

Obesity and pregnancy

Obesidade e gravidez

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ABSTRACT

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Obesity is a serious public health problem and affects women of reproductive age. During the last decades, women have become more obese, with twice the prevalence found among men. In countries like the U.S., about two thirds of women are overweight, and of these, one third is obese. In the seventies, the prevalence of obesity in women of reproductive age was 9%. In 2004 (data from NHANES 2003-2004), it rose to 29%.¹ In Brazil, data from the Risk Factors Surveillance and Protection for Chronic Diseases Telephone Survey (VIGITEL) provided by the Brazilian Institute of Geography and Statistics (IBGE) show excess weight (BMI > 25 kg/m²) prevalences of 24.9, 36 and 45.7% in women aged 18-24, 25-34 and 35-44 years, respectively.² Pregnancy is considered a classical risk factor of obesity. The onset or maintenance of obesity in this phase is associated with numerous maternal and fetal risks. Maternal obesity predisposes the mother to gestational diabetes (GDM) and type 2 diabetes (T2DM) in the future, to hypertension, cardiovascular disease and cancer. Children of obese mothers also present with a high incidence of obesity in the future, as well as of T2DM, hypertension and cardiovascular disease.^{1,2}

Key words: Obesity; Pregnant Women; Public Health; Women's Health.

RESUMO

A obesidade é um grave problema de saúde pública e afeta mulheres em idade reprodutiva. Durante as últimas décadas, as mulheres tornaram-se mais obesas, com prevalência duas vezes mais que em homens. Em países como os EUA, cerca de 2/3 das mulheres estão acima do peso e, destas, 1/3 é de obesas. Nos anos 70, a obesidade em mulheres em idade reprodutiva era de 9%, porém, em 2004 (dados do NHANES 2003-2004), elevou-se para 29%.¹ No Brasil, entre as mulheres, dados da Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico (VIGITEL) fornecidos pelo Instituto Brasileiro de Geografia e Estatística (IBGE) mostram excesso de peso (IMC > 25 kg/m²) em 24,9, 36 e 45,7% nas faixas etárias de 18-24, 25-34 e 35-44 anos, respectivamente.² A gestação está incluída na lista dos fatores clássicos desencadeantes da obesidade. O início ou manutenção da obesidade nessa fase está associado a inúmeros riscos maternos e fetais. A obesidade materna predispõe a mãe ao diabetes gestacional (DMG) e ao diabetes tipo 2 (DM2) no futuro, à hipertensão, a doenças cardiovasculares e câncer. Filhos de mães obesas também exibem elevada incidência de obesidade no futuro, de DM2, hipertensão e doenças cardiovasculares.^{1,2}

Palavras-chave: Obesidade; Gestantes; Saúde Pública; Saúde da Mulher.

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INTRODUCTION

Nutritional status is the result of a balance between nutrient intake and energy expenditure to meet the body's needs. Its research is based on the measurement of

parameters and on overall body composition. The parameters used for nutritional surveillance in pregnant women are: body mass index (BMI) and gestational weight gain. Measurements of weight and height are frequently used and BMI is essential for diagnosing maternal nutritional status.^{1,2} As an index, BMI helps identify pregnant women at nutritional risk, mainly in cases of maternal obesity. Nutritional guidance is recommended for these cases so as to promote maternal health and provide better conditions for delivery and adequate weight at birth.^{1,2}

PREGNANCY AND THE RISK OF OBESITY

Pregnancy contributes to the process of obesity in women in the long term. Both pregnancy and the postpartum period are critical for the development of obesity, and despite much research conducted in the past 20 years on the relationships between maternal weight and risk of becoming obese, the level of evidence is still uncertain.

