

Nutritional status of pregnant women: prevalence and associated pregnancy outcomes

Estado nutricional de gestantes: prevalência e desfechos associados à gravidez

Luciana Bertoldi Nucci^a, Maria Inês Schmidt^a, Bruce Bartholow Duncan^a, Sandra Costa Fuchs^a, Eni Teresinha Fleck^b and Maria Margarida Santos Britto^c

^aDepartamento de Medicina Social da Faculdade de Medicina da Universidade Federal do Rio Grande do Sul. Porto Alegre, RS, Brasil. ^bCentro de Ciências da Saúde da Universidade de Fortaleza. Fortaleza, CE, Brasil. ^cFaculdade de Medicina da Universidade Federal da Bahia. Salvador, BA, Brasil

Keywords

Obesity.[#] Pregnancy complications.[#]
Body mass index.[#] Nutritional status.[#]
Prevalence. Prenatal care. Risk factors. Brazil.

Abstract

Introduction

Although obesity is well recognized as a current public health problem, its prevalence and impact among pregnant women have been less investigated in Brazil. The objective of the study was to evaluate the impact of pre-obesity and obesity among pregnant women, describing its prevalence and risk factors, and their association with adverse pregnancy outcomes.

Methods

A cohort of 5,564 pregnant women, aged 20 years or more, enrolled at approximately 20 to 28 weeks of pregnancy, seen in prenatal public clinics of six state capitals in Brazil were followed up, between 1991 and 1995. Prepregnancy weight, age, educational level and parity were obtained from a standard questionnaire. Height was measured in duplicate and the interviewer assigned the skin color. Nutritional status was defined using body mass index (BMI), according to World Health Organization (WHO) criteria. Odds ratios and 95% confidence interval were calculated using logistic regression.

Results

Age-adjusted prevalences (and 95% CI) based on prepregnancy weight were: underweight 5.7% (5.1%-6.3%), overweight 19.2% (18.1%-20.3%), and obesity 5.5% (4.9%-6.2%). Obesity was more frequently observed in older black women, with a lower educational level and multiparous. Obese women had higher frequencies of gestational diabetes, macrosomia, hypertensive disorders, and lower risk of microsomia.

Conclusions

Overweight nutritional status (obesity and pre-obesity) was seen in 25% of adult pregnant women and it was associated with increased risk for several adverse pregnancy outcomes, such as gestational diabetes and pre-eclampsia.

Resumo

Introdução

A obesidade é um problema atual de saúde pública, com repercussões na gravidez. Pouco se sabe sobre sua prevalência em gestantes brasileiras. Assim, realizou-se estudo com o objetivo de avaliar o impacto da obesidade e da pré-obesidade na gravidez, descrevendo sua prevalência, fatores de risco e sua associação com complicações da gestação.

Descritores

Obesidade.[#] Complicações na gravidez.[#] Índice de massa corporal.[#] Estado nutricional.[#] Prevalência. Cuidado pré-natal. Fatores de risco. Brasil.

Correspondence to:

Luciana Bertoldi Nucci
Rua da Granja Julieta, 9/34
04721-060 São Paulo, SP, Brasil
E-mail: lbnucci@terra.com.br

Partial supported by "Ministério da Saúde"; "Programa de Apoio a Núcleos de Excelência" (PRONEX, Process nº 661041/1998-4); "Conselho Nacional de Desenvolvimento Científico e Tecnológico" (CNPq, Process nº 520368/95-9); "Fundação de Apoio à Pesquisa do Rio Grande do Sul" (FAPERGS); ; Organização Pan-Americana da Saúde (OPAS); Fundo de Incentivo à Pesquisa (FIPE, Process nº 97217 do Hospital de Clínicas de Porto Alegre, and Bristol-Myers Squibb Foundation.

Submitted on 5/4/2001. Reviewed on 29/8/2001. Approved on 27/9/2001.

