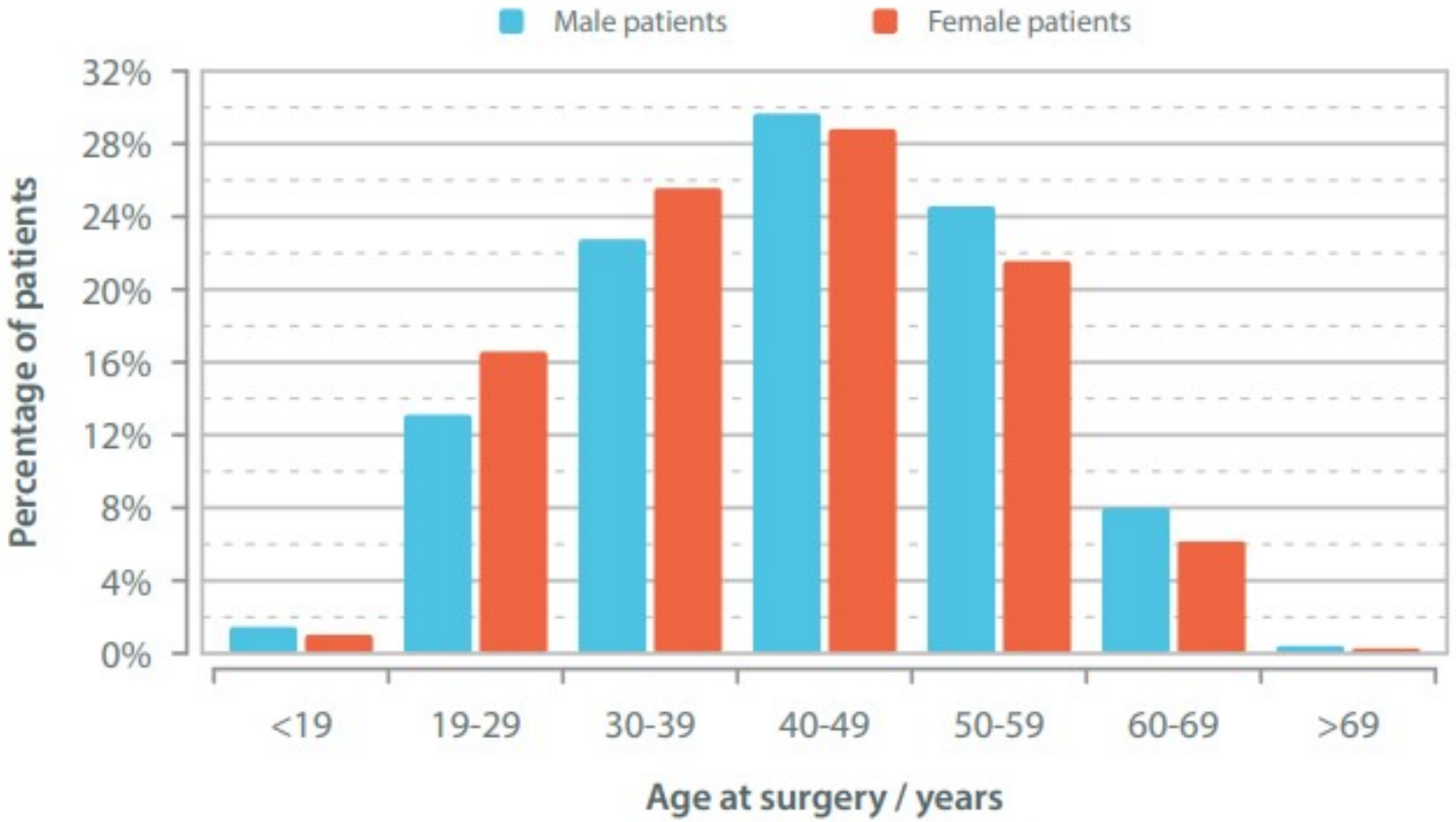
DR. ROSARIO BELLINI

U.O.C. CHIRURGIA BARIATRICA E METABOLICA

AZIENDA OSPEDALIERO UNIVERSITARIA PISANA - OSPEDALE «NUOVO SANTA CHIARA» PISA

No Disclosures

Primary surgery: Age and gender; calendar years 2016-2020 (n=254,960)



BS from a gynaecologist's perspective

Santry et al. 2005

Table 3. Characteristics of Patients Undergoing Elective Bariatric Surgical Procedures From 1998 to 2002 Based on Data From the Nationwide Inpatient Sample

	No. (%) of Patients*					
	1998 (n = 13 265)	1999 (n = 22 800)	2000 (n = 31 082)	2001 (n = 56 781)	2002 (n = 72 177)	*P* Value for Trend†
Age, mean (SD), y	39.6 (0.28)	41.5 (0.31)	40.8 (0.28)	40.9 (0.17)	41.7 (0.21)	<.001
Age categories, y						
<18	52 (0.4)	141 (0.6)	119 (0.4)	196 (0.4)	195 (0.3)	.09
18-34	4321 (32.3)	6052 (26.5)	8932 (28.7)	16 312 (28.7)	19 488 (27.0)	.007
35-49	6832 (51.1)	11 301 (49.6)	15 574 (50.1)	27 819 (49.0)	34 732 (48.1)	.01
50-64	2032 (15.2)	5029 (22.0)	6240 (20.0)	12 085 (21.3)	17 055 (23.6)	<.001
>64	127 (1.0)	286 (1.3)	217 (0.7)	368 (0.6)	706 (1.0)	.29
Women	10 782 (81.3)	18 595 (81.6)	26 493 (85.2)	47 714 (84.0)	60 671 (84.1)	.003

Cosa ti ha convinto a cambiare vita?

Racconta la tua storia

"Il sogno
di avere
un bambino"

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INFERTILITÀ

- Secondo l'*American Society of Reproductive Medicine Practice Committee*, l'infertilità è una malattia generalmente definita come **mancato concepimento dopo dodici o più mesi di tentativi di fecondazione naturale** ed è un **problema crescente nella società odierna**[1]
- La stima mondiale dell'OMS indica che questa patologia **colpisce attualmente fino a 50-80 milioni di donne** con una **incidenza che può arrivare fino al 50% di tutte le donne**[1]

Categoria	BMI (kg/m²)
Sottopeso	**<18,5**
Normale	**18,5-24,9**
Sovrappeso	**25,0-29,9**
Obesità, grado I	**30,0-34,9**
Obesità, grado II	**35,0-39,9**
Obesità, grado III	**≥40,0**

Tabella 1 di Rif. 3

Note **BMI=** *body mass index*, indice di massa corporea.
[a] WHO 2004.

- L'obesità è responsabile di un aumento del rischio di fecondità ridotta ed infertilità[4,5]
- Le donne obese mostrano esiti riproduttivi minori indipendentemente dal metodo di concepimento, e l'**indice di massa corporea più elevato** (BMI) **è associato con prognosi di fertilità più bassa**[5,6]
- **Ogni aumento di 1 punto** del BMI **oltre** il valore di **29 kg/m² riduce la probabilità di concepimento di circa il 5%**[5]
- Una meta-analisi ha mostrato che le donne con **BMI ≥25 kg/m²** presentano una **probabilità significativamente più elevata di aborto spontaneo, indipendentemente dal metodo di concepimento** (OR=1,67; 95% IC da 1,25 a 2,25)[7]

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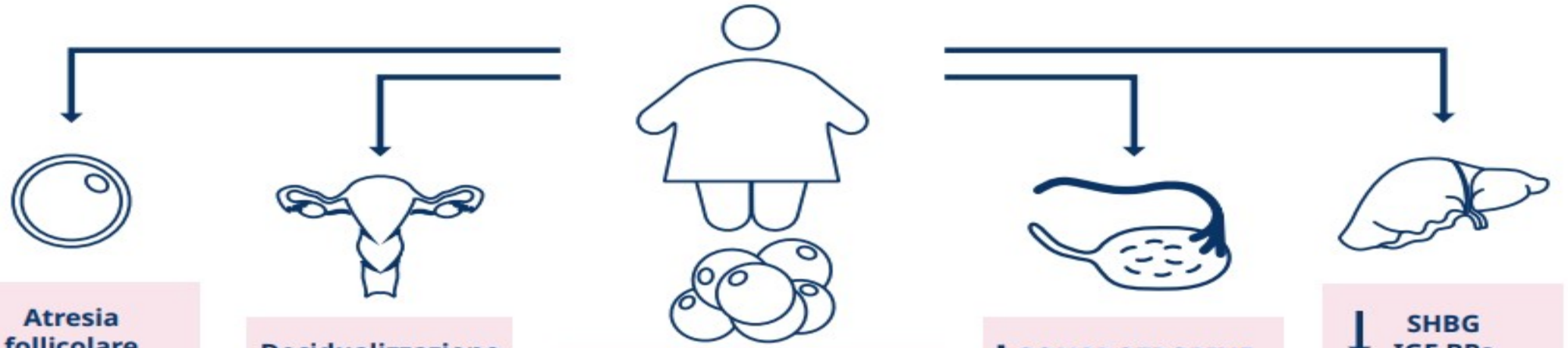
Meccanismi che collegano l'obesità con l'infertilità



Atresia follicolare precoce

Maturazione meiotica ritardata

Aumento dell'aneuploidia

Aumentata apoptosi follicolare

Decidualizzazione stromale

↓ **Recettività endometriale**

LEPTINA
TNF-α
↑ **IL-6**
FFA
ANDROGENI
ESTROGENI

↑ **INSULINO-RESISTENZA E IPERINSULINEMIA**

↓

INFERTILITÀ

↓ **GONADOTROPINE**
GH

↓ **SHBG**
IGF BPs

TNF-α, fattore di necrosi tumorale alfa;
IL-6, interleuchina 6;
FFA, *free fatty acid* (acido grasso libero);
GH, *growth hormone* (ormone della crescita);
SHBG, *sex hormone binding globulin* (globulina legante gli ormoni sessuali);
IGFBPs, *insulin-like growth factor-binding proteins* (proteine leganti il fattore di crescita insulino-simile).