There are few controlled studies on the subject, and the majority of the large epidemiological studies were conducted in other countries and thus cannot be generalized to more diversified populations of Brazil. Despite these limitations, maternal obesity deserves attention as an important public health issue due to its consequences, both for women and children.^{3,4}

EFFECTS OF OBESITY ON FERTILITY AND CONCEPTION

Obese women have decreased fertility. Weight reduction in obese infertile women increases the frequency of ovulation and the likelihood of pregnancy. Obesity is highly prevalent in women with polycystic ovary syndrome (PCOS), a common cause of infertility. PCOS affects 5-7% of women and is often associated with women with BMI ≥ 25 kg/m². Anovulation is more common among obese women with PCOS (>50% of PCOS patients) than among non-obese women with PCOS. It is triggered by insulin resistance typical to obesity and leads to androgen accumulation in the ovarian microenvironment, which makes follicular maturation and ovulation more difficult.⁵

For these women, spontaneous pregnancy or treatment-assisted reproduction are associated with a

high incidence of complications. The risk of having an isolated miscarriage is higher, as are recurring miscarriages and spontaneous loss after in vitro fertilization (IVF). Current data suggest that obesity can affect corpus luteum and trophoblast functions, as well as early embryonic development and endometrial receptivity.⁵

Studies analyzing fertility after bariatric surgery have shown that weight loss improves fertility and regularity of menstrual cycles in most patients.⁵

FACTORS CONNECTED TO MATERNAL WEIGHT GAIN

Maternal weight gain during the perinatal period has been the focus of several studies because it gives insight into the development of obesity in women. Perinatal factors such as excess weight before pregnancy, excessive weight gain during pregnancy, maintenance of weight acquired postpartum and multiparity are risk factors for the development of obesity and type 2 diabetes.^{4,6}

Weight before conception

Pregestational weight is an important risk factor for both weight gain during pregnancy and for weight maintenance after delivery. Several studies have shown that women who are overweight in early pregnancy are significantly heavier after birth and tend not to return to pregestational weight. Women whose BMI is above 25 kg/m² before pregnancy are more likely to present adverse outcomes related to pregnancy, such as gestational diabetes, pregnancy-induced hypertension, puerperal infections, and surgical delivery, as well as neonatal complications such as neonatal hypoglycemia.^{2,3,6}

Weight gain during pregnancy

Physiological changes

The total weight gain during pregnancy, also known as gestational weight gain, is determined by various components needed to maintain fetus growth and mother support, including maternal organs

(uterus, mammary glands and blood), maternal reserves (fatty tissue), and the products of conception (placenta and fetus). Women double their volume of blood while ligaments and joints relax to accommodate the expanding uterus. Mammary glands grow rapidly, preparing for milk production, and maternal fat storage increases to provide enough energy and substrates to support the mother and the growing fetus. Maternal fat reserves are responsible for 30 to 40% of total maternal weight gain. Table 1 shows the distribution of maternal weight gain during pregnancy and distinguishes between the products of conception and weight increase in maternal tissues.⁷

Table 1 - Distribution of maternal weight gain during pregnancy

Products of conception	Weight(kg)
Fetus	2.7 kg to 3.6 kg
Amniotic liquid	0.9 kg to 1.4 kg
Placenta	0.9 kg to 1.4 kg
Increase in maternal tissues	Weight
Expansion of blood volume	1.6 kg to 1.8 kg
Extracellular fluid expansion	0.9 kg to 1.4 kg
Uterus growth	1.4 kg to 1.8 kg
Breast volume increase	0.7 kg to 0.9 kg
Increase in maternal deposits – fatty tissue	3.6 kg to 4.5 kg

Source: Gabbe: Obstetrics: Normal and Problem Pregnancies, 6th ed. Saunders; 2012.⁷

Recommended weight gain

In the mid-twentieth century, caloric reduction was recommended to restrict excessive maternal weight gain, with the objective of preventing macrosomia (big babies) and cesarean deliveries, as well as to reduce the incidence of pre-eclampsia. This practice, however, revealed that excessively restricting food intake during pregnancy reduces fetal weight in about 400 to 500g. Epidemiological studies in the 1960s and 1970s revealed a link between maternal weight gain and fetal and infant mortality. High morbimortality rates were related to low birth weight (<2500 g) and very low birth weight (<1,500 g).^{6,7} Thus, in order to reduce infant mortality based on maternal weight gain, the Institute of Medicine (IOM) released in 1990 guidelines for ideal weight gain in pregnancy, which were re-evaluated in 2009 and are used worldwide to date.^{2,8} The current recommendation is that the ideal weight gain in pregnancy should consider the patients' BMI before conception (Table 2).

