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Research Article

Obesity and Classification Grades Analyzed in Pregnant Women at the High-Risk Prenatal Clinic: What is their Importance?

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Abstract

Objective: Obesity is a frequent disease in pregnancy; however, the pathophysiological mechanisms that associate maternal obesity with unfavorable obstetric events during prenatal care, delivery and postpartum are not known, and therefore, adequate studies are lacking.

Methods: Documentary and exploratory study was carried out with data obtained during consultation from 370 medical charts of patients seen at the high-risk prenatal outpatient clinic in a primary care unit, a reference center for six other units, in the city of Barueri, Sao Paulo, Brazil. In prenatal care, the guidelines of the Stork Network Program (Programa Rede Cegonha) of the Ministry of Health were used and include a pregnancy risk and obesity stratification system for pregnant women.

Results: It was observed that 65% of the pregnant women were between 20 and 34 years old, 48.9% were white; most were in their first pregnancy. The mean gestational age at birth was 37.9 weeks. At the beginning of gestation, the women weighed an average of 71.2 kilograms, with a height of 159 cm and Body Mass Index (BMI) of 27.9 kg/m2. BMI with overweight or obesity prepregnancy had a lower risk of having a low-birth-weight NB (62% and 69%, respectively) when compared to pregnant women of adequate weight. Cesarean delivery prevailed, and among women with morbid obesity, the cesarean section rate was 90%.

Conclusion: Epidemiological knowledge of this population is important for proposing policies to control chronic diseases that may affect pregnancy and to adjust the risk stratification according to the local reality.

Keywords: High-risk pregnancy; Prenatal care; Obesity; Maternal risk factors; Prematurity; Cesarean section

Abbreviations

PN: Prenatal Period; HRPC; High-Risk Prenatal Care; AIDS: Immunodeficiency Syndrome; BMI: Body Mass Index; GA: Gestational Age; NB: Newborns; SPSS: Statistical Package for the Social Sciences; WHO: World Health Organization; IOM: Institute of Medicine

Introduction

In a woman's life, pregnancy is a physiological phenomenon that typically has an uneventful progression and comes to an end, requiring only follow-up and simple procedures. Thus, under "normal" physiological conditions (absence of diseases), prenatal care may be performed in primary care units or family health units, as these pregnant women are considered low- or usual-risk [1]. In contrast, some pregnant women already have a diagnosis of some disease or will present some complication during pregnancy, requiring specific care and more complex procedures. This population is called high-risk pregnant women [1,2].

According to the Brazilian Ministry of Health, the definition of a high-risk pregnancy shows that "the life or health of the mother, and/or the fetus, and/or the newborn are more likely to be affected than when considering the average population" [3]. Considering this definition, knowledge of maternal risk factors may be a determinant for reducing the risk to fetal life; however, there may be a risk to fetal or newborn life that does not involve a risk to maternal life. Thus, there may be high-risk fetuses and newborns that do not necessarily cause greater risk to pregnant women. Consequently, the health team should be aware of the risk factors, and this evaluation should be made frequently and dynamically throughout the Prenatal (PN) period [4].

After committing to achieve the Millennium Development Goals, Brazil has made progress in reducing infant mortality, but the target established for reduced maternal mortality has not been reached, despite good progress in indicators and the positive impact of public policies. The infant mortality rate (in less than one year) per 1000 live births decreased from 29.7 in 2000 to 15.6 in 2010, with the target for 2015 set at 15.7, so the goal was reached four years earlier. The maternal mortality ratio was 141 per 100,000 live births in 1990 and fell to 68 per 100,000 live births in 2010. Between January and

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September 2011, maternal mortality declined 21%. From 2003 to 2010, the number of pregnant women with seven or more prenatal visits increased by 12.5%, and the proportion of Brazilian mothers with no visits was reduced from 4.7 to 1.8%. In 2011, more than 1.7 million pregnant women had at least seven prenatal visits (Saúde).