Métodos

Uma coorte de 5.564 gestantes, com idade maior ou igual a 20 anos, com 20 a 28 semanas de gestação, atendidas em serviços de pré-natal geral do Sistema Único de Saúde em seis capitais brasileiras, foram seguidas entre 1991 e 1995. Medidas de peso pré-gravídico, idade, escolaridade e paridade foram obtidas mediante entrevistas utilizando-se questionário padronizado. A altura foi medida em duplicata, e a cor da pele, descrita pelo entrevistador. O estado nutricional foi estabelecido a partir do índice de massa corporal (IMC), utilizando-se os critérios da Organização Mundial da Saúde. Razão de chances e intervalo de confiança de 95% foram calculados por meio de regressão logística.

Resultados

As prevalências (IC95%) ajustadas para idade foram: magreza ($IMC \leq 18,5 \text{ kg/m}^2$), 5,7% (5,1%-6,3%); pré-obesidade ($25 \leq IMC < 30 \text{ kg/m}^2$), 19,2% (18,1%-20,3%); e obesidade ($30 \leq IMC \text{ kg/m}^2$), 5,5% (4,9%-6,2%). A obesidade foi mais freqüente em mulheres mais velhas, negras, com menor grau de escolaridade e múltiparas. Mulheres obesas apresentaram risco maior para diabetes gestacional, macrosomia, distúrbios hipertensivos, e menor risco para microsomia.

Conclusões

Sobrepeso (pré-obesidade ou obesidade) ocorreu em 25% das gestantes adultas estudadas e associou-se a vários riscos de complicações de gravidez, como diabetes gestacional e pré-eclâmpsia.

INTRODUCTION

According to the World Health Organization (WHO), the increased frequency of obesity in many countries can be characterized as a pandemic of major public health concern.¹³ Maternal nutritional status is an important determinant of pregnancy outcomes since prepregnancy underweight has been traditionally considered a risk factor for adverse gestation outcomes.³ Obesity also increases pregnancy complications, such as gestational diabetes, hypertensive disorders, and perinatal morbimortality.¹²

Brazil is a heterogeneous country regarding its population characteristics, and health problems of pre-obesity and obesity coexist with undernutrition. Recent trend analyses of nutritional status have placed the problem of obesity squarely on the Brazilian public health agenda.⁸

The objective of the present study was to assess prepregnancy nutritional status among women seen in prenatal clinics of the Brazilian national health system, its population correlates and its associated adverse pregnancy outcomes.

METHODS

The study was conducted in prenatal care clinics of the national health system (Sistema Único de Saúde – SUS) of six state capitals in Brazil, between 1991 and 1995. A cohort of 5,564 consecutive women aged 20 years and more, otherwise non-diabetic, were followed from about weeks 20-28 of gestation till delivery. Ana-

lysis was carried out for 5,314 women, as in 250 there was a lack of information required to calculate prepregnancy body mass index (BMI).

At enrollment, a standardized questionnaire provided information on age, prepregnancy weight (in kilograms), years of education, and parity. Maternal height was measured in duplicate and recorded in centimeters according to the standard protocol. Skin color was subjectively assigned. Prepregnancy nutritional status was classified based on BMI, according to the World Health Organization (WHO) criteria: underweight ($BMI < 18.5 \text{ kg/m}^2$), normoweight ($18.5 \text{ kg/m}^2 \leq BMI < 25 \text{ kg/m}^2$), pre-obesity ($25 \text{ kg/m}^2 \leq BMI < 30 \text{ kg/m}^2$), and obesity ($BMI \geq 30 \text{ kg/m}^2$). Women who fall in the latter two categories were also characterized as overweight.¹³

Gestational diabetes mellitus was defined according to the current WHO criteria as fasting plasma glucose of at least 7.0 mmol/l or a 2-hour-post 75g glycemia of at least 7.8 mmol/l.¹⁴ Gestational age was characterized according to hierarchical criteria based on four clinical examinations: ultrasound before week 26 in 52% of the sample; ultrasound after week 26 consistent with neonatal age estimation or last menstrual period in 15%; reported last menstrual period consistent with neonatal age estimation or uterine height in 23%; and neonatal age estimation, ultrasound after week 26, uterine height, or last menstrual period in the remaining 10%. Macrosomia was defined as birth weight at or above the 90th percentile for the gestational age of the study sample; microsomia was defined as birth weight below the 10th percentile for the gestational age. Hypertensive disorder

ders were ascertained through chart review and classified according to the National High Blood Pressure Education Program Working Group. Pre-eclampsia (hypertension after week 20 of gestation associated with proteinuria or seizures) included only cases of new onset hypertension.