According to the initial nutritional status of pregnant women (underweight, appropriate weight, overweight or obese), a range of weight gain is recommended for each trimester. Mothers should be informed of their recommend weight gain on their first medical appointment. Patients with low weight should gain 2.3 kg in the first trimester and 0.5 kg/week in the second and third trimesters. Likewise, pregnant women with healthy BMI should gain 1.6 kg in the first trimester and 0.4 kg/week in the second and third trimesters. Overweight pregnant women should gain up to 0.9 kg in the first trimester and obese pregnant women need not gain weight in the first trimester. Then, in the second and third trimesters, overweight and obese pregnant women should gain up to 0.3 kg/week and 0.2 kg/week, respectively. The diagnosis of maternal nutritional status can be done according to gestational stage using the table developed by Atallah *et al.*⁹ in 1997^{2,8} (Table 3).

Monitoring the evolution of weight during pregnancy can be done using the chart also developed in 1997 by Atallah *et al.*⁹ (Figure 1). Women who gain weight within the proposed limits are less likely to have children at the extremities of weight for gestational age. Approximately two thirds of women, however, gain more weight than recommended, incurring in complications during pregnancy. They also tend to retain weight after delivery and can thus develop obesity and its complications for the rest of their lives.

Excessive weight gain during pregnancy

Despite guidelines for adequate weight gain during pregnancy, it is common that women gain more weight than recommended. During the last 10 years, several authors have reported high incidences of excessive weight gain during pregnancy. Nucci *et al.*¹⁰ showed in their study that 29% of patients were above the recommended weight. Stulbach *et al.*¹¹, found in 2007 that 37% of women were above the IOM recommendations for weight at the end of pregnancy. Stuebe *et al.*¹² found that 51% of pregnant women gained excessive weight during this phase.

In Brazil, between 1991 and 1995 multicenter study was conducted in six capitals, including approximately 3,082 pregnant women in the public health system. Less than one third of the women gained weight within the IOM recommended range. A 52% weight gain above the expected was significantly more common in women who were overweight before pregnancy.¹⁰

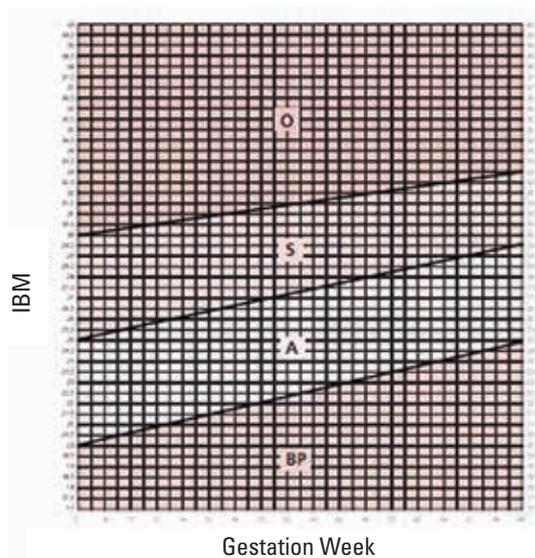
Table 2 - Recommended weight gain according to maternal prepregnancy BMI

Nutritional status before pregnancy	BMI (kg/m ²)	Weight gain during pregnancy (kg)	Weekly weight gain in the 2 nd and 3 rd trimesters (kg)
Low weight	<18,5	12,5 – 18	0,5
Adequate weight	18,5 -24,9	11 – 16	0,4
Overweight	25,0-29,9	7 – 11,5	0,3
Obese	≥30,0	5 – 9	0,2