Given the above, although the specialized literature provides data on the reason for referral to High-Risk Prenatal Care (HRPC), there is no information about which and how many diseases may be associated with the course of pregnancy. The importance of some high-risk diseases such as obesity, although known, has been neglected, resulting in delayed referral to and follow-up in HRPC and, consequently, delay in adequate care to the pregnant woman, possibly leading to an undesirable outcome. Obesity in pregnancy, among other diseases, is a predisposing factor for diabetes, hypertension, and infections, which are among the main causes of prematurity and anticipation of cesarean delivery. Children of obese mothers also exhibit a high incidence of obesity in the future. Therefore, knowledge of the profile of pregnant women by health managers, together with a structured care network known by health professionals and the population, would allow the municipality to optimally allocate funds, increase the quality of life to the population and decrease maternal and fetal risk.

Methods

Study population

The present was a retrospective study with documentary and exploratory analysis in medical charts. A total of 500 medical charts were evaluated, and 370 charts were selected of pregnant women who were referred from six primary care units to the reference HRPC outpatient clinic in the city of Barueri during the period from August 2010 to April 2012. The study participants were recruited for a period of time (20 months) using nonprobabilistic convenience sampling. Data from the medical charts of patients referred to the outpatient clinic were included in the sample, after reassessment of risk and continuation of prenatal follow-up. Pregnant women with Acquired Immunodeficiency Syndrome (AIDS), with a dead fetus, at normal risk and who were in labor were excluded. For statistical analysis, obesity grade I and II and adolescents aged 15 years and over were considered only as conditions of vulnerability. The data collected by the responsible doctor in the outpatient clinic refer to the period from the first prenatal visit until the puerperal visit. One of the limiting factors of data collection was the need to change the standard information for educational level and family income, and these data were excluded. At the end of this period, the data were compiled and organized into Excel spreadsheets. This study was submitted to and approved by the Ethics and Research Committee of the University of Mogi das Cruzes under CAAE n. 54955616.0.0000.5497.

Study variables

At the beginning of prenatal care, the following parameters were evaluated: race, age, marital status, smoking, weight, height, prepregnancy Body Mass Index (BMI), number of pregnancies, parity, number of miscarriages, and probable delivery date. At the beginning of HRPC, the evaluated parameters were the Gestational Age (GA), number of normal risk prenatal visits, BMI, and BMI according to GA (according to the modified standard of Atalah et al. [5]). Postpartum, the GA at birth, date of birth, outcome and/or mode of delivery (cesarean section, vaginal delivery or miscarriage), and live Newborns (NB) weight were determined.

Statistical analysis

The data were first analyzed descriptively. Absolute and relative frequencies were used for the categorical variables and summary measures (mean, quartiles, minimum, maximum, and standard deviation) for the numerical variables. For the determination of associations between two categorical variables, the Chi-Square test was used; alternatively, in cases of small samples, Fisher's exact test was used. To form homogeneous groups of pregnant women according to the diseases, cluster analysis for categorical data was used (two-step cluster analysis) [6]. For interpretation of the patterns of similarities found by cluster analysis, it was fundamental to evaluate the behavior of the original variables within each group. It was sought to identify those that most distinguished a certain group from the others, verifying the consistency of the results with the nature of the phenomenon or process studied. This analysis was performed by determining the association between the groups formed and each one of the obstetric complications, diseases or risk factors. To evaluate the simultaneous effects of age group, obesity and disease or risk factors (predictor variables) on low birth weight, mode of delivery and preterm birth (dependent variables), a logistic regression analysis was performed. Due to the large number of predictor variables given the sample size, the variables whose associations with each of the dependent variables were significant at 20% in the univariate analysis were selected for the initial models. Then, the nonsignificant variables at 5% were excluded one by one in order of significance (backward method). In addition, goodness-of-fit of the final model was evaluated *via* the Hosmer and Lemeshow test. A significance level of 5% was adopted for all statistical tests. Statistical analyses were performed using the statistical software SPSS 20.0.