Frequencies of underweight, pre-obesity and obesity – and their 95% confidence intervals –, both crude and adjusted, are displayed, the latter obtained through logistic regression.^{11,15} Odds ratios for pregnancy outcomes were also calculated using logistic regression. Statistical analyses were performed using the statistical software SAS.

The Ethical Committees of the Institutions approved the study protocol, and participants signed the study consent.

RESULTS

Table 1 shows the distribution of characteristics of

5,314 women included in the analysis and of those excluded due to missing information. Inability to calculate prepregnancy BMI was more frequently seen among multiparous women with lower educational level and miscellaneous skin color in the Salvador center.

Age specific prevalences of prepregnancy nutritional status are presented in Table 2. Prevalences of underweight decreased in the age groups from 9% for women aged 20 to 24 years to 3.4% for those 30 years and more. In contrast, for pre-obesity and obesity, prevalences increased with age. Overall age-adjusted prevalences (95% CI) based on prepregnancy weight were: underweight 5.7% (5.1%-6.3%), pre-obesity 19.2% (18.1%–20.3%), and obesity 5.5% (4.9%-6.2%) (p<0.001).

Table 3 describes age-adjusted prevalences (95% CI) of prepregnancy nutritional status, according to study center, educational level, skin color, and parity. Although the Salvador center had the highest prevalence of underweight, the obesity prevalence in this

Table 1 - Characteristics of studied and excluded pregnant women aged 20 to 48, 1990 to 1994.

Characteristics	Studied sample* (n=5,314)		Women with missing BMI* (n=250)		P value
	N	%	N	%	
Age					
20 to 24	1,783	33.6	83	33.2	0.9
25 to 29	1,691	31.8	78	31.2	
≥30	1,840	34.6	89	35.6	
Education					
<8 years	2,303	43.4	180	72.0	<0.001
8-11 years	2,480	46.8	67	26.8	
≥12 years	518	9.8	3	1.2	
Skin color					
White	2,391	45.2	51	20.7	<0.001
Mixed	2,188	41.4	45	61.1	
Black	710	13.4	151	18.2	
Parity					
0	1,449	30.6	39	16.5	<0.001
1	1,589	33.6	59	24.9	
2	904	19.1	50	21.1	
≥3	788	16.7	89	37.6	
Study center					
Porto Alegre	1,072	20.2	38	15.2	<0.001
São Paulo	1,232	23.2	4	1.6	
Rio de Janeiro	549	10.3	8	3.2	
Salvador	881	16.6	104	41.6	
Fortaleza	1,122	21.1	51	20.4	
Manaus	458	8.6	45	18.0	

*The small variation in category totals results from missing information relating to the characteristic in question.

Table 2 - Frequency (95%CI) of prepregnancy World Health Organization nutritional status* categories among 5,314 women aged 20 to 48, 1990 to 1994.

Age (years)	Underweight (n=309)	Nutritional status* Pre-obesity (n=1,086)	Obesity (n=336)
20 to 24 (n=1,783)	9.0 (7.8-10.5)	14.6 (13.0-16.3)	3.8 (3.0-4.7)
25 to 29 (n=1,691)	5.0 (4.1-6.2)	20.6 (18.7-22.6)	6.2 (5.2-7.5)
≥30 (n=1,840)	3.4 (2.7-4.4)	26.0 (24.0-28.0)	8.9 (7.7-10.3)
P	<0.001	<0.001	0.001
Overall	5.8 (5.2-6.5)	20.4 (19.4-21.5)	6.3 (5.7-7.0)
Overall age adjusted**	5.7 (5.1-6.3)	19.2 (18.1-20.3)	5.5 (4.9-6.2)

*BMI cut points according to WHO¹³: underweight (BMI<18.5 kg/m²), pre-obesity (25.0 kg/m²≤BMI<30 kg/m²) and obesity (BMI≥30.0 kg/m²)