Source: Institute of Medicine (IOM-2009).⁸**Table 3** - Assessment of nutritional status of pregnant women aged 19+ years according to (BMI) by gestational week

Gestational week	Low weight BMI ≤	Adequate weight BMI between		Overweight BMI between		Obese BMI ≥
6	19,9	20.0	24.9	25.0	30.0	30.1
8	20.1	20.2	25.0	25.1	30.1	30.2
10	20.2	20.3	25.2	25.3	30.2	30.3
11	20.3	20.4	25.3	25.4	30.3	30.4
12	20.4	20.5	25.4	25.5	30.3	30.4
13	20.5	20.7	25.6	25.7	30.4	30.5
14	20.6	20.8	25.7	25.8	30.5	30.6
15	20.7	20.9	25.8	25.9	30.6	30.7
16	20.8	21.1	25.9	26.0	30.7	30.8
17	21.0	21.2	26.0	26.1	30.8	30.9
18	21.2	21.3	26.1	26.2	30.9	31.0
19	21.4	21.5	26.2	26.3	30.9	31.0
20	21.5	21.6	26.3	26.4	31.0	31.1
21	21.7	21.8	26.4	26.5	31.1	31.2
22	21.8	21.9	26.6	26.7	31.2	31.3
23	22.0	22.1	26.8	26.9	31.3	31.4
24	22.2	22.3	26.9	27.0	31.5	31.6
25	22.4	22.	27.0	27.1	31.6	31.7
26	22.	22.7	27.2	27.3	31.7	31.8
27	22.7	22.8	27.3	27.4	31.8	31.9
28	22.9	23.0	27.5	27.6	31.9	32.0
29	23.1	23.2	27.6	27.7	32.0	32.1
30	23.3	23.4	27.8	27.9	32.1	32.2
31	23.4	23.5	27.9	28.0	32.2	32.3
32	23.6	23.7	28.0	28.1	32.3	32.4
33	23.8	23.9	28.1	28.2	32.4	32.5
34	23.9	24.0	28.3	28.4	32.5	32.6
35	24.1	24.2	28.4	28.5	32.6	32.7
36	24.2	24.3	28.5	28.6	32.7	32.8
37	24.4	24.5	28.7	28.8	32.8	32.9
38	24.5	24.6	28.8	28.9	32.9	33.0
39	24.7	24.8	28.9	29.0	33.0	33.1
40	24.9	25.0	29.1	29.2	33.1	33.2
41	25.0	25.1	29.2	29.3	33.2	33.3
42	25.0	25.1	29.2	29.3	33.2	33.3

Source: Atalah *et al.*, 1997.⁹



BP Low Weight – A Adequate – S Overweight – O Obese

Figure 1 - Nutritional status follow up graph of pregnant women, (BMI according to gestational week. Source: Atalah et al, 1997;9 Ministry of Health, 2005.²

Excessive weight gain during pregnancy, in addition to contributing to later obesity, is also associated with complications, including fetal macrosomia, hemorrhage, fetal trauma, low birth weight, and infant mortality.^{6,7} Some maternal characteristics are associated with weight gain during pregnancy. Besides the nutritional factors (inadequate nutritional status in early pregnancy, high energetic consumption, and physical inactivity), we can also highlight sociodemographic factors (low education level and age above 35 years), presence of a partner, obstetric factors (multiparity, low interpregnancy interval), and behavioral factors, such as smoking and working outside the home.¹⁰⁻¹³

Postpartum weight retention

Although many women return to their pre-conceptual weight about a year after delivery, this number has diminished progressively. Approximately 14 to 20% of women retain over 5 kg, which contributes to obesity in the future. Determinant factors for postpartum weight retention include excessive weight gain during pregnancy, high pre-gestational weight, African-American ethnicity, low socioeconomic status and the extremes of maternal age (<17 years and >35 years).^{6,10,13}