Figura 1 di Rif. 8

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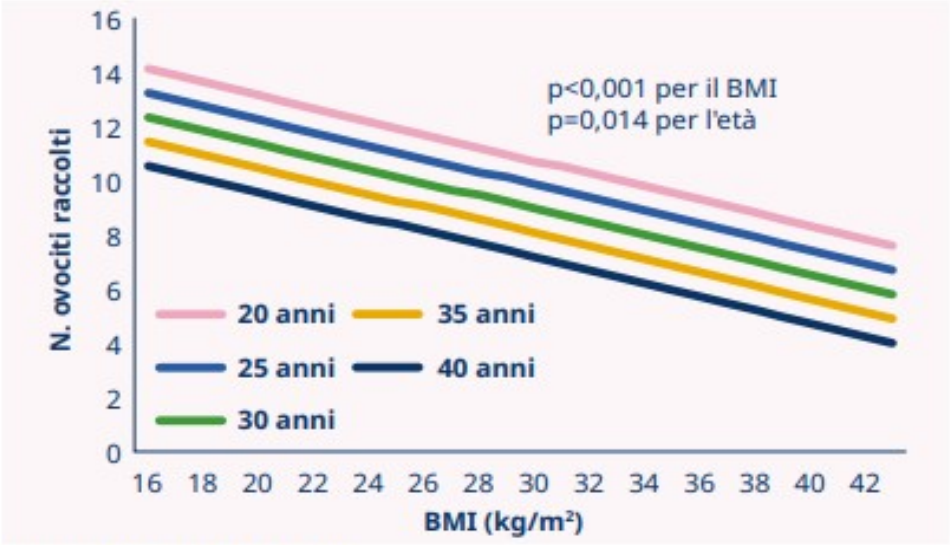
Correlazione negativa tra numero di ovociti raccolti, BMI ed età delle donne



Minor numero di embrioni nelle donne obese

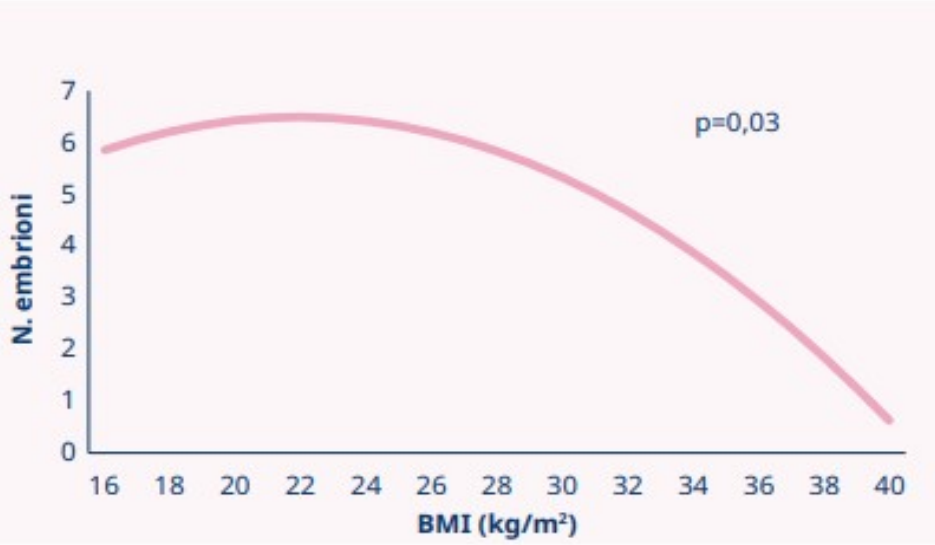


Figura 2 e Figura 3 di Rif. 9

RISULTATI PRINCIPALI[9]

- **Numero di cicli IVF con esito nullo significativamente più elevato nelle donne con obesità**
- **Diminuzione dell'HCG sierico associata ad aumento del BMI**
- **Numero di gravidanze in corso inferiore tra le donne con obesità rispetto a quelle normopeso**

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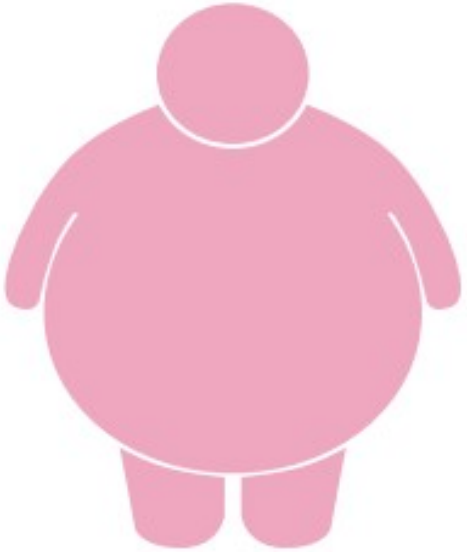
Lim SS et al. Overweight, obesity and central obesity in women with polycystic ovary syndrome: a systematic review and meta-analysis. Hum Reprod Update 2012; 18 (6): 618-637

Risultati di una meta-analisi che ha incluso **35 studi**, su una popolazione di **15.129 donne** - confronto tra soggetti con o senza diagnosi di PCOS -[17]



Le donne affette da PCOS hanno un rischio maggiore di:

- sovrappeso* (BMI ≥25 kg/m^2)
- obesità** (BMI ≥30 kg/m^2)
- obesità centrale# (misura del giro-vita ≥80 cm)

La prevalenza di obesità nelle ragazze di età compresa tra 12 e 19 anni era del 17%, rispetto al 50-80% tra le adolescenti con PCOS[17]

Aumento del rischio di obesità fino a 6 volte nelle adolescenti con PCOS[17]

Caratteristiche della sindrome dell'ovaio policistico (PCOS)

Irsutismo
(crescita eccessiva di peli sul viso, sul petto o sulle gambe)

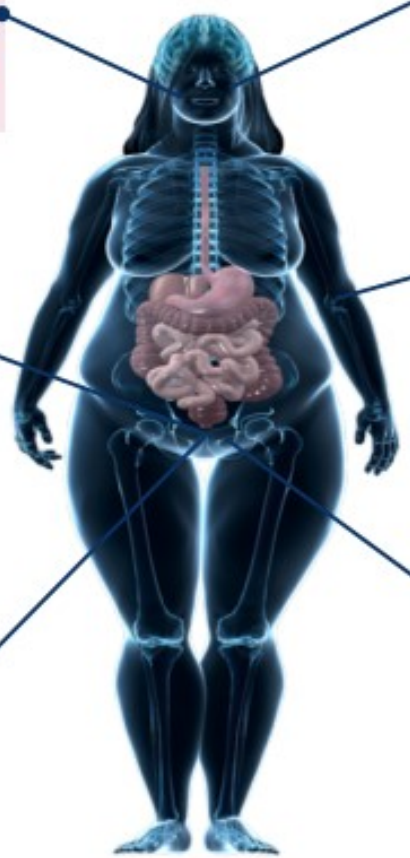
Circa il 60% dei casi[13]

Cicli mestruali irregolari
(assenti, poco frequenti, troppo frequenti, abbondanti, imprevedibili)

70%-80% dei casi[13]

Infertilità
(la PCOS è la più comune tra le cause di infertilità femminile)

40% dei casi[13]



Acne

circa il 33% dei casi[13]

Acanthosis nigricans
(zone della pelle ispessite e scure, con aspetto vellutato)

55% dei casi[14]

Morfologia dell'ovaio policistico
(alterazioni morfologiche dell'ovaio)

>80% dei casi[15]

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. Ryan DH, Yockey SR. Weight Loss and Improvement in Comorbidity: Differences at 5%, 10%, 15%, and Over. Curr Obes Rep 2017

Miglioramento della fertilità

Livello di androgeni più basso

Miglioramento della qualità della vita correlata allo stato di salute

Aumento della sensibilità all'insulina

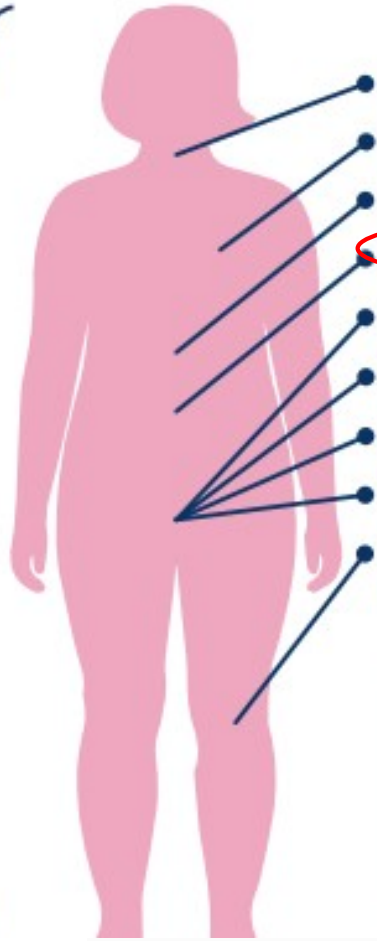
Prevenzione o remissione del DT2

Livelli più bassi di emoglobina glicata

Riduzione della pressione arteriosa

Miglioramento del profilo lipidico

Minor rischio di morte cardiovascolare



Diminuzione della gravità dell'apnea notturna

Rischio inferiore di cancro alla mammella

Miglioramento della NAFLD

Prevenzione della PCOS

Minor rischio di cancro ginecologico

Miglioramento dell'ovulazione

Miglioramento dell'incontinenza da stress

Minor rischio di dismenorrea

Miglioramento o diminuzione del rischio di osteoartrite

Solide evidenze supportano **migliori esiti dei cicli ovulatori e delle gravidanze associate a percentuali di perdita di peso superiori al 5-10%**[12]

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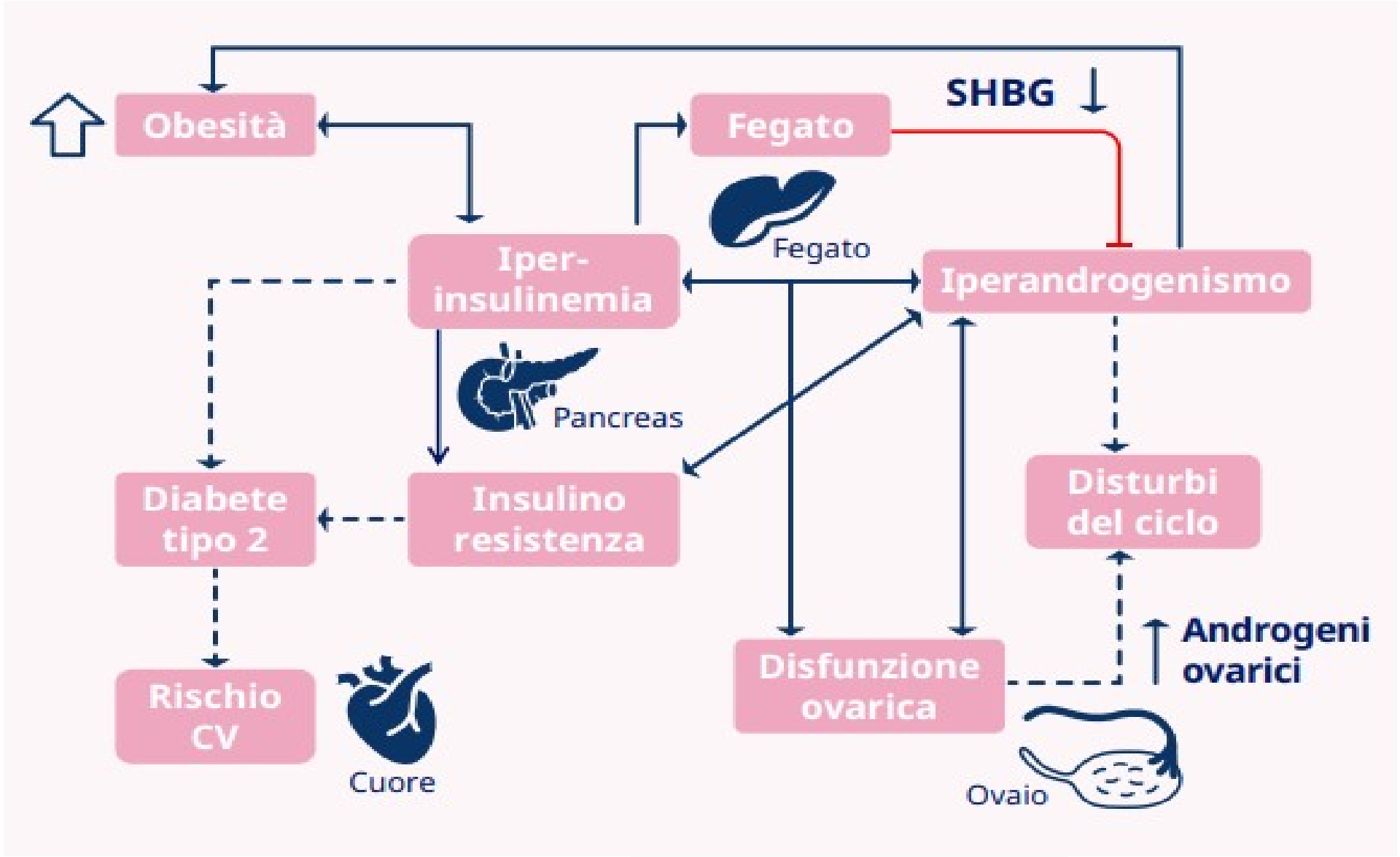
Obesità
Fegato
SHBG
Fegato
Iper-
insulinemia
Iperandrogenismo
Pancreas
Diabete
tipo 2
Insulino
resistenza
Disturbi
del ciclo
Androgeni
ovarici
Disfunzione
ovarica
Rischio
CV
Cuore
Ovaio

Obesity is an independent risk factor for adverse obstetric outcome

American Journal of Obstetrics and Gynecology (2004) 190, 1091–7

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www.elsevier.com/locate/ajog

Obesity, obstetric complications and cesarean delivery rate—A population-based screening study

Joshua L. Weiss, MD,* Fergal D. Malone, MD, Danielle Emig, MPH, Robert H. Ball, MD, David A. Nyberg, MD, Christine H. Comstock, MD, George Saade, MD, Keith Eddleman, MD, Suzanne M. Carter, MS, Sabrina D. Craigo, MD, Stephen R. Carr, MD, Mary E. D'Alton, MD, for the FASTER Research Consortium

Columbia Presbytrian Medical Center, New York, NY

Received for publication May 13, 2003; revised September 2, 2003; accepted September 15, 2003

KEY WORDS
Obesity

Objective: This study was undertaken to determine whether obesity is associated with obstetric complications and cesarean delivery.