**Adjusted to represent frequencies for 27 year old women

center was also high. Overweight was more frequent in study centers in the more industrialized south and southeast regions (Porto Alegre, São Paulo, and Rio de Janeiro) ($p < 0.001$). Porto Alegre and Rio de Janeiro showed the highest adjusted frequencies for obesity. Educational level was inversely related to nutritional status, obesity being more prevalent among less educated women ($p = 0.03$). Overweight was commonly seen among black women, and obesity was more prevalent in black than in white or miscellaneous skin color women ($p = 0.01$). Nulliparous women presented a different nutritional status distribution than multiparous ones, the age-adjusted prevalence of underweight was higher and pre-obesity and obesity was lower than among parous women. Those having three or more previous pregnancies had higher age-adjusted prevalence of obesity ($p = 0.002$).

Table 4 demonstrates an inverse association of nutritional status and microsomia. Pre-obese and obese women had lower risk of microsomia (OR=0.65, 95%

CI 0.48-0.88, and OR=0.47, 95% CI 0.260-0.84, respectively). On the other hand, they showed a higher risk of having gestational diabetes mellitus (OR=2.0, 95% CI 1.60-2.5 and OR=2.4, CI 95% 1.7-3.4), macrosomia (OR=1.6, 95% CI 1.3-2.0 and OR=1.5, CI 95% 1.1-2.2), and hypertensive disorders (OR=2.5, 95% CI 2.0-3.0 and OR=6.6, 95% CI 5.0-8.6), than women with normal nutritional status. Obesity was also a risk factor for pre-eclampsia (OR=3.9, 95% CI 2.4-6.4).

DISCUSSION

Brazilian national health system provides care for approximately 75% of the population⁴. These data show that more than 1/3 of women seen in selected prenatal clinics of the national health system feel out of normal nutritional range ($18.5 < \text{BMI} < 25.0$). Of these, there were about 4 women overweight for every underweight one. Though these prevalences varied somewhat over the categories such as age, educational level, skin color, parity, and geographic region, sig-

Table 3 - Age adjusted* prevalence (95%CI) of prepregnancy World Health Organization nutritional status** among 5,314 women aged 20 to 48, by study center, years of education, skin color and parity, 1990 to 1994.

Characteristics		Underweight % (95%CI)	Nutritional status** Pre-obesity % (95%CI)	Obesity % (95%CI)
Center of study				
Porto Alegre	(n=1,059)	3.7 (2.7-5.1)	23.5 (21.0-26.3)	8.6 (7.0-10.6)
São Paulo	(n=1,221)	4.7 (3.6-6.1)	22.5 (20.2-25.1)	5.3 (4.1-6.7)
Rio de Janeiro	(n=536)	5.8 (4.0-8.4)	25.2 (21.6-29.1)	8.5 (6.4-11.2)
Salvador	(n=877)	9.2 (7.4-11.3)	16.5 (14.1-19.2)	7.4 (5.8-9.5)
Fortaleza	(n=1,108)	6.9 (5.5-8.5)	16.7 (14.5-19.1)	4.1 (3.1-5.5)
Manaus	(n=447)	4.6 (3.1-6.9)	18.7 (15.2-22.8)	4.5 (2.8-7.2)
P		<0.001	<0.001	<0.001
Years of education				
<8	(n=2,271)	6.1 (5.1-7.1)	21.3 (19.6-23.2)	7.1 (6.0-8.3)
8-11	(n=1,134)	5.9 (5.0-6.9)	20.1 (18.5-21.8)	6.0 (5.0-7.0)
≥11	(n=1,829)	4.2 (2.7-6.6)	18.8 (15.6-22.4)	4.2 (2.8-6.2)
P		0.33	0.33	0.03
Skin color				
White	(n=2,355)	5.3 (4.4-6.3)	20.7 (19.0-22.4)	5.5 (4.6-6.5)
Mixed	(n=2,164)	6.6 (5.6-7.7)	19.4 (17.8-21.2)	6.6 (5.6-7.8)
Black	(n=705)	5.5 (4.0-7.5)	22.4 (19.4-25.7)	8.4 (6.5-10.8)
P		0.16	0.23	0.01
Parity				
0	(n=1,433)	6.8 (5.6-8.2)	16.6 (14.7-18.8)	5.2 (4.0-6.6)
1	(n=1,572)	5.1 (4.1-6.3)	22.1 (20.1-24.3)	6.9 (5.7-8.4)
2	(n=887)	5.0 (3.7-6.8)	24.5 (21.7-27.6)	5.8 (4.4-7.6)
≥3	(n=779)	6.3 (4.6-8.7)	21.1 (18.2-24.3)	9.4 (7.4-11.9)
P		0.15	<0.001	0.002