Results

The data from 370 medical charts were evaluated. The parturients had a mean age of 29.1 ± 7.5 years, with a minimum age of 13 and maximum of 45 years. Table S1 presents the sociodemographic and behavioral characteristics of the pregnant women whose charts were consulted. Of the parturients, 65% were between 20 and 34 years of age, nearly half were white (48.9%), 81.1% were in a stable union (married or cohabitating) and 90.3% did not smoke. Most were in their first pregnancy (30.3%), had never given birth (33.8%) and had not had miscarriages (77.3%).

Table 1 shows that 37.3% of the women presented adequate prepregnancy BMI, 55% had cesarean delivery, 16.7% of the NBs were born preterm, and 15.5% of the NBs had low birth weight. The mode of delivery that prevailed was cesarean section (55%). Regarding the gestational age at birth, 82% of the pregnant women delivered at 37 weeks or more, and of the preterm deliveries (16.7%), only 3.3% were extremely preterm.

Table S1 presents the anthropometric data, medical follow-up and gestational age from the charts of the analyzed pregnant women. The mean gestational age at birth was 37.9 weeks. On average, the parturients were 29.1 years old and weighed 71.2 kilograms, with a height of 159 cm and a BMI of 27.9 kg/m^2. The women averaged 9.7 total prenatal visits and 6.8 HRPC visits. The gestational age at the

Table 1: Prepregnancy and pregnancy BMI, gestational age at the end of pregnancy, pregnancy outcome and newborn weight (n=370).

	n	%
BMI classes	370	100,0
< 18.5	5	1.4
18.5 a 24.9	138	37.3
25 a 29.9	114	30.8
30 to 34.9	55	14.9
35 to 39.9	36	9.7
> 40	22	5.9
BMI-Atalah	370	100
Low weight	32	8.6
Adequate	113	30.5
Overweight	116	31.4
Obese	109	29.5
Final gestational age	367	100
< 20	5	1.4
20-31	12	3.3
32-36	49	13.4
37 and over	301	82
Unknown	3	
Pregnancy outcome	364	100
Miscarriage	2	0.5
Cesarean delivery	199	54.7
Cesarean – fetal death	1	0.3
Forceps	2	0.5
Vaginal delivery	156	42.9
Vaginal – fetal death	3	0.8
Fetal death*	1	0.3
Unknown	6	
Newborn weight	361	100
< 2,500	56	15.5
< 2,500 and > 3,000	68	18.8
>3,000 and < 3,500	157	43.5
>3,500	80	22.2
Unknown	9	

n: Number of Cases; %: Percentage; BMI-Prepregnancy: Prepregnancy Body Mass Index; BMI-Atalah: Body Mass Index in Pregnancy in According to Atalah's Classification; Final gestational age: gestational age at the end of pregnancy; *maternal and fetal death, resulting in no delivery

start of prenatal care was 10.7 weeks and at the start of HRPC was 20.8 weeks [7]. Describes the most frequent obstetric pathologies, diseases or risk factors (at least 10 cases) found in the medical charts of the 370 pregnant women studied, and a pregnant woman may have one or more of these. Chronic hypertension (22.7%), gestational diabetes (15.1%), preeclampsia (9.5%), previous cesarean sections (8.4%) and hypothyroidism (6.2%) were the five most prevalent diseases or risk factors.

In Table S2, all obstetric complications, diseases or risk factors were considered for analysis, except those related to obesity, low weight, age and low risk to determine which of these were more frequently associated with each other. Thus, the analysis of the typologies of pregnant women regarding obstetric complications, diseases or risk factors was distributed into three groups.