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Table III Obstetric complications by maternal BMI

	Obese vs control		Morbidly obese vs control	
Outcome	Adjusted OR (95% CI)	*P*-value	Adjusted OR (95% CI)	*P*-value
Gestational diabetes	2.6 (2.1-3.4)	<.0001	4.0 (3.1-5.2)	<.01
Gestational hypertension	2.5 (2.1-3.0)	<.0001	3.2 (2.6-4.0)	<.01
Preeclampsia	1.6 (1.1-2.25)	.007	3.3 (2.4-4.5)	<.01
Birth weight >4500 g	2.0 (1.4-3.0)	.0006	2.4 (1.5-3.8)	<.01
Birth weight >4000 g	1.7 (1.4-2.0)	<.0001	1.9 (1.5-2.3)	<.01
Preterm delivery	1.1 (0.9-1.5)	.4	1.5 (1.1-2.1)	.01
Operative vaginal delivery	1.0 (0.8-1.3)	.9	1.7 (1.2-2.2)	<.01
PPROM	1.3 (0.9-2.0)	.14	1.3 (0.8-2.2)	.2
IUGR	0.9 (0.5-1.6)	.82	0.8 (0.4-1.8)	.6
Placenta previa	1.3 (0.7-2.5)	.4	0.7 (0.3-2.0)	.6
Placental abruption	1.0 (0.6-1.9)	.9	1.0 (0.5-2.2)	.9

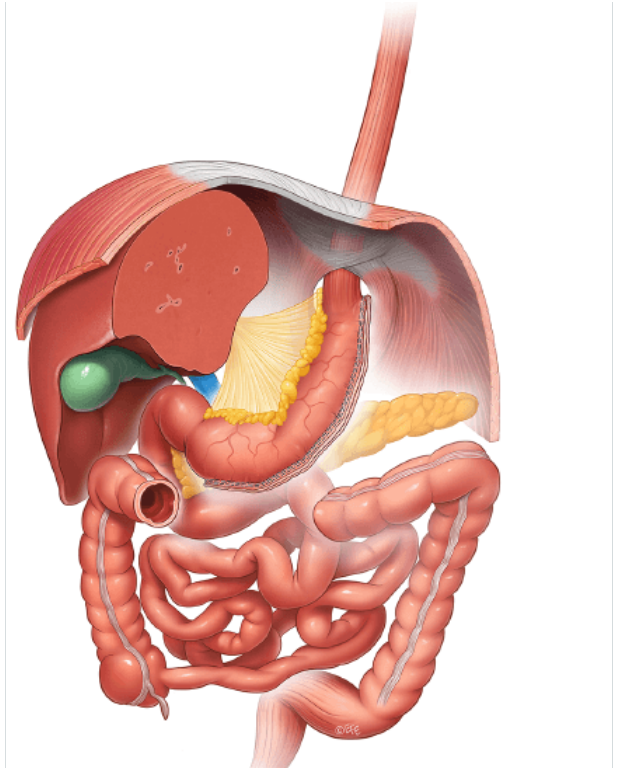
Table V Cesarean delivery rate among nulliparous patients

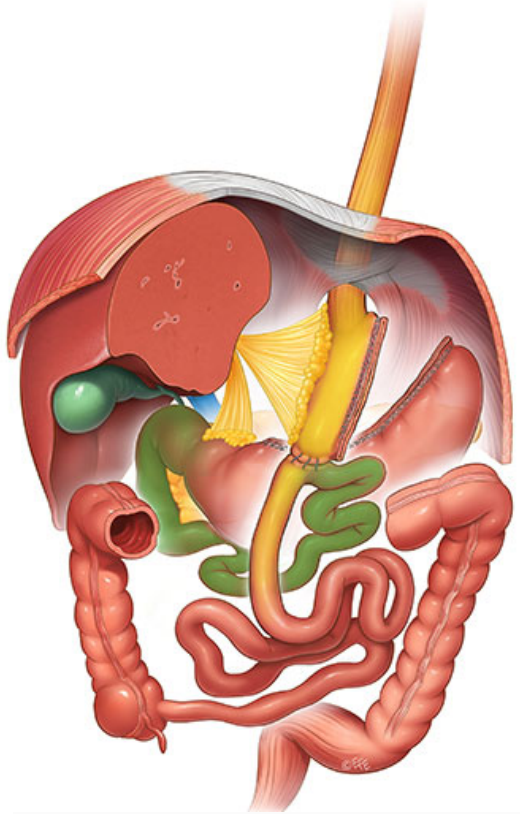
	Cesarean delivery	OR (95% CI)	*P*-value
Overall	22.7%	—	—
Control	20.7%	—	—
Obese	33.8%	1.7 (1.4-2.2)	<.01
Morbidly obese	47.4%	3.0 (2.2-4.0)	<.01

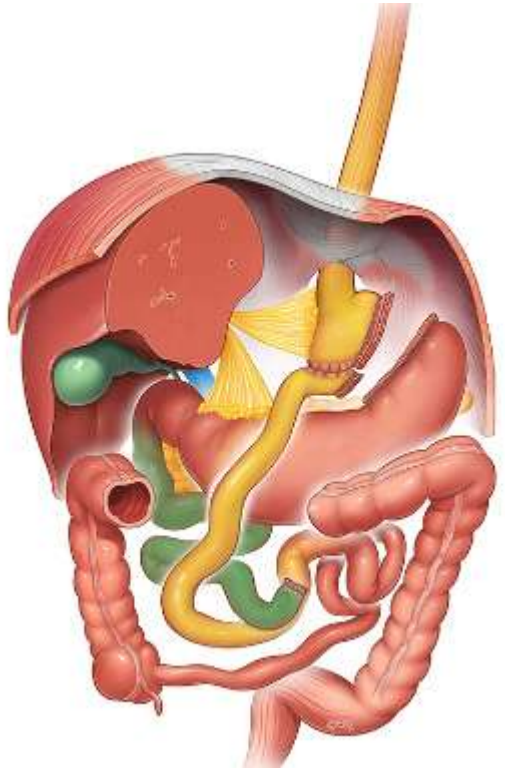
Operative complications for obese and morbidly obese patients include:

- excessive operative blood loss greater than 1000 mL
- increased operative time
- increased incidence of postoperative wound infection