*Adjusted to represent frequencies for 27 year old women

**BMI cut points according to WHO¹³: underweight ($\text{BMI} < 18.5 \text{ kg/m}^2$), pre-obesity ($25.0 \text{ kg/m}^2 \leq \text{BMI} < 30 \text{ kg/m}^2$) and obesity ($\text{BMI} \geq 30.0 \text{ kg/m}^2$)

Table 4 - Odds ratio (95%CI) for pregnancy outcomes according to nutritional status* among 5,314 women aged 20 to 48, 1990 to 1994.

Pregnancy outcomes	Underweight OR (95%CI)	Nutritional status Pre-obesity OR (95%CI)	Obesity OR (95%CI)
GDM	0.40 (0.19-0.85)	1.98 (1.56-2.53)	2.36 (1.65-3.39)
Microsomia	2.03 (1.42-2.90)	0.65 (0.48-0.88)	0.47 (0.26-0.84)
Macrosomia	0.56 (0.33-0.95)	1.61 (1.30-2.00)	1.53 (1.08-2.17)
Hypertensive disorders	0.72 (0.42-1.23)	2.46 (1.99-3.04)	6.60 (5.06-8.60)
Pre-eclampsia	0.70 (0.25-1.93)	1.26 (0.79-2.00)	3.92 (2.40-6.38)

*BMI cut points according to WHO¹³: underweight ($\text{BMI} < 18.5 \text{ kg/m}^2$), pre-obesity ($25.0 \text{ kg/m}^2 \leq \text{BMI} < 30 \text{ kg/m}^2$) and obesity ($\text{BMI} \geq 30.0 \text{ kg/m}^2$); reference group is those with normal BMI ($18.5 \text{ kg/m}^2 \leq \text{BMI} < 25 \text{ kg/m}^2$).

GDM - Gestational diabetes mellitus

nificant overweight prevalences were present in all categories studied. These data are of a major importance given the increased risk of adverse outcomes among overweight here demonstrated.

The study findings are consistent with recent population-based surveys of nutritional status in Brazil. Monteiro et al⁷ reported an obesity prevalence of 13.3% in a probability sample of Brazilian women aged 25-64 years⁸ conducted in 1989. While not all women in these population surveys have equal probability of becoming pregnant, it is important to add to these data from clinical samples in order to obtain a more complete picture of the significance of these recent changes in nutritional status to current obstetric practice.

The study data illustrate important risks at both extremes of the nutritional status spectrum, as both under and overweight at the beginning of gestation are associated with adverse pregnancy outcomes, consistent with other authors' findings in different contexts. While underweight women presented a higher frequency of microsomia,⁶ overweight was related to macrosomia and other disease conditions, such as gestational diabetes mellitus and hypertensive disorders.^{6,12} As being overweight is commonly seen and confers risk not only to the mother but also to the neonate, the study findings, along with the literature, call for greater attention to the prevention and management of obesity in childbearing age women, both prior to and during pregnancy.

The dilemma of weight control strategies for overweight pregnant women should be stressed. Although a lesser weight gain during pregnancy might be desirable for overweight women, insufficient weight gain is associated with an increased risk of microsomia,⁶ per se a risk for several undesirable outcomes, both immediate and chronic.¹ Thus, international limits for adequate weight gain have been set for specific nutritional categories, from lean to obese. It was previously reported here that only ¼ of the overweight women studied gained weight within these recommended limits.⁹

REFERENCES

1. Barker D. *Mothers, babies and health in later life*. 2nd ed. Edinburgh: Churchill Livingstone; 1998.
2. Chor D, Coutinho E, Laurenti R. Reliability of self-reported weight and height among state bank employees. *Rev Saúde Pública* 1999;33:16-23.
3. Cnattingius S, Bergstrom R, Lipworth L, Kramer MS. Prepregnancy weight and the risk of adverse pregnancy outcomes. *N Engl J Med* 1998;338:147-52.
4. Faquim L. Planos de saúde: os dois lados da regulamentação. *RH em síntese* [serial online] 1999;27:6-15. Disponível em: http://www.gestaoverh.com.br/artigos/legi_010.shtml [2000 ago 12]
5. Fundação IBGE. *DATASUS* [online] 1996. Disponível em: <http://www.datasus.gov.br/tabnet/tabnet.htm> [2000 ago 5]
6. Institute of Medicine (US). *Nutrition during pregnancy*. Washington (DC): National Academy Press; 1990.