Table S3 shows a fetal death with no description of mode of delivery, as there was maternal death before delivery. There was only an association between groups and the variables BMI in classes (p=0.022) and BMI-Atalah (p=0.006). Group 2 (preeclampsia, asthma, twin pregnancy, intrauterine growth restriction, oligohydramnios, placenta previa and toxoplasmosis) showed a higher percentage of pregnant women with BMI between 18.5 and 24.9 (43.9% *vs.* maximum 33.8%) and with low weight (12.9% versus maximum 8.8%) compared to the other groups. Group 3 (chronic arterial hypertension, previous cesarean, hypothyroidism, poor obstetric history, threat of miscarriage, depression, sexually transmitted disease, fetal malformation, epilepsy, habitual miscarriage and hepatitis) had the highest percentage of women with a BMI above 30 (39.7% versus a maximum of 31.4%) and BMI-Atalah classified as obese (39.0% *versus* a maximum of 30.4%) in relation to the other groups.

Table 2 shows the association among obstetric complications, diseases or risk factors with low birth weight, and variables that obtained statistical significance. There were associations among low birth weight and obstetric complications, diseases or risk factors, intrauterine growth restriction (p=0.003), twin pregnancy (p<0.001), and chronic arterial hypertension (p=0.001). Thus, women with intrauterine growth restriction had higher percentages of NBs with low birth weight (54.5% *vs.* 14.3%) compared to those without this disease. Likewise, higher percentages of NBs with low birth weight were observed for those with twin pregnancies (57.9% *vs.* 13.2%) and chronic arterial hypertension (27.2% *vs.* 12.1%) compared to women without these conditions.

Considering the results found, a logistic regression model was fit with low birth weight as dependent variable and BMI in classes, intrauterine growth restriction, gestational diabetes, twin pregnancy, chronic arterial hypertension and previous cesarean as explanatory variables (associated with success at a significance level of 20% in the univariate analysis). In this section, the odds ratio consists of the quotient between the probability of a woman having a low-birth-weight NB and the probability of not having such a condition. Table 3 presents the results of the initial and final models. The final model presented a good fit according to the Hosmer and Lemeshow test (p=0.930). BMI in classes (p=0.014), intrauterine growth restriction (p=0.001), twin pregnancy (p<0.001), and chronic arterial hypertension (p<0.001) remained significant in the final model. Thus, the odds of low-birth-weight NBs in women with BMIs between 25 and 29.9 kg/m^2 were 62% lower than that of women with a BMI between 18.5 and 24.9 (reference category). This chance was 69% lower for women with a BMI above 30 kg/m^2. There were no differences in the odds of low-birth-weight NBs between women with a BMI <18.5 and women with a BMI between 18.5 and 24.9. A similar pattern was observed for women with a BMI greater than 40 kg/m^2.

With regard to diseases, it was found that women with intrauterine growth restriction had a 9.7 times higher chance of having a low birth

Table 2: Distribution of pregnant women according to low birth weight.

	Newborns with Low Weight				Total		p
	Yes		No				
	n	%	n	%	n	%	
Intrauterine growth restriction	56	15.5	305	84.5	361	100	0.003
No	50	14.3	300	85.7	350	100	
Yes	6	54.5	5	45.5	11	100	
Twin pregnancy	56	15.5	305	84.5	361	100	< 0.001
No	45	13.2	297	86.8	342	100	
Yes	11	57.9	8	42.1	19	100	
Chronic arterial hypertension	56	15.5	305	84.5	361	100	0.001[a]
No	34	12.1	246	87.9	280	100	
Yes	22	27.2	59	72.8	81	100	
Diseases/risk factor group	56	15.5	305	84.5	361	100	0.097[a]
G1	10	9.8	92	90.2	102	100	
G2	26	20.2	103	79.8	129	100	
G3	20	15.4	110	84.6	130	100	

P: Significance Level of Fisher's exact test or Chi-square test ([a]); n: Number of Cases; %: Percentage; G1: Group 1; G2: Group 2; G3: Group 3.

Table 3: Results of the initial and final models for low birth weight.