OBESITY DURING PREGNANCY

Maternal Complications

Miscarriage

A recent study by Boots et al. showed that among women with recurring miscarriages, obese women presented with higher rates of miscarriage than non-obese women (46% versus 43%, OR: 1,71, CI 95%, 1,05). Based on retrospective studies, we concluded that obesity is associated with a high rate of miscarriage in women who conceive spontaneously.¹⁴ Further prospective studies are needed to verify these preliminary results.^{13,14}

Thromboembolism

Pregnancy is in itself a thrombotic condition characterized by increased plasma coagulation factors I, VII, VIII and X, decreased protein S and inhibited fibrinolysis. These changes, in combination with other risk factors such as maternal age over 35 years, multiparity, cesarean delivery, preeclampsia and obesity result in increased risk of venous thrombosis. According to several studies, obesity (BMI>30 kg/m²) doubles the risk of thrombosis due to increased concentration of factors VIII and IX, but not fibrinogen.^{7,15} Risk factors for thromboembolism in obese pregnant women must be assessed and prophylaxis should also be considered in case the risk is too high (past thromboembolism, thrombophilia, antiphospholipid syndrome, heart disease, smoking). Although recent guidelines recommend thromboprophylaxis in obese parturients, the lack of adequate prospective studies prevent a universal adoption of this measure. The arbitrary use of prolonged bed rest for obese pregnant women is a risk factor for venous thromboembolism. Despite the scarcity of gold-standard evidence, the prevalence of obesity and the associated risk of venous thromboembolism must be taken into account when considering the use of thromboprophylaxis in obese pregnant women. This is especially important in the presence of additional risk factors.¹⁵

Gestational diabetes and type 2 diabetes

Incidence of gestational diabetes mellitus (GDM) in obese women is three times higher than in the general population.^{16,17} During pregnancy, women undergo a physiological increase in insulin resistance, even those with appropriate weight. In obese pregnant women this physiological event is exacerbated and can lead to GDM. Moreover, the prevalence of pre-gestational type-2 diabetes (T2DM) is also higher in the obese population. For these reasons, it is recommended that obese pregnant women be submitted to early screening of fasting glucose, glycosylated hemoglobin and, if necessary, oral glucose tolerance test, in order to detect patients who may have been diabetic even before pregnancy but who did not have the diagnosis.^{17,18} Obese women with previous GDM are at a six times higher risk of developing T2DM in the future when compared with other women with the same antecedent.

Hypertension disorders and metabolic syndrome

Obesity is associated with insulin resistance and hyperinsulinemia, which may result in conditions such as hypertension, hyperlipidemia, degenerative heart disease, hyperuricemia, glucose intolerance, and T2DM. Hyperleptinemia, increased PAI-1 concentrations, micro or macroproteinuria and endothelial dysfunctions have also been reported. This group of diseases has been collectively described as “metabolic syndrome” and is commonly observed in gestations of obese women.

Maternal weight is an independent risk factor for preeclampsia. Specifically, women with a BMI > 30 kg/m² are two to three times more likely to develop preeclampsia. Evidence has shown that the risk of preeclampsia doubles for every additional 5 to 7 kg/m² in pregestational BMI.¹⁹ A previous pregnancy with preeclampsia complications is a major risk factor for the developing preeclampsia in a new pregnancy. Preeclampsia is also associated with increased long-term coronary heart disease.²⁰

Vitamin D Deficiency

Reduced concentrations of vitamin D - 25(OH)D - are frequently observed in obese individuals. One of

the causes of 25(OH)D deficiency in obese subjects may be connected to vitamin D deposits in the adipocytes, which reduces their bioavailability and activates the hypothalamus, which then develops a chain reaction resulting in increased hunger and lower energy expenditure. This situation also leads to an increase in PTH levels, with a consequent decrease in insulin sensitivity, a predisposing condition for type-2 diabetes and gestational diabetes during pregnancy.²¹⁻²³

In a recent review, vitamin D deficiency during pregnancy was associated with an increased risk of gestational diabetes, preeclampsia, newborns that are small for their gestational age and bacterial vaginosis. No increase was recorded in the rate of cesarean deliveries.