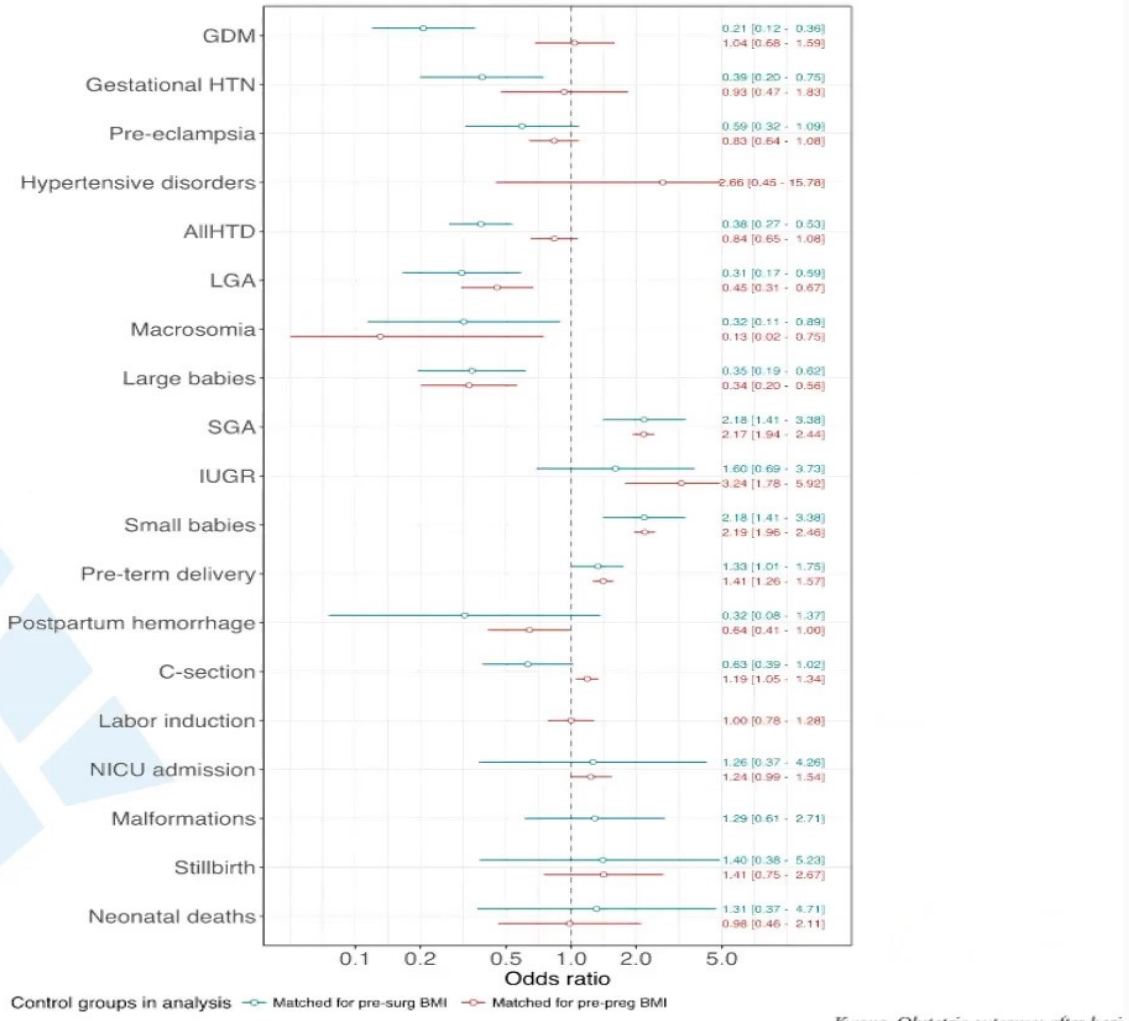
BARIATRIC AND METABOLIC SURGERY



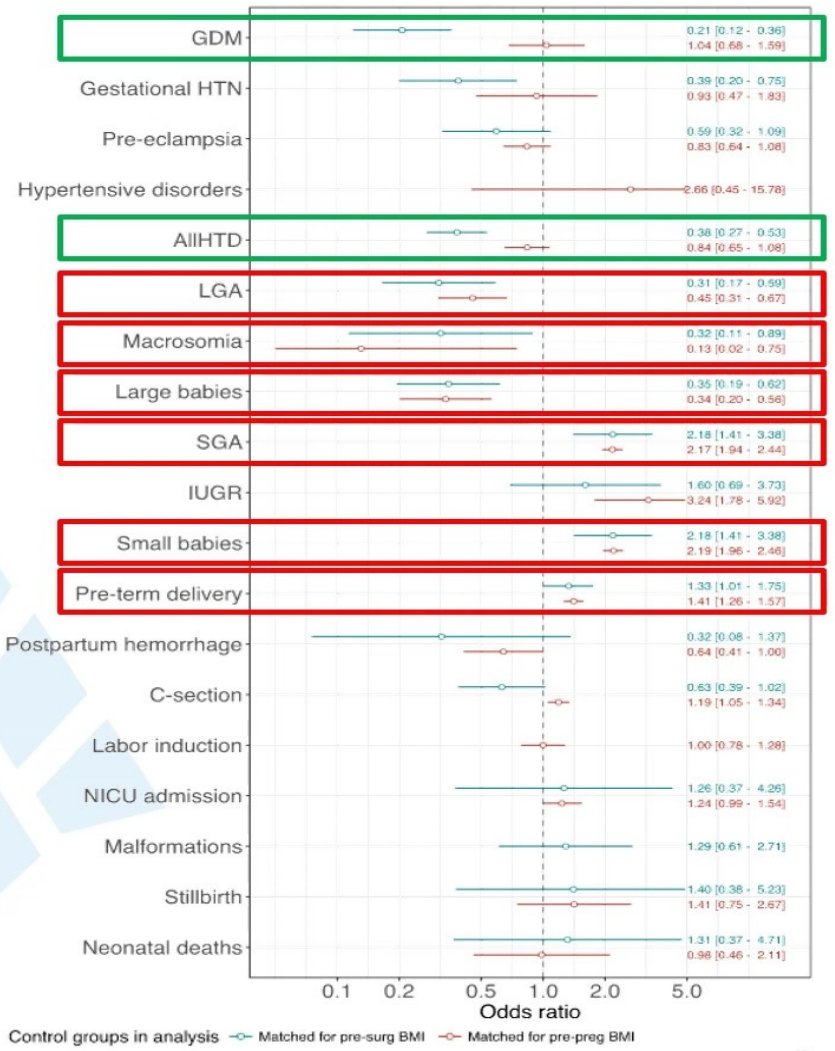




Maternal and neonatal outcomes after bariatric surgery; a systematic review and meta-analysis: **do the benefits outweigh the risks?** W Kwong Am J Obstet Gynecol 2018 Jun;218



Kwong. Obstetric outcomes after bari



NNB = 5

NNB = 8

NNB = 6

NNB = 13

NNB = 7

NNH = 21

NNH = 21

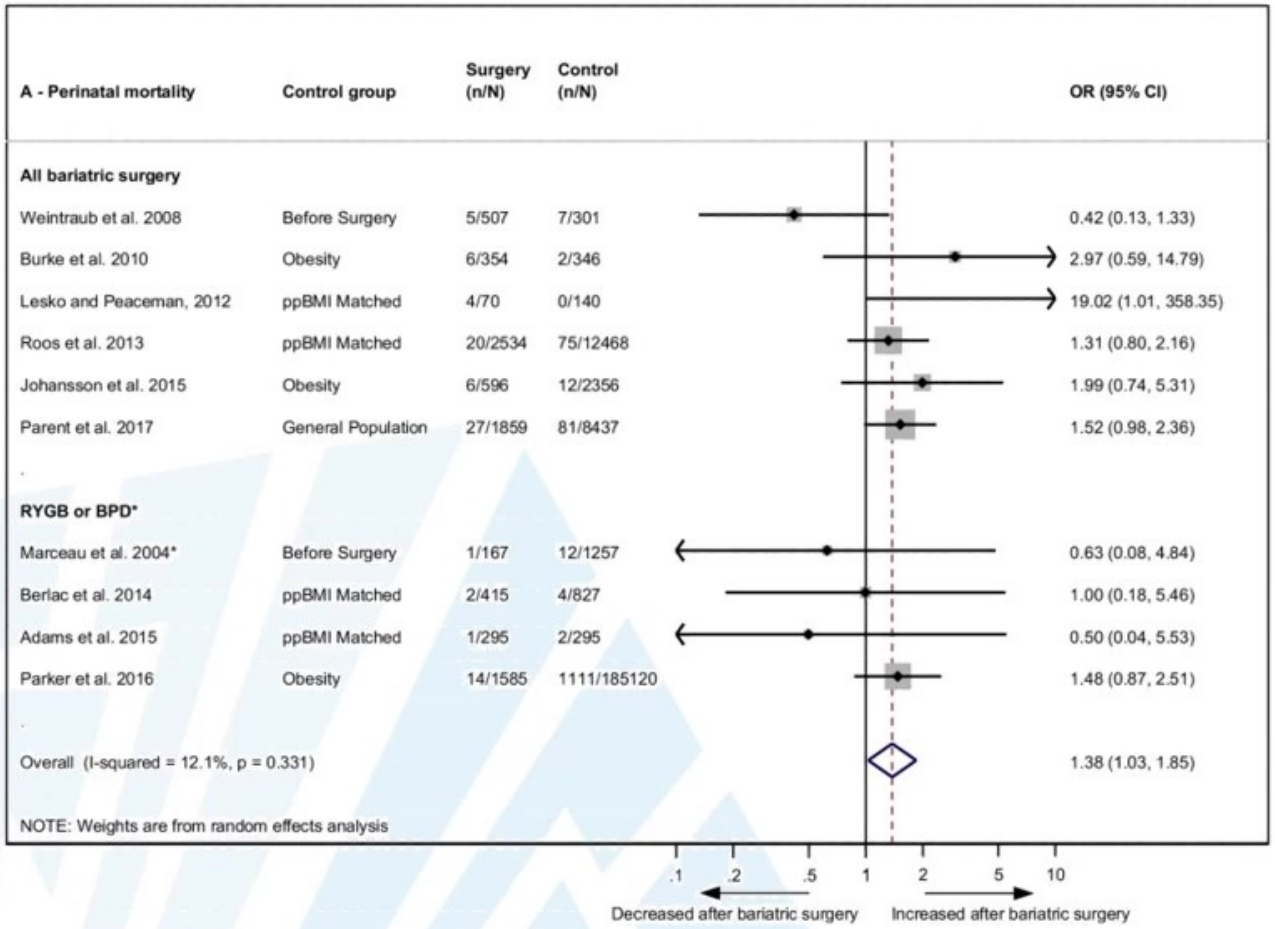
NNH = 35

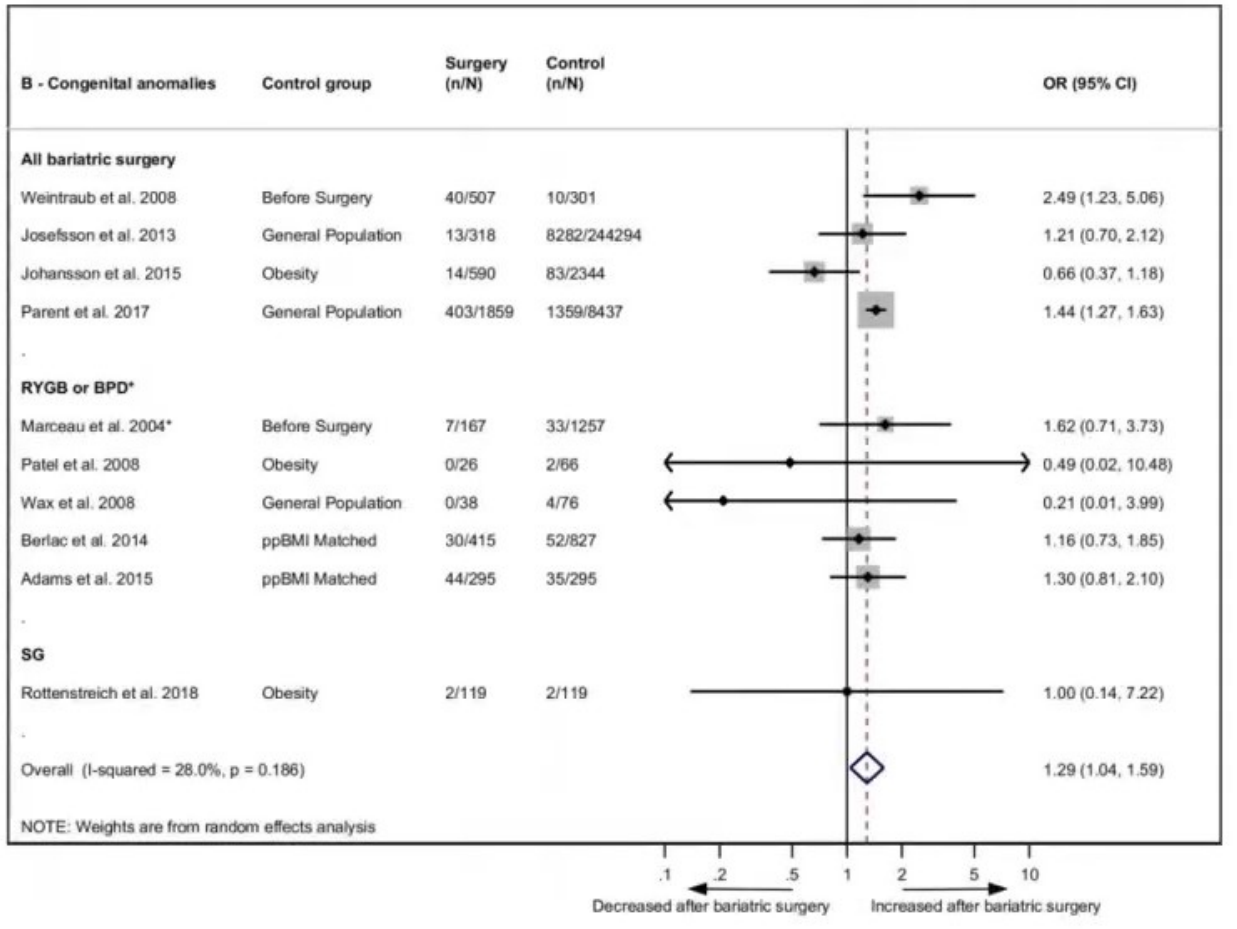
Kwong. Obstetric outcomes after bariatric surgery. Am J Ob

PLOS | MEDICINE

Pregnancy after bariatric surgery and adverse perinatal outcomes: A systematic review and meta-analysis

Zainab Akhter[1]*, Judith Rankin[1], Dries Ceulemans[2], Lem Ngongalah[1], Roger Ackroyd[3], Roland Devlieger[2], Rute Vieira[4], Nicola Heslehurst[1]





ACOG PRACTICE BULLETIN

CLINICAL MANAGEMENT GUIDELINES FOR OBSTETRICIAN–GYNECOLOGISTS

NUMBER 105, JUNE 2009

Bariatric Surgery and Pregnancy

ACOG Clinical Considerations and Recommendations (Grade B , Grade C)

Recommended waiting 12–24 months after bariatric surgery before conceiving so that the fetus is not exposed to a rapid maternal weight loss environment

Most common nutritional deficiencies after Bariatric surgery are of protein, iron, vitamin B12, folate, vitamin D, and calcium.