There are some limitations in the interpretation of these results. As the study was conducted in selected clinics of the national health system of six capitals, representativeness cannot be assured. However, comparisons of data on educational level, nutritional status and gestational age at delivery⁵ suggest that the study sample characteristics are comparable with those of pregnant women living in large metropolitan areas of Brazil. In this regard, the data are also less likely to be representative of those women seen outside of the national health system. An additional limitation is that prepregnancy weight was reported and not objectively measured, and thus subject to recall bias. However, based on previous findings concerning weight recall for Brazilian women studied outside of pregnancy¹⁰ and other studies about referred weight,² it seems that weight measure bias is probably small.

As a conclusion, overweight nutritional status is highly prevalent among women seen in prenatal public clinics of major Brazilian cities, even for the age range of 20-24 years. Approximately 25% of women are overweight at conception. Older black multiparous women with lower educational level and living in the southern or southeastern regions are more likely to be overweight at the onset of pregnancy. Maternal overweight status is associated with adverse pregnancy outcomes. Greater awareness of these facts are key for minimizing the risks of obesity for pregnant women and their offspring.

ACKNOWLEDGEMENTS

To the following people for the study regional coordination in the centers: AJ Reichelt of Santa Casa de Misericórdia and Hospital de Clínicas de Porto Alegre; JMD Pousada of Instituto de Perinatologia da Bahia (IPERBA); T Yamashita of Hospital do Servidor Público Estadual "Francisco Morato de Oliveira", São Paulo); ERS Spichler of Instituto Fernandes Figueira. Fundação Oswaldo Cruz, Rio de Janeiro; MM Teixeira of Serviço de Obstetrícia do Posto de Assistência Médica da Cadajás, Manaus; A Costa e Forti of Maternidade Escola Assis Chateaubriand da Universidade do Ceará, Fortaleza.

7. Monteiro CA, Mondini L, Medeiros de Souza AL, Popkin BM. The nutritional transition in Brazil. *Eur J Clin Nutr* 1995;49:105-13.
8. Monteiro CA, D'A Benicio MH, Conde WL, Popkin BM. Shifting obesity trends in Brazil. *Eur J Clin Nutr* 2000;54:342-6.
9. Nucci L, Duncan BB, Mengue S, Branchtein L, Schmidt MI, Fleck E. Assessment of weight gain during pregnancy in general prenatal care services of Brazil. *Cad Saúde Pública*, 2001;17(6). In press.
10. Schmidt MI, Duncan BB, Tavares M, Polanczyk CA, Pellanda L, Zimmer PM. Validity of self-reported weight: a study of urban Brazilian adults. *Rev Saúde Pública* 1993;27:271-6.
11. Wilcosky TC, Chambless LE. A comparison of direct adjustment and regression adjustment of epidemiologic measures. *J Chronic Dis* 1985;38:849-56.
12. Wolfe H. High prepregnancy body-mass index: a maternal-fetal risk factor. *N Engl J Med* 1998;338:191-2.
13. World Health Organization. WHO Consultation on Obesity. *Obesity: preventing and managing the global epidemic*. Geneva; 1998.
14. World Health Organization. WHO Study Group on Diabetes Mellitus. *Prevention of Diabetes Mellitus: report of a WHO Study Group*. Geneva;1994. [WHO Technical Report Series, 844].
15. Zhao PY. Logistic regression adjustment of proportion and its macro procedure. In: *Proceedings of the Twenty-Second Annual SAS Users Group International Conference*; San Diego, California 1997. Cary, NC: SAS Institute Inc., 1997 p. 1045-50.