Obese women transfer less 25-OH D to the fetus than women with normal weight, even with similar serum levels. A recent study demonstrated that fetuses with low levels of 25(OH)D in their umbilical cord blood showed a high percentage of body fat. These new findings highlight the evolutionary relationships between maternal obesity, vitamin D nutritional status and neonatal adiposity, which may influence body weight and fat distribution in childhood and adult life.^{21,22} This is, however, still a controversial topic, and further studies are needed to elucidate forms of vitamin D replacement during pregnancy.

Delivery and puerperium

Prolonged labor is more likely for obese women, probably due to decreased myometrial tone.²⁴ Prevalence of surgical delivery is also higher for these patients, regardless of prenatal complications, fetal size or gestational age.²⁵ Factors that contribute to the high frequency of this delivery method are cephalopelvic disproportion and dystocia caused by more soft tissue being deposited in the maternal pelvis. Cesarean delivery is known to be associated with high risk of complications, such as wound infection, thromboembolism and endometritis, when compared to vaginal delivery. Due to the high prevalence of macrosomia, there is also a high risk of shoulder dystocia in vaginal deliveries in these patients, which can cause perineal lacerations and brachial plexus palsy in the newborn.^{24,25} While post-term delivery (41- 42 weeks) is also more likely among obese women, the mechanisms for this occurrence have not yet been elucidated.

Compared to the non-obese, obese mothers are at a higher risk of puerperal infection and prolonged

hospitalization (regardless of the mode of delivery). These patients also find breastfeeding more difficult, possibly due to reduced prolactin response upon suction in the first puerperal week.^{24,26}

Fetal, neonatal and long-term complications

Maternal obesity is associated with increased risk of perinatal mortality and genetic disorders, macrosomia and di-zygotic (not homozygous) twins even without induced ovulation. In the long term, macrosomic newborns of obese or diabetic mothers are more prone to develop childhood obesity, metabolic syndrome, type 2 diabetes and increased cardiovascular mortality in adult life.^{27,28}

Macrosomia

Fetal macrosomia is the most frequent complication in children of obese women, even for those who did not develop GDM.²⁹ There is a direct association between BMI and the risk of macrosomia due to increased insulin resistance in obese pregnant women, leading to fetal hyperinsulinemia, an important factor for intrauterine growth. In addition, placental lipases that cleave triglycerides are excessive in insulin resistant patients and transfer more free fatty acids to the fetus. The fetal environment is thus totally modified, with changes in the synthesis, secretion and action of leptin, affecting fetal adipocyte metabolism.^{27,28} Moreover, in the last weeks of pregnancy, more glucose, amino acids, and free fatty acids become available to the fetus, contributing to excessive fetal growth.²⁹

Congenital Anomalies

Congenital anomalies seem to occur more frequently in children of obese women.³⁰ The most relevant anomalies are neural tube defects, cardiac and abdominal wall abnormalities such as omphalocele. A possible explanation for this increased incidence of neural tube defects can be the interference of excessive fatty tissues in folate metabolism, so that the protective effect offered by folic acid is lost in these patients.

Long-term complications

There is considerable evidence that the complications of maternal obesity extend beyond intrauterine and neonatal life, reaching the adult age and causing a series of problems throughout life (Figure 2). Maternal obesity constitutes a risk for childhood obesity, regardless of birth weight, as well as for the development of metabolic syndrome and cardiovascular disease in adult life.^{27,28}

Obesity in childhood and adolescence has a long duration physical and psychological impact and increases morbidity and mortality in the population. An increase in prevalence of maternal obesity before and during pregnancy results in a vicious circle of obesity in subsequent generations. Thus, obese mothers give birth to obese daughters, who are at a greater risk of suffering from obesity and diabetes during their own pregnancies.^{27,28}