Daily recommendation for protein intake of 60 g

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Overview

After surgery

Periconception

First trimester

Second trimester

Third trimester

Postpartum and lactation

Research gaps

After surgery

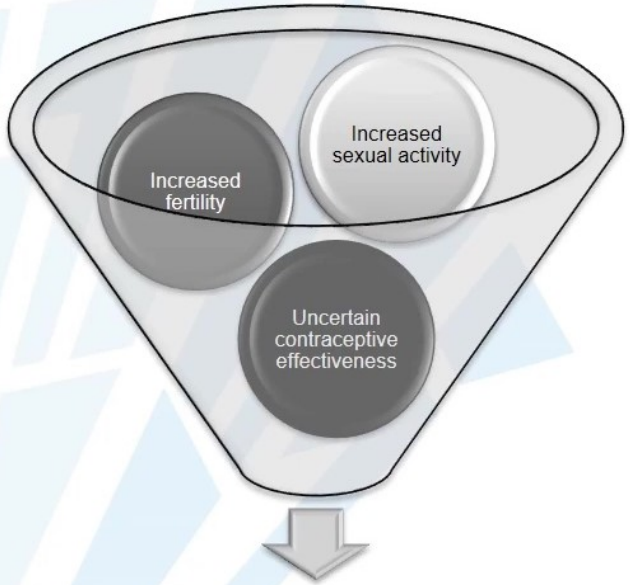
Interval to conception

JAMA Surgery | Original Investigation

Bariatric Surgery in Women of Childbearing Age, Timing Between an Operation and Birth, and Associated Perinatal Complications

Brodie Parent, MD; Ira Martopullo, BS; Noel S. Weiss, MD, DrPH; Saurabh Khandelwal, MD; Emily E. Fay, MD; Ali Rowhani-Rahbar, MD, PhD

Contraception



Unplanned pregnancies

Periconception and during pregnancy

Nutrition and micronutient deficiencies!

- Depleted maternal concentrations of vitamins A, B12, K and folate, alongside low iron levels (Jans et al, 2015).

Most common deficiency linked to neonatal impairments:

- Visual complications (vitamin A)
- Intracranial haemorrhage (vitamin K)
- Neurological and developmental impairment (vitamin B12)
- Neural tube defects (folate)

- Evidence base linking maternal nutrient deficiencies to fetal outcomes **was poor**, due to inappropriate study designs.

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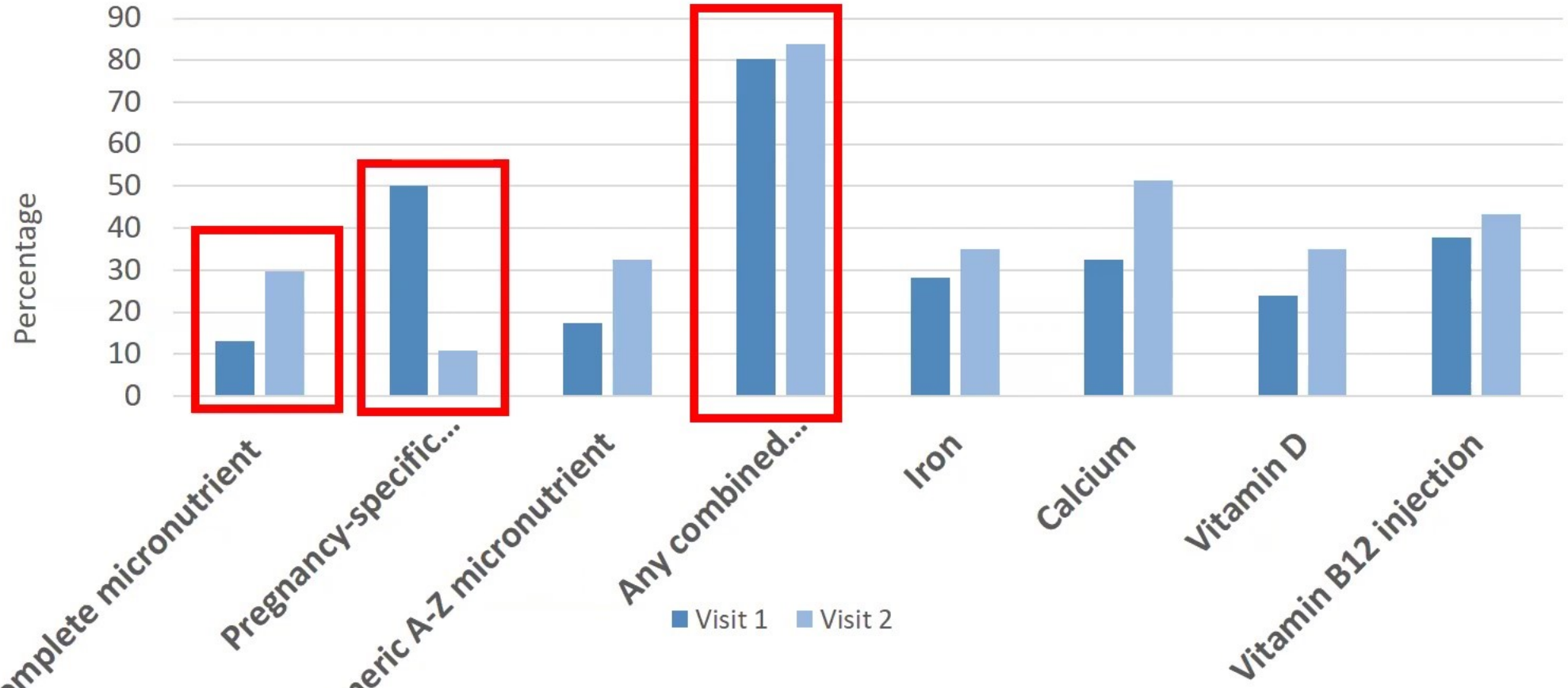
Table 1 Routine nutrient supplementation after bariatric surgery

*Non-pregnant population**	*During pregnancy*
Multivitamin 1–2 daily	One prenatal vitamin daily
Calcium citrate (1200–2000 mg/day) with vitamin D (400–800 U/day)	Calcium citrate (1200 mg/day) with vitamin D (400–800 U/day)
Folic acid 400 μg/day in multivitamin	Folic acid 400 μg/day in prenatal vitamin, replace with additional doses if deficiency confirmed
Elemental iron with vitamin C (40–65 mg/day)	Elemental iron (40–65 mg/day) plus prenatal vitamin, replace with additional doses if deficiency confirmed
Vitamin B12 ≥350 μg/day orally or 1000 μg/month intramuscularly or 3000 μg every 6 months intramuscularly or 500 μg/week intranasally	Vitamin B12 ≥350 μg/day orally, replace with additional doses if deficiency confirmed

*Adapted from Mechanick JI, Kushner RF, Sugerman HJ, *et al.* American Association of Clinical Endocrinologists, The Obesity Society, and American Society for Metabolic and Bariatric Surgery Medical Guidelines for Clinical Practice for the Perioperative Nutritional, Metabolic, and Nonsurgical Support of the Bariatric Surgery Patient. Perioperative bariatric guidelines. *Obesity* 2009;17:s1–s7050, with permission

Perinatal outcome measures	
Gestational weight gain	Early and late miscarriage
Gestational diabetes	Pre and post term birth
Type of delivery	Small for Gestational Age
Iron and Vitamin D status	Low Birth Weight
Method of feeding	Macrosomia

Intake of micronutrient supplements



Micronutrient biomarkers

- 56.1% and 64.6% had suboptimal iron or vitamin D statuses respectively.

- Anaemia affected over half of women (56.1%) at the first appointment, decreasing to 13% of women by the second appointment.

- Iron status **did not differ by surgery type or time to conception**, but was more common in those who were not taking iron supplements ($p < 0.05$).

Received: 10 April 2019 | Revised: 10 July 2019 | Accepted: 11 July 2019
DOI: 10.1111/obr.12927

BARIATRIC SURGERY/PREGNANCY

WILEY obesityreviews

Pregnancy after bariatric surgery: Consensus recommendations for periconception, antenatal and postnatal care

Jill Shawe[1] | Dries Ceulemans[2,3] | Zainab Akhter[4] | Karl Neff[5] | Kathryn Hart[6] | Nicola Heslehurst[4] | Iztok Štotl[7] | Sanjay Agrawal[8] | Regine Steegers-Theunissen[9] | Shahrad Taheri[10] | Beth Greenslade[11] | Judith Rankin[4] | Bobby Huda[12] | Isy Douek[11] | Sander Galjaard[9] | Orit Blumenfeld[13] | Ann Robinson[14] | Martin Whyte[15] | Elaine Mathews[16] | Roland Devlieger[2,3,17]

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[2] Department of Development and Regeneration, KU Leuven, Leuven, Belgium
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[7] Department of Endocrinology, Diabetes and Metabolic Diseases, University Medical Centre, Ljubljana, Slovenia
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[9] Department of Obstetrics and Gynaecology, Division of Obstetrics and Prenatal Medicine, Erasmus MC, Rotterdam, the Netherlands

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TABLE 3 Recommendations for clinical practice

Summary of Recommendations	Periconception	First Trimester	Second Trimester	Third Trimester	Postpartum/Breastfeeding
Surgery-to-conception interval	Postpone pregnancy until a stable weight is achieved (level 2++)				
Contraception	Counsel women regarding contraception prior to surgery (level 2−) Avoid COCs (level 2+), and encourage the use of LARCs (level 2−)				Counsel women regarding contraception (level 2−) Avoid COCs (level 2+), and encourage the use of LARCs (level 2−)
Nutritional advice	Energy requirements should be individualized on the basis of prepregnancy BMI, GWG, and physical activity level, with limitations on energy dense foods if excessive GWG is identified (level 2−) Provide standard postsurgical dietary advice (level 4) Aim for protein intakes of at least 60 g/day (level 4) Where deranged glucose levels are identified (hyperglycaemia or hypoglycaemia) manipulation of carbohydrate quantity, and/or quality may be warranted (level 4) Hyperglycaemia—reduce rapidly absorbed carbohydrates. Substitute with protein and low GI alternatives (level 4) Early or late dumping—eliminate rapidly absorbed carbohydrates. Substitute with protein and low GI alternatives, six smaller meals. Use liquids 30 min after meals and lay down after eating (level 2−). Avoid caffeinated or alcoholic beverages (level 4) and consider changing eating frequency and portion size (level 4). Artificial nutrition support may be indicated in cases of severe malnutrition during pregnancy, with initiation and choice of feeding route determined by local nutrition support protocols (level 4)				
Nutritional monitoring	Serum indices to be checked every 3 months: full blood count, serum ferritin, and iron studies including transferrin saturation (level 2−), serum folate or red blood cell folate, serum vitamin B12 or transcobalamin (level 2−), serum vitamin A (level 2−). Serum indices to be checked every 6 months: prothrombin time, INR, and serum vitamin K1 concentration (level 2+), serum protein and albumin (level 2−), serum vitamin D with calcium, phosphate, magnesium, and PTH (level 4), renal function and liver function tests (level 4), serum vitamin E	Serum indices to be checked every trimester: full blood count, serum ferritin, and iron studies including transferrin saturation (level 2−), serum folate, and serum vitamin B12 (level 2−), serum vitamin A (level 2−), prothrombin time, INR, and serum vitamin K1 concentration (level 2+), serum protein and albumin (level 2−), serum vitamin D with calcium, phosphate, magnesium, and PTH (level 4), renal function and liver function tests (level 4) Extra serum indices to be checked during first trimester: serum vitamin E (level 4), serum zinc, copper, and selenium (level 4).			Serum indices to be checked every 3 months while breastfeeding: full blood count, serum ferritin, and iron studies including transferrin saturation (level 2−), serum folate, and serum vitamin B12 (level 2−), serum vitamin A (level 2−), serum vitamin D with calcium, phosphate, magnesium, and PTH (level 4). Serum indices to be checked every 6 months while breastfeeding: prothrombin time, INR, and serum vitamin K1 concentration (level 2+), serum protein and albumin (level 2−), renal function

(Continues)

TABLE 3 (Continued)