	Initial Model		Final Model	
	Odds Ratio (95% CI)	p	Odds Ratio (95% CI)	p
BMI classes (ref. = 18.5 to 24.9)				
< 18.5	3.81 (0.5 - 29.01)	0.196	3.70 (0.48 - 28.26)	0.207
25 to 29.9	0.38 (0.16 - 0.90)	0.027	0.38 (0.17 - 0.89)	0.026
≥ 30	0.31 (0.13 - 0.76)	0.011	0.31 (0.12 - 0.75)	0.01
Intrauterine growth restriction	9.01 (2.25 - 36.04)	0.002	9.66 (2.45 - 38.06)	0.001
Gestational diabetes	0.65 (0.23 - 1.89)	0.431	-	ns
Twin pregnancy	20.32 (6.72 - 61.46)	< 0.001	19.45 (6.5 - 58.19)	< 0.001
Chronic arterial hypertension	7.73 (3.4 - 17.61)	< 0.001	8.25 (3.64 - 18.67)	< 0.001
Previous cesarean	2.35 (0.87 - 6.35)	0.092	-	ns

n -number of cases (N = 361); BMI in classes: Prepregnancy Body Mass Index; ns: Not Significant.

weight than those without this condition. For women with twin pregnancies, this chance was 19.5 higher, while women with chronic arterial hypertension had a 8.3-fold higher chance.

Table S4 presents the association among obstetric complications, diseases or risk factors with mode of delivery and variables that obtained statistical significance. Associations were found among mode of delivery and age group (p=0.010), BMI in classes (p<0.001), BMI-Atalah (p<0.001) and the complications risk of preterm birth (p=0.032), diabetes (p=0.019), sexually transmitted disease (p=0.048), twin pregnancy (p=0.002), and chronic arterial hypertension (p<0.001). Thus, it was observed that adolescents (up to 14 years of age) had a greater percentage of vaginal deliveries (88.9% against up to 60%) compared to that of the other age groups. With respect to BMI, there was a higher percentage of cesarean delivery among women with a BMI greater than 40 kg/m^2 (90.0% *vs.* 64.8%). Corroborating this result, higher percentages of vaginal deliveries (71.9% and 52.2%, respectively) were observed in women with low or adequate weight in the BMI-PN, as opposed to obese women, who had a higher rate of cesarean section (68.3%).

With respect to diseases or obstetric complications, women with diabetes, twin pregnancy, chronic arterial hypertension, and previous cesarean-presented higher percentages of cesarean delivery compared to women without these problems. An inverse pattern was observed for women at risk of preterm birth and sexually transmitted disease. According to Table 4, BMI in classes - 30 to 34.9 (p=0.047) and above 40 kg/m^2 (p=0.005), twin pregnancy (p=0.002), chronic arterial hypertension (p = 0.002) and myoma (p=0.030) remained in the final model. Thus, the chances of cesarean delivery were 2.0 and 8.5 times higher among women with a BMI of 30 to 34.9 kg/m^2 and above 40 kg/m^2, respectively, than those of women with a BMI between 18.5 and 24.9 (reference category). There were no differences in the odds ratio of the other age groups compared to women with a BMI between 18.5 and 24.9. With regard to obstetric complications and diseases, the chances of cesarean delivery were higher in women

Table 4: Results of the initial and final models for mode of delivery.