TREATMENT

Before pregnancy

Reaching normal weight before pregnancy is ideal, important not only for conception but also to avoid complications during pregnancy. Many women, however, do not plan their pregnancies, and even when they do, few of them manage reach their ideal weight before pregnancy, given that obesity treatments require changes in lifestyle, often regarded as a difficult task.³¹

Nevertheless, it is essential that obese women be properly informed about the risks of obesity, both for themselves and their children, as well as the benefits of weight loss. Treatment includes improved lifestyle, balanced diet and exercise. Drugs and bariatric surgery should be left as second and third line options. Low-calorie diet with adequate carbohydrate percentage, around 50% of total caloric consumption and adequate protein and monounsaturated fats ingestion reduce hyperinsulinemia. Practice of physical activity, especially aerobic exercise, results in weight loss, as well as in a reduction in triglycerides, glucose and insulin.^{32,33}

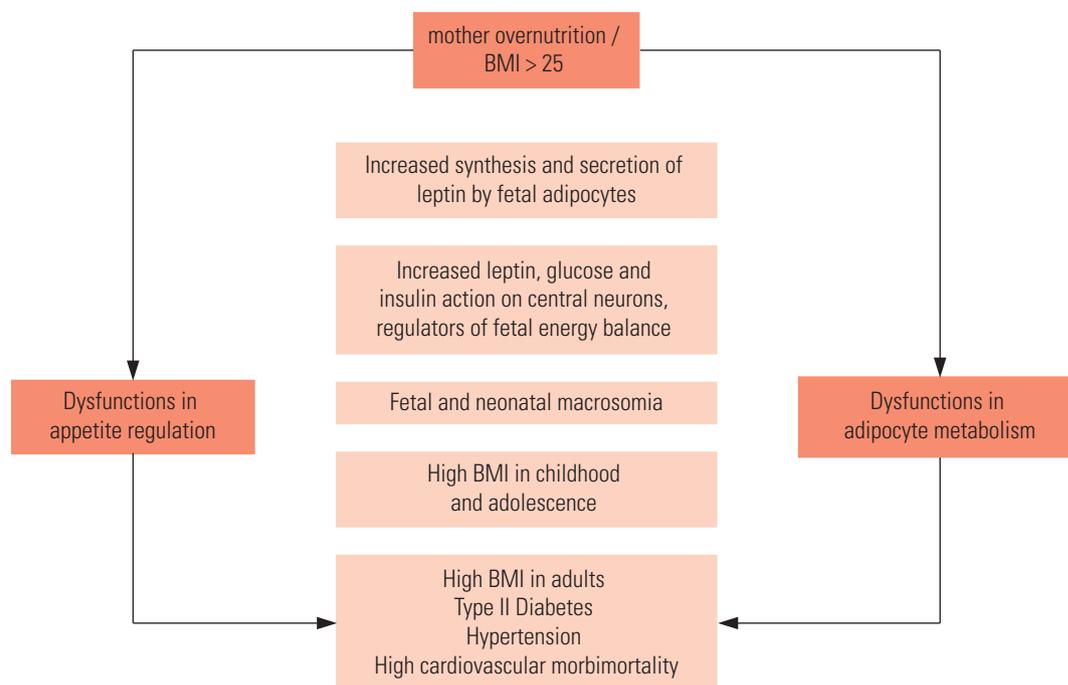


Figure 2 - Complications related to maternal overnutrition.

It is worthy to mention that women who submitted to bariatric surgery should avoid pregnancy during the rapid weight loss period, usually between 12 and 18 months after surgery, and should have thorough nutritional assessment with all the necessary supplementation before and during pregnancy.³³

During Gestation

Given the fact that obesity or excessive weight gain during pregnancy are important risk factors to both mother and fetus, and that women who gain excessive weight during pregnancy are three times more likely to maintain this excess after delivery and increase it further more in subsequent pregnancies, a balanced diet and supervised physical activity during and, if possible, before pregnancy, are strongly recommended.³⁰⁻³⁷ The focus during pregnancy is not on weight loss, but on ensuring adequate weight gain for each pregnant woman, based on pre-pregnancy BMI, so as to avoid excessive weight gain.