Summary of Recommendations	Periconception	First Trimester	Second Trimester	Third Trimester	Postpartum/Breastfeeding
	(level 4), serum zinc, copper, and selenium (level 4).				and liver function tests (level 4), serum vitamin E (level 4), serum zinc, copper, and selenium (level 4).
Nutritional supplementation	Prepregnancy multivitamin and mineral supplement to ensure total daily dosing from all supplements, eg, Table 3 (level 4). Folic acid 0.4 mg daily during preconception and first trimester, 4-5 mg if obese or diabetic (level 4). Convert Vitamin A to beta-carotene form (level 2+). Add oral dose of vitamin K weekly if deficiency is noted with coagulation defect (level 2−). Vitamin B12 supplementation (1 mg IM 3 monthly) (level 4). Oral supplementation can be attempted, but reduced absorption is to be expected (level 4). Supplement vitamin D to keep levels above 50 nmol/L, and serum PTH within normal levels (level 4). Add calcium as needed (level 4). Additional supplementation should be given if deficiency is identified.	Thiamine 300 mg daily with two vitamin B compound strong tablets three times daily if vomiting. Prolonged vomiting may require intravenous thiamine and vitamin B complex supplementation (level 3). Give folic acid at a dose of 0.4 mg daily during preconception and first trimester, 4-5 mg if obese or diabetic (level 4). Further supplementation as during preconception period.			
Diabetes screening	Monitor HbA1c every 3 months in the absence of haemoglobinopathies.	Check fasting glucose/ HbA1c if there is a personal history of diabetes or if other risk factors are	OGTT at 24-28 weeks for women who have had AGB (level 4). For all other women either seven-point	Repeat screening if clinical suspicion of diabetes (level 4).	Offer screening to patients with GDM. Screen other patients according to local policies or as

TABLE 3 (Continued)

Summary of Recommendations	Periconception	First Trimester	Second Trimester	Third Trimester	Postpartum/Breastfeeding
	If haemoglobin is abnormal then monitor with fasting glucose +/− OGTT. Less frequent testing can be considered if the woman does not have a history of diabetes, according to local policies (level 4).	present. Treat as T2DM if HbA1c ≥6.5% and/or FPG ≥7.0 mmol/L (level 4).	CBG profiles or CGM for 1 week between 24 and 28 weeks of gestation (level 4). Repeat HbA1c if there is a personal history of diabetes (level 4).		clinically indicated (level 4).
AGB management		Deflate in case of hyperemesis to prevent band slippage and nutrient deficiencies (level 3).	Assess GWG and fetal growth and manage band as appropriate (level 2++).	Assess GWG and fetal growth and manage band as appropriate (level 2++).	After establishment of lactation, return band to prepregnancy levels (level 2+).
Surgical complications	Excess vomiting—AGB deflation in symptomatic women only to prevent band slippage and/or nutrient requirements not being met (level 3). In case of RYGB, patients should seek medical attention upon onset of abdominal symptoms—timely recognition and early surgical intervention of internal herniation is associated with reduced risk of adverse maternal and fetal outcomes (level 2++).				
Weight management	Postpone pregnancy until a stable weight is achieved (level 2++). Measure preconception weight (level 4).	Measure maternal weight (level 4).	Measure maternal weight and assess for excessive or inadequate GWG. If excessive GWG, assess for complications (level 2+). If ABG, assess GWG and fetal growth and manage band as appropriate (level 2++). If insufficient GWG, monitor fetal growth carefully (level 4)		Pregnancy does not affect long-term weight loss from BS (level 2+).
Ultrasound scans		Perform routine 12-week scan (routine) (level 4).	AGB should be deflated if fetal growth is compromised (level 2++). Perform routine 20-week scan congenital anomaly screening (level 4).	Perform monthly fetal growth monitoring scan(s) from viability (level 2+). Assess for developmental problems such as intracranial bleeding (level 3).	
Mental health	Screen for substance abuse and anxiety or other mental health disorders and offer follow-up if necessary (level 2+). Advise smoking cessation if necessary (level 2−).				
Breastfeeding					Breastfeeding can be recommended to bariatric patients (level 2++). Monitor maternal micronutrients during lactation (level 3).

Abbreviations: COC, combined oral contraceptive; LARC, long-acting reversible contraception; BMI, body mass index; GWG, gestational weight gain; GI, glycaemic index; PTH, parathyroid hormone; OGTT, oral glucose tolerance test; AGB, adjustable gastric banding; CBG, capillary blood glucose; CGM, continuous glucose monitoring.

Periconception and during pregnancy

Mental Health

Depression and Anxiety: Lack of Associations with an Inadequate Diet in a Sample of Pregnant Women with a History of Bariatric Surgery—a Multicenter Prospective Controlled Cohort Study

Goele Jans[1,2] · Christophe Matthys[3,4] · Annick Bogaerts[1,2,5] · Lieveke Ameye[1] · Frank Delaere[6] · Kristien Roelens[7] · Anne Loccufier[8] · Hilde Logghe[9] · Ben De Becker[10] · Johan Verhaeghe[1,11] · Roland Devlieger[1,10,11]

Table 3 Antenatal anxiety and depression scores in women with previous bariatric surgery compared to those in obese controls

	Bariatric surgery $N=54$	Obese $N=25$	P value
T1 state anxiety	43 ± 11	34 ± 9	< 0.001
≥ 40	31 (57)	4 (16)	< 0.001
T1 trait anxiety	42 ± 11	37 ± 10	0.05
≥ 40	25 (46)	9 (36)	0.47
T1 depression	9 ± 6	8 ± 5	0.29
≥ 13	12 (22)	3 (12)	0.36
T3 state anxiety	43 ± 12	38 ± 9	0.04
≥ 40	26 (54)	8 (32)	0.09
T3 trait anxiety	41 ± 11	37 ± 8	0.08
≥ 40	25 (52)	9 (36)	0.22
T3 depression	8 ± 5	7 ± 4	0.17
≥ 13	9 (19)	2 (8)	0.31

Scores presented as mean ± std. The proportion of women being "highly anxious" (≥ 40) or at major risk for depression (≥ 13) was presented as n (%)

ECADEMIA COB

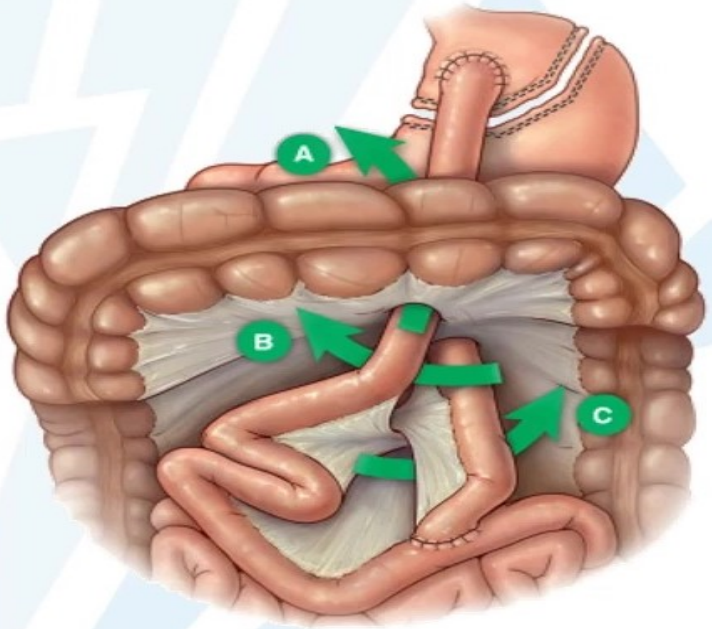
First trimester

Check Vitamins

Check Vomiting

Check Sugar

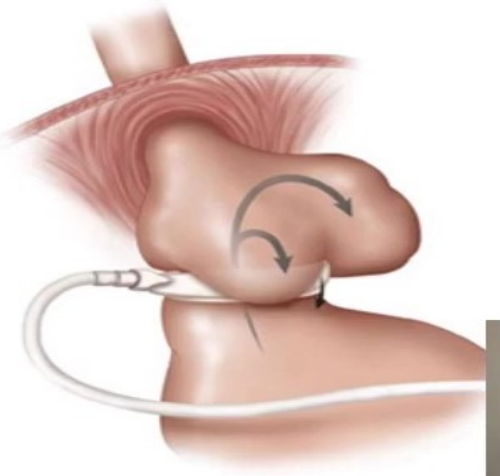
Check Weight



Surgical complications

~ 2-11%

High mortality!