	Initial Model		Final Model	
	Odds ratio (95% CI)	p	Odds ratio (95% CI)	p
Age group (ref. = 20 to 34 years)				
Up to 14 years	0.22 (0.03 - 1.89)	0.169	-	ns
15 to 19 years	0.71 (0.28 - 1.82)	0.477	-	ns
35 years and over	1.15 (0.66 - 2.00)	0.632	-	ns
Prepregnancy BMI (ref. = 18.5 to 24.9)				
< 18.5	0.65 (0.06 - 7.60)	0.735	0.29 (0.03 - 2.91)	0.291
25 to 29.9	1.19 (0.36 - 3.94)	0.77	1.62 (0.95 - 2.75)	0.076
30 to 34.9	2.24 (0.16 - 32.09)	0.553	2.01 (1.01 - 3.99)	0.047
35 to 39.9	1.90 (0.11 - 32.34)	0.657	1.45 (0.63 - 3.34)	0.385
> 40	9.45 (0.42 - 210.88)	0.156	8.77 (1.89 - 40.62)	0.005
BMI-PN (ref. = adequate)				
Low weight	0.56 (0.2 - 1.52)	0.255	-	ns
Overweight	0.96 (0.29 - 3.18)	0.951	-	ns
Obese	0.58 (0.04 - 8.90)	0.696	-	ns
Threat of preterm birth	0.47 (0.14 - 1.56)	0.218	-	ns
Gestational diabetes	1.26 (0.66 - 2.41)	0.49	-	ns
Gestational hypertension	2.02 (0.88 - 4.63)	0.098	-	ns
Sexually transmitted disease	0.22 (0.02 - 1.96)	0.175	-	ns
Twin pregnancy	10.54 (2.3 - 48.23)	0.002	10.47 (2.34 - 46.75)	0.002
Chronic arterial hypertension	2.74 (1.44 - 5.18)	0.002	2.63 (1.44 - 4.83)	0.002
Myoma	3.85 (1.12 - 13.29)	0.033	3.83 (1.14 - 12.87)	0.03
Polyhydramnios	2.73 (0.87 - 8.55)	0.084	-	ns

n = 360, respectively, for the initial and final model; ns - not significant; prepregnancy BMI: Prepregnancy Body Mass Index; BMI-PN: Prenatal Body Mass Index.

with twin pregnancy, chronic arterial hypertension and myoma than those in women without these conditions (10.5, 2.6 and 3.8 times higher, respectively).

Table S5 presents associations observed between preterm delivery and BMI-PN (p=0.015), habitual miscarriage (p=0.019), threat of premature delivery (p=0.010), twin pregnancy (p<0.001), chronic arterial hypertension (p=0.018) and oligohydramnios (p=0.038). Thus, women with adequate BMI-Atalah had a greater percentage of preterm labor (27.4% *versus* a maximum of 15%) compared to the other women. With respect to obstetric complications or diseases, women with habitual miscarriage, threat of preterm birth, twin pregnancy, chronic arterial hypertension and oligohydramnios had higher rates of preterm birth compared to women without these conditions. Next, a logistic regression model was fit with preterm delivery as dependent variable and BMI-Atalah, habitual miscarriage, iron deficiency anemia, asthma, preterm delivery, depression, twin pregnancy, chronic arterial hypertension, hepatitis, previous cesarean, oligohydramnios and rubella as explanatory variables (associated with success at a significance level of 20% in the univariate analysis). Kidney stone was not included in the model because it was deterministic -100% of the women with this pathology had full-term infants. BMI was not included in the model to avoid multicollinearity with BMI-Atalah.

Table 5 presents the results of the initial and final model (odds ratio for preterm delivery). The final model presented a good fit according to the Hosmer and Lemeshow test (p=0.443). BMI-Atalah (p=0.005), preterm delivery (p=0.003), depression (p=0.018), twin pregnancy (p<0.001), chronic arterial hypertension (p<0.001) and oligohydramnios (p=0.011) remained significant in the final model. Age group, although not significant, was maintained in the model as a control variable.

Thus, the chance of having a premature NB was 68% lower in overweight women than that in women with adequate BMI (reference category). This chance was 70% lower for obese women. There was no difference in odds ratio between women of low weight and adequate weight. With regard to obstetric complications or diseases, it was found that the chances of having a premature NB in women with threat of premature delivery, depression, twin pregnancy, chronic arterial hypertension and oligohydramnios were 5.7; 7.2; 13.1; 4.9 and 7.7 times higher, respectively, than those of women without these conditions.

Discussion

One of the goals of the HRPC clinic is to reduce preterm births and low birth weights to decrease the risk of death in the neonatal period, which may be associated with adequate prenatal care. For the

Table 5: Results of the initial and final models for preterm delivery.