Beliefs supporting the view that pregnant women should “eat for two” are not scientifically proven. It is, however, essential that pregnant women are advised to follow a diet with high nutritional value, which includes all food groups, but with limited amounts of high-fat and high and glycemic index foods. At the

same time, whenever there is no medical or obstetric contraindication, moderate intensity aerobic exercise (such as walking at a brisk pace, swimming, cycling, circuits-training under heart rate supervision, etc.) has been proven beneficial. Moreover, given that physical activity reduces the risk of developing preeclampsia, intolerance to glucose, and gestational diabetes, overweight and obese women should be encouraged to adopt less sedentary lifestyles. Pregnancy is also an ideal time for other lifestyle changes, such as quitting smoking and following a healthy balanced diet. Mothers should be encouraged and motivated to consider these efforts as investments both in maintaining their own health, as well as their child's.³⁰⁻³⁷

After Gestation

The postpartum period is another crucial moment for women to adopt healthy habits that will allow them not only to lose excessive weight gained during pregnancy, but also to reach ideal weight before another pregnancy.^{24,31} However, the need to take care of the newborn baby, the psychological changes of the puerperal period and, very often, previous unsuccessful attempts to lose weight discourage women in their efforts. Support from whole family, from doctors and a team of nutritionists, psychologists, and physical

educators is necessary, so that women can reach and maintain this desirable change to a healthier lifestyle.

Although there has been substantial improvements in the treatment of maternal obesity, especially as part of a city government effort that established public gyms for obese pregnant women, more investment is needed to meet the needs of obese pregnant women, who must be closely followed up, not only during pregnancy, but also in the postnatal period.

GUIDELINES AND INTERVENTIONS

The stigma of obesity can be disturbing for many pregnant women, who must be cared for very carefully, sensitively, and respectfully.³¹ Some of the best recommendations are:

- obese women should be advised to lose weight before becoming pregnant;
- obese women should take a high dose of folic acid supplementation (5 mg/day) in the preconception period to reduce the risk of congenital malformations, especially neural tube defects;
- all pregnant women should have their height and weight accurately measured in their first prenatal visit. Their body mass index (BMI) should be properly calculated and recorded;
- obese women should have their arm circumference measured in their first prenatal visit. If the circumference is higher than 33 cm, a suitable cuff with a larger diameter should be used;
- women with a BMI >29.9 kg/m² should be assessed in their first visit and at subsequent times in order to detect possible gestational diabetes;
- obese women submitted to cesarean section should receive antibiotic prophylaxis and routine thromboprophylaxis. All obese women who are immobilized in the antepartum or postpartum period should receive thromboprophylaxis. Early mobilization of obese women in postpartum should be encouraged to prevent venous thromboembolism;
- obese women should be given extra support to help them start and continue breastfeeding;
- provided there is no obstetric contraindication, obese women should be encouraged to maintain physical exercise during and after pregnancy;
- maternities should be audited to determine whether the facility and equipments are suitable for the care of women with morbid obesity;

- although it is still a controversial practice, obese women should be given vitamin D supplementation, preferably started before pregnancy, when the dose of 25(OH) vitamin D is more reliable;
- after delivery, women should be reevaluated to ascertain whether gestational diabetes persists, with fasting glycemia and two hours after ingestion of 75 grams of dextrose, starting eight weeks postpartum.

CONCLUSIONS

Maternal obesity is a serious health risk to both mother and baby, and the higher the level of obesity the more it can impact on health. An unbalanced diet and a sedentary lifestyle both before and during pregnancy contribute not only for the development of an abnormal fetus, but also to increased morbidity and mortality in the neonatal period, during childhood, adolescence, and in adult life (“origins of the development of the disease in adults”). Systematic effort to reduce weight is imperative in order to avoid the transmission of obesity from generation to generation. Reaching that objective will much likely result in a marked decrease of neonatal and adult mortality and morbidity, and reduce obesity rates in future generations.

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