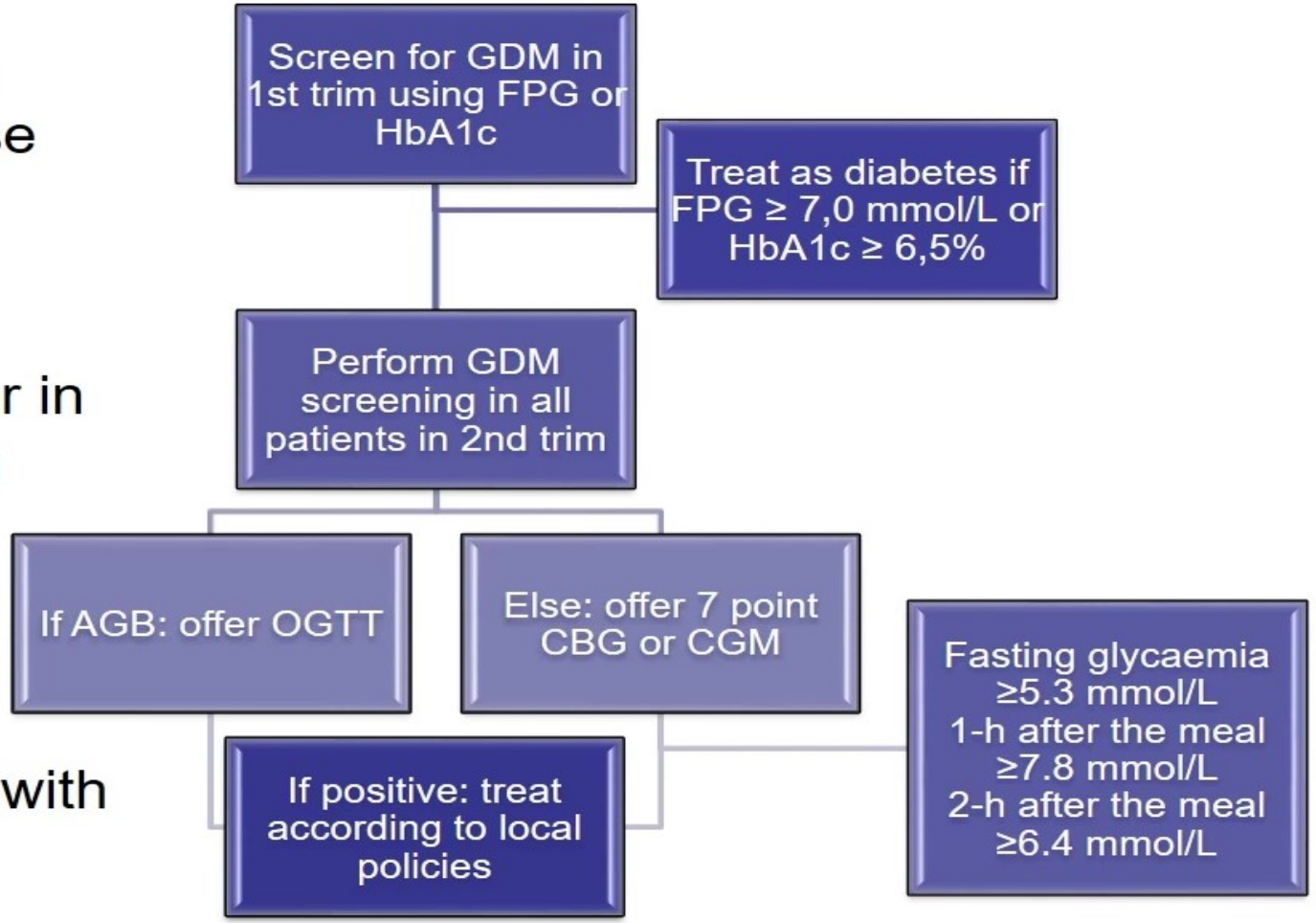
Second trimester

Gestational diabetes

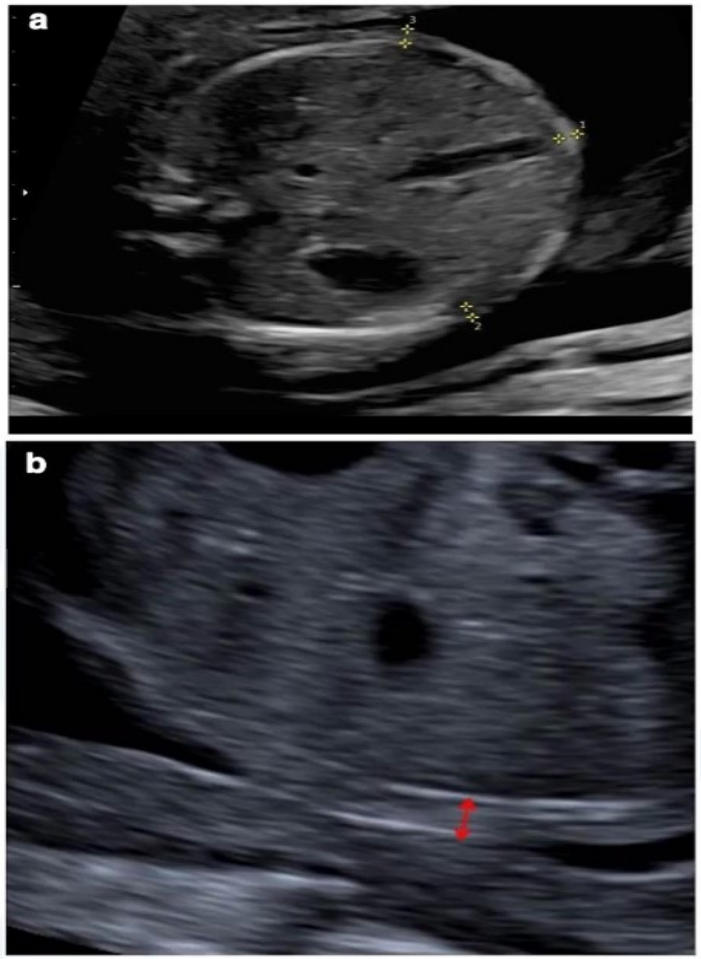
Andrade et al. 2016: Evaluation of the tolerance of the OGTT showed adverse events in 65%.

Rottenstreich et al. 2018. Reactive hypoglycaemia was significantly higher in women with RYGB (83%) than among women with prior sleeve gastrectomy (54%) or ABG (12%)

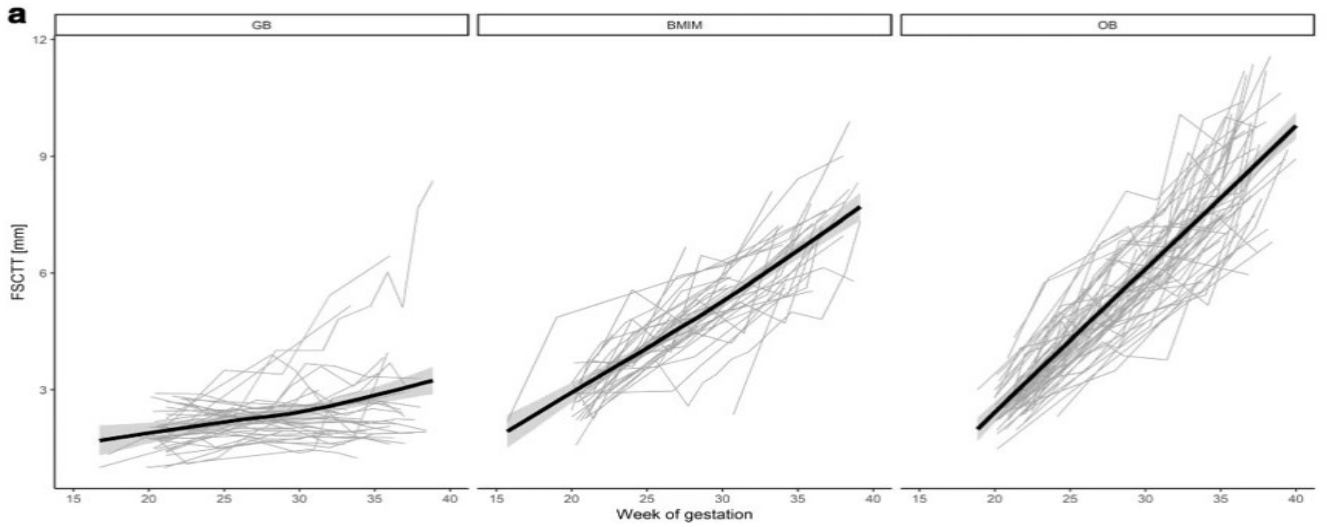
Freitas et al. 2014: 50% of all post-BS pregnant women would be diagnosed with GDM but this diagnosis did not affect pregnancy outcomes

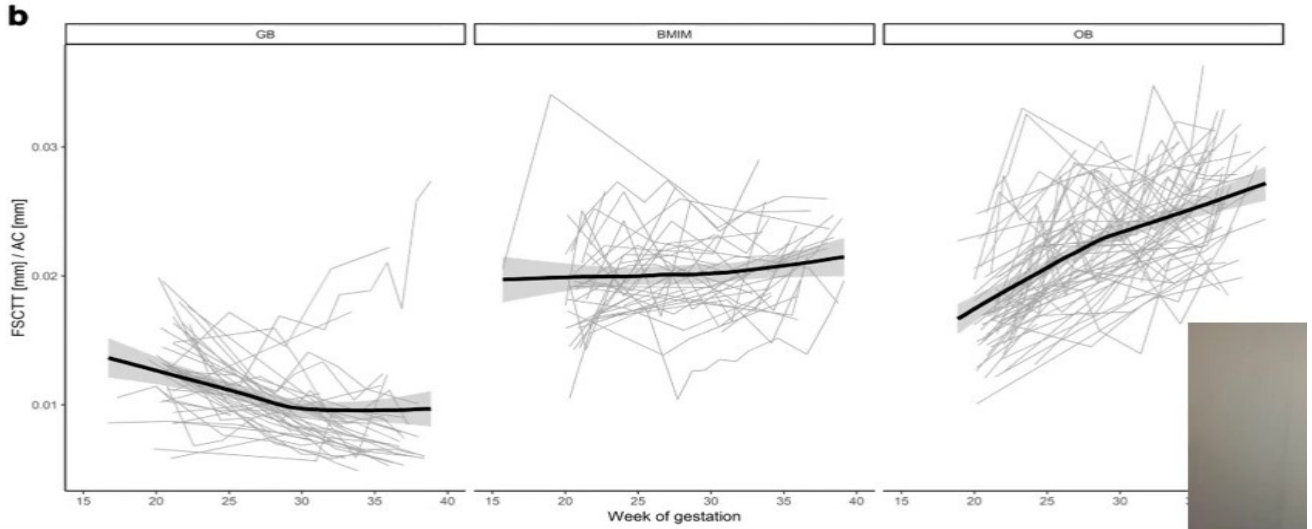


Second trimester



*Yerlikaya-Schatten et al. 2020





Second trimester

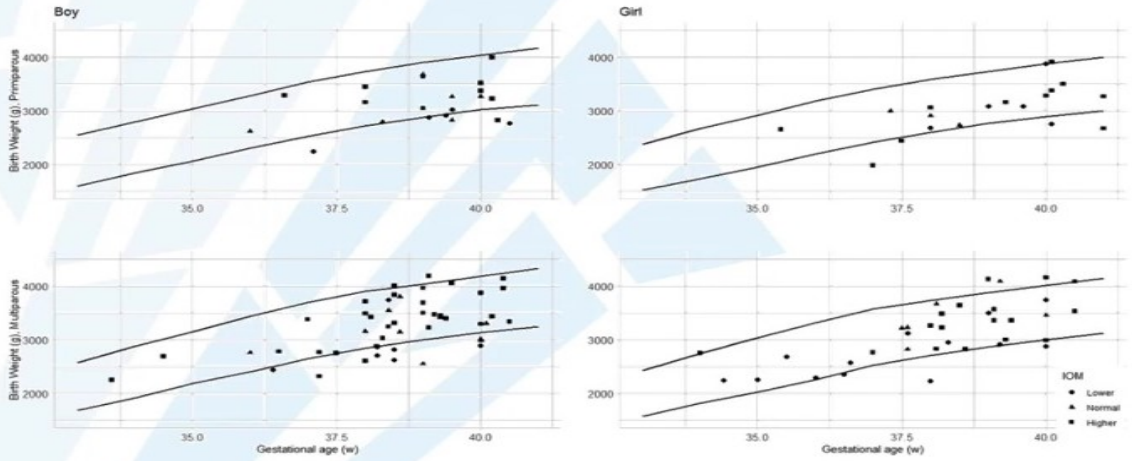
Gestational Weight Gain

Institute of Medicine guidelines on gestational weight gain

Weight category	Recommended gestational weight gain
Underweight (BMI <18.5 kg/m^2)	12.5–18 kg
Normal weight (BMI 18.5–25 kg/m^2)	11.5–16 kg
Overweight (BMI 25–30 kg/m^2)	7–11 kg
Obese (BMI >40 kg/m^2)	5–9 kg

Overview of adherence to Institute of Medicine guidelines per BMI category

	Total, n = 127
GWG lower than IOM, n (%)	30 (24%)
GWG according to IOM, n (%)	26 (20%)
GWG higher than IOM, n (%)	71 (56%)



Overview of adherence to Institute of Medicine guidelines per BMI category

	Total, n = 127 SGA
GWG lower than IOM, n (%)	14 (47%)
GWG according to IOM, n (%)	4 (15%)
GWG higher than IOM, n (%)	9 (13%)

* Ceulemans et al. 2021, SOARD

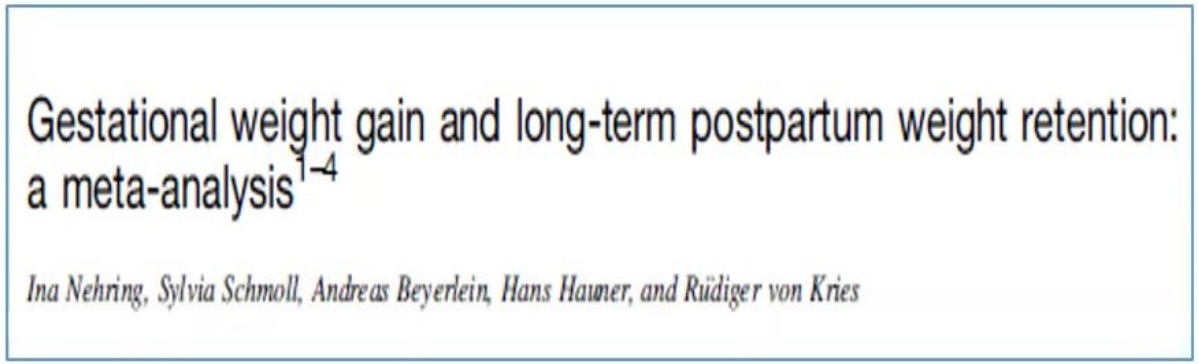
Third trimester

Postpartum

Do not forget about contraception!

Offer follow-up screening to patients with a diagnosis of GDM

- What is “normal”? What is “healthy”? When is the PPWR “window?”