	Initial Model		Final Model	
	Odds ratio (95% CI)	p	Odds ratio (95% CI)	p
Age group (ref. = 20 - 34 years)				
Up to 14 years	0.84 (0.07 - 9.93)	0.89	1.64 (0.11 - 24.40)	0.721
15 to 19 years	0.56 (0.11 - 2.93)	0.495	2.57 (0.53 - 12.33)	0.239
35 years and over	1.00 (0.49 - 2.04)	0.998	2.68 (0.52 - 13.84)	0.238
BMI-Atalah (ref. = adequate)				
Low weight	0.22 (0.05 - 0.99)	0.048	0.27 (0.07 - 1.09)	0.066
Overweight	0.30 (0.13 - 0.68)	0.004	0.32 (0.15 - 0.68)	0.003
Obese	0.33 (0.14 - 0.78)	0.012	0.30 (0.13 - 0.70)	0.005
Habitual miscarriage	16.23 (1.55 - 169.57)	0.02	-	ns
Iron deficiency anemia	0.23 (0.03 - 2.10)	0.193	-	ns
Asthma	0.51 (0.06 - 4.12)	0.528	-	ns
Threat of premature delivery	9.58 (2.8 - 32.76)	<0.001	5.71 (1.82 - 17.91)	0.003
Depression	5.56 (0.92 - 33.56)	0.061	7.15 (1.40 - 36.61)	0.018
Twin pregnancy	18.24 (5.90 - 56.34)	<0.001	13.1 (4.47 - 38.40)	<0.001
Chronic arterial hypertension	5.39 (2.36 - 12.28)	<0.001	4.94 (2.30 - 10.62)	<0.001
Hepatitis	12.67 (1.49 - 107.50)	0.02	-	ns
Previous cesarean	3.22 (1.23 - 8.42)	0.017	-	ns
Oligoamnios	10.97 (2.11 - 57.17)	0.004	7.74 (1.58 - 37.88)	0.011
Rubella	37.09 (2.69 - 511.49)	0.007	-	ns

n = 366; ns: Not Significant; BMI-Atalah: Prenatal Body Mass Index.

most part, the pregnant women studied reached a GA of 37 weeks or more, and 15% had NBs weighing less than 2,500 g. Patients seen at the HRPC clinic had a cesarean section rate of 55%, a number far from that recommended by the WHO but close to the general population of the municipality. In this sense, because it is a HRPC outpatient clinic, higher rates of cesarean delivery were expected, and values close to the general population were obtained; this outcome can certainly be considered a positive factor for the prenatal follow-up of Barueri.

Recent studies have reported that overweight and obese women are at increased risk for spontaneous miscarriage, preterm birth, and congenital abnormalities [8-10]. These findings led us to analyze, in the present study, if there was also a possible correlation with the reasons for referral, as obesity could be related to a higher incidence of preeclampsia, chronic arterial hypertension, gestational diabetes, urine tract infections and depression, when compared with patients with adequate weight [9,11]. Unexpectedly, the present study found that more than half of the women were above normal weight, one patient had a BMI of 51.4, the mean BMI was 27.9, and the 3rd quartile was 31.5. Thus, according to the methods proposed by the Ministry of Health, in the present study, the majority of the women had a BMI considered adequate or overweight, having as reference the Atalah chart. Obesity was identified with close values in both methods, and morbid obesity (grade III) was present in 5.9% of the patients; however, the recommendations proposed by the Ministry of Health did not categorize obesity into different classes, and thus, it was not possible to compare the outcome of a pregnant woman with grade I obesity (BMI of 30 to 34.9 kg/m^2) and morbid obesity (BMI >40 kg/m^2) and to further assume that the risk in this class is higher. The WHO estimates that 23% of women in Europe [12] and 28.9% of women in the United States are obese; of this total, 8% are morbidly obese [13]. Obesity in pregnancy increases the incidence of gestational diabetes three-fold compared to the general population, and there is consistent evidence that the risk of preeclampsia doubles with each increase of 5 kg/m^2 to 7 kg/m^2 in the prepregnancy BMI [8,14].

In the present study, the incidence of pregnant women with morbid obesity was similar to that of the general population of the United States, and although it is an important risk factor in the chart proposed by Atalah et al. [5], there are no conditions for monitoring weight gain for follow-up of pregnant women with morbid obesity (BMI >40 kg/m^2). This factor would be relevant for the adequate follow-up of pregnant women [15], considering that the rate of morbid obesity has been increasing in Brazil. Thus, only the IOM recommendation of a total weight gain of five to nine kilos in pregnancy would be applied to this group of patients [16], a fact that is questioned by some researchers. In this respect, a study that followed women with grade II and III obesity found that weight gain below that recommended by the IOM was only associated with low-birth-weight NBs when the pregnant women lost more than 4.5 kg during pregnancy. That is, pregnant women who gained less than 5 kg and lost up to 4.5 kg would be associated with lower rates of pre-eclampsia, cesarean sections and large NB for gestational age [17].

Patients who presented prepregnancy BMI with overweight or

obesity had a lower risk of having a low-birth-weight NB (62% and 69%, respectively) when compared to pregnant women of adequate weight. Cesarean delivery prevailed, and among women with morbid obesity, the cesarean section rate was 90%. Women who were overweight and obese at the beginning of the prenatal care (BMI-Atalah) presented a lower chance of having a low-birth-weight NB compared to those of adequate weight; this outcome is confirmed by a recent study in fetuses followed-up during prenatal care by serial ultrasound. That study found that starting at a GA of 32 weeks, the fetuses of obese women had higher weights than those of fetuses of nonobese women [18]. However, this finding does not reflect a positive factor, since children from obese mothers who were born large for gestational age are at higher risk for childhood obesity and have twice the risk of developing insulin resistance [19].

BMI plays a fundamental role in patients who wish to become pregnant and who should therefore be instructed to maintain adequate weight, although BMI was neglected as a risk factor because in the present study, it was the primary reason for referral to the HRPC clinic in only 10 patients (2.7% of the 370 analyzed charts). According to a previous study, lifestyle interventions only help modestly [10], and patients who become pregnant outside of the adequate weight should be followed up by professionals who can guide them through pregnancy for a healthier progress. Although monitoring weight gain does not meet the current reality, there are no other studies in pregnant women with morbid obesity that can serve as a guideline with ease of application and low cost; thus, there is opportunity for further studies monitoring weight gain in obese and especially in morbidly obese pregnant women. In this respect, the present study reinforces the importance of the inclusion of obesity, with its different grades of classification, in the stratification of prenatal risk. It also emphasizes the importance of recognizing the complications clinical, surgical and obstetric that are associated with obesity to minimize the damage to reproductive health and the obstetric future of women and to minimize future damage to the mother-child binomial. Investing in public health policies that can help modify the lifestyle and decrease the incidence of obesity may lead to a decrease in the cost of assisted reproduction (infertility treatment, artificial insemination, among others), obstetric complications (higher number of cesarean sections, infections) and follow-up of high-risk NBs (malformations and childhood obesity, among others).

Conclusion

Taken together, the results of this study demonstrated that, considering the profile of the population studied and the associations found, morbid obesity should be considered a disease requiring referral to and follow-up in a high-risk prenatal care outpatient clinic. Pregnant women with morbid obesity do not have a reference that can guide the follow-up of their weight gain. In addition, understanding the epidemiological profile of the patients is important for the development of public policies and the direction of funds towards health prevention to decrease the cost of health care, which has become much more expensive.

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Contributions

Oliveira, P.R participated in the design, the draft and in the revision of the study; Oliveira, A.B. and Silva, T.R.C. participated in the revision of the manuscript; Batista, M.L. Jr. conceived the study and participated in its design, its coordination and in the drafting of the manuscript. All of the authors read and approved the final manuscript.

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