Gestational weight gain and long-term postpartum weight retention: a meta-analysis[1–4]

Ina Nehring, Sylvia Schmoll, Andreas Beyerlein, Hans Hauner, and Rüdiger von Kries

RESEARCH ARTICLE Open Access

Effect of interpregnancy weight change on perinatal outcomes: systematic review and meta-analysis

Noor E. W. D. Teulings[1,2*], Katya L. Masconi[1], Susan E. Ozanne[2], Catherine E. Aiken[2,3] and Angela M. Wood[1]

- Those with a GWG above the IOM guidelines retained an additional 3.06 kg after 3y and 4.72 kg on average after 15 y (N > 65,000) (Nehring et al., 2011).

- Interpregnancy weight gain was consistently associated with a higher risk of perinatal complications in a subsequent pregnancy (N =280,672) **especially in those who started the first pregnancy with a BMI < 25** (Teulings et al., 2019).

  Similar findings by Timmermans et al. (2020) (N > 1 million).

NHS Somerset Foundation Trust

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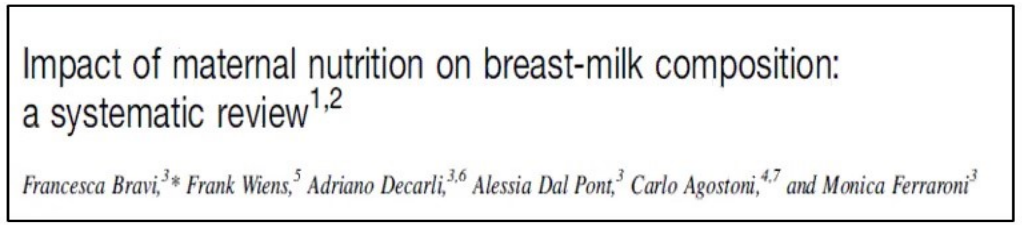
PPWR post bariatric surgery

- Little is known about postpartum weight loss in women with a history of bariatric surgery.
- Postpartum weight loss/retention has been reported retrospectively in a few studies as an exploratory objective.
- Unclear whether pregnancy contributes to long term excess weight gain/loss (Froylich et al. 2016, n = 62, Rottenstreich et al., 2018, n=80).
- PPWR associated with excess GWG (Ceulemans et al. 2021, n=127).

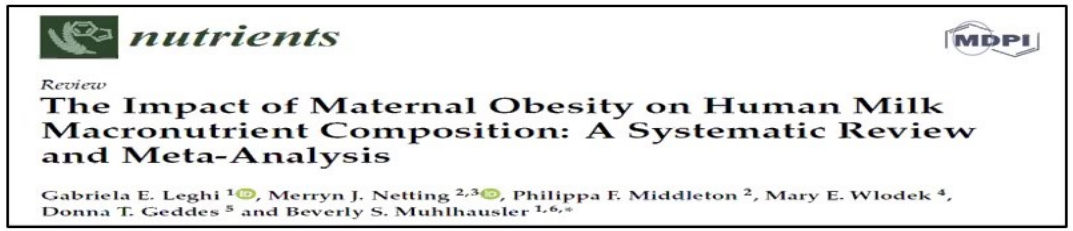
Breastfeeding and lactation

- Breast milk is usually sufficient to support infant growth in the first six months of life.



Impact of maternal nutrition on breast-milk composition: a systematic review[1,2]

Francesca Bravi,[3]* Frank Wiens,[5] Adriano Decarli,[3,6] Alessia Dal Pont,[3] Carlo Agostoni,[4,7] and Monica Ferraroni[3]



nutrients

MDPI

Review

The Impact of Maternal Obesity on Human Milk Macronutrient Composition: A Systematic Review and Meta-Analysis

Gabriela E. Leghi [1], Merryn J. Netting [2,3], Philippa F. Middleton [2], Mary E. Wlodek [4], Donna T. Geddes [5] and Beverly S. Muhlhausler [1,6,*]

- No convincing evidence that milk production and/or quality are affected by mild or moderate variations in maternal nutrition (Bravi, 2016).

- Higher maternal BMI/adiposity associated with higher fat and lactose concentrations at different stages of lactation (Leghi, 2020): **but study quality poor.**

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Breastfeeding and lactation

Composition of breastmilk after surgery largely comparable to those without prior bariatric surgery (macronutrient, energy and vitamin A) (Jans, 2018)

Children born to mothers who had undergone bariatric surgery and breastfed for > 6 months had lower fat mass and glucose levels at 46 months (n = 13) (Gimenes, 2018)

Case reports have highlighted adverse infant/maternal outcomes post bypass surgery, related to B12, zinc, vitamin A, iron and protein deficiencies (Celikar 2009, Monshi 2015)

Nutritional deficiencies in those breastfeeding after bariatric surgeries may in fact be less common than in control women in an inner city (n=119) (Garretto et al., 2019)

Women living with overweight or obesity are less likely to initiate and continue breastfeeding than healthy weight women

(Turcksin, 2014)

Positive effects breastfeeding has on postpartum weight loss and the protective role in the development of childhood obesity.

> Pediatrics. 2006 Dec;118(6):e1644-9. doi: 10.1542/peds.2006-1379.

Large maternal weight loss from obesity surgery prevents transmission of obesity to children who were followed for 2 to 18 years

John G Kral [1], Simon Biron, Serge Simard, Frédéric-Simon Hould, Stéfane Lebel, Simon Marceau, Picard Marceau

Affiliations + expand

PMID: 17142494 DOI: 10.1542/peds.2006-1379

Abstract

Objective: Our aim was to compare the prevalence of obesity in 172 children who were aged 2 to 18 years and born to 113 obese mothers (BMI: 31 +/- 9 kg/m2) with substantial weight loss after biliopancreatic bypass surgery with 45 same-age siblings who were born before maternal surgery (mothers' BMI: 48 +/- 8 kg/m2) and with current population standards.

Methods: In this case series, with >88% follow-up in a tertiary referral center, cross sectional office chart and telephone data on childhood and adolescent weights were transformed to z scores.

Results: After maternal surgery, the prevalence of obesity in the offspring decreased by 52% and severe obesity by 45.1%, with no increase in the prevalence of underweight. The z score reduction in obesity was gender specific, with boys reducing from 1.4 +/- 1.3 before to 0.57 +/- 1.7 after maternal surgery, corrected for birth order. The difference was not significant in girls (0.8 +/- 1.3 vs 0.8 +/- 1.2). Among children of both genders who were aged 6 to 18 years of age and born after maternal surgery, the prevalence of overweight was reduced to population levels.

Conclusions: Contrary to outcomes after intrauterine under- and overnutrition, the prevalence of overweight and obesity in children of mothers with large voluntary postsurgical weight loss was similar to that in the general population, with no increase in underweight. The results demonstrate the importance of potentially modifiable epigenetic factors in the cause of obesity.

Bond et al. BMC Medicine (2022) 20:34
https://doi.org/10.1186/s12916-021-02216-w

RESEARCH ARTICLE Open Access

Exploring the causal effect of maternal pregnancy adiposity on offspring adiposity: Mendelian randomisation using polygenic risk scores

Tom A. Bond[1,2,3,4,5*], Rebecca C. Richmond[4,5], Ville Karhunen[1,6,7], Gabriel Cuellar-Partida[3,8], Maria Carolina Borges[4,5], Verena Zuber[1,9], Alexessander Couto Alves[1,10], Dan Mason[11], Tiffany C. Yang[11], Marc J. Gunter[12], Abbas Dehghan[1,2], Ioanna Tzoulaki[1,2,13], Sylvain Sebert[6], David M. Evans[3,4,14], Alex M. Lewin[1,15], Paul F. O'Reilly[16], Deborah A. Lawlor[4,5†] and Marjo-Riitta Järvelin[1,2,6,17,18†]

Abstract

Background: Greater maternal adiposity before or during pregnancy is associated with greater offspring adiposity throughout childhood, but the extent to which this is due to causal intrauterine or periconceptional mechanisms remains unclear. Here, we use Mendelian randomisation (MR) with polygenic risk scores (PRS) to investigate whether associations between maternal pre-/early pregnancy body mass index (BMI) and offspring adiposity from birth to adolescence are causal.

Methods: We undertook confounder adjusted multivariable (MV) regression and MR using mother-offspring pairs from two UK cohorts: Avon Longitudinal Study of Parents and Children (ALSPAC) and Born in Bradford (BiB). In ALSPAC and BiB, the outcomes were birthweight (BW; N = 9339) and BMI at age 1 and 4 years (N = 8659 to 7575). In ALSPAC only we investigated BMI at 10 and 15 years (N = 4476 to 4112) and dual-energy X-ray absorptiometry (DXA) determined fat mass index (FMI) from age 10–18 years (N = 2659 to 3855). We compared MR results from several PRS, calculated from maternal non-transmitted alleles at between 29 and 80,939 single nucleotide polymorphisms (SNPs).

Results: MV and MR consistently showed a positive association between maternal BMI and BW, supporting a moderate causal effect. For adiposity at most older ages, although MV estimates indicated a strong positive association, MR estimates did not support a causal effect. For the PRS with few SNPs, MR estimates were statistically consistent with the null, but had wide confidence intervals so were often also statistically consistent with the MV estimates. In contrast, the largest PRS yielded MR estimates with narrower confidence intervals, providing strong evidence that the true causal effect on adolescent adiposity is smaller than the MV estimates ($P_{difference}$ = 0.001 for 15-year BMI). This suggests that the MV estimates are affected by residual confounding, therefore do not provide an accurate indication of the causal effect size.

Conclusions: Our results suggest that higher maternal pre-/early-pregnancy BMI is not a key driver of higher adiposity in the next generation. Thus, they support interventions that target the whole population for reducing overweight and obesity, rather than a specific focus on women of reproductive age.

Keywords: Obesity, BMI, Pregnancy, Child, Maternal, Offspring, DOHaD, Mendelian randomisation

- Pregnancy in the catabolic phase soon after surgery, when nutritional deficiencies are exacerbated, has the potential for poor fetal outcomes.

- Nutritional supplementation practices improved following attendance at MDT antenatal clinic, with positive perinatal outcomes.

- Encourage/support return to pre-pregnancy weight and breastfeeding.

Healthy pregnancies after bariatric surgery

Contraception

- Postpone pregnancy until weight has stabilised
- Avoid oral contraception and encourage long-acting reversible contraceptive methods such as IUD

Nutrient levels

- Check serum indices (micronutrients, protein and albumin, FBC, INR) after surgery, preconception, and every trimester in pregnancy and supplement as necessary

Fetal monitoring

- Monitor fetal growth every trimester
- Assess for congenital anomalies or developmental problems such as intracranial bleeds

Diet

- Reduce quick-absorbing carbohydrates and opt for protein and low glycaemic index alternatives
- Avoid caffeine and alcohol
- Frequent, smaller meals

Diabetes

- Avoid OGTT due to risk of dumping syndrome
- Monitor HbA1c every trimester if personal history of diabetes or risk factors
- CGM or seven point CBG between 24 and 28 weeks

Surgical issues

- Inflate and deflate LAGB according to hyperemesis, GWG, and fetal growth
- Assess for internal herniation when abdominal pain is reported and treat promptly

Breastfeeding

- Breast milk is not compromised after surgery and breastfeeding is recommended
- Monitor maternal micronutrients during lactation

Supplements

Vit D >40mcg	Iron 45-60mg
Vit E 15mg	Copper 2mg
Vit K 90-120µg	Selenium 50µg

Thiamine >12mg
Zinc 8-15mg per 1mg copper
Calcium 1200-1500mg
Vit A 5000IU (B-carotene)
Folic acid 0.4mg, 4-5mg for GDM/obesity

Gestational weight gain

- Monitor GWG according to IOM guidelines and screen for associated complications if necessary

Mental health

- Screen for substance abuse, anxiety, or other mental health disorders
- Offer follow up during and after pregnancy


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