

Changes in pre-pregnancy weight and weight gain during pregnancy: retrospective comparison between 1986 and 2004

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Summary

Questions under study: To compare the incidence of pre-pregnancy overweight, obesity, and difference in weight gain during pregnancy in the years 1986 and 2004, in women delivered at the maternity unit of our hospital.

Methods: Retrospective study. Maternity records of patients delivered in the years 1986 and 2004 were compared. Data extraction included booking weight, height, weight gain, birth weight as well as information on mode of delivery and gestational age at delivery.

Results: During the year 1986 and 2004 a total of 690 and 668 patients respectively were included in the analysis. The pre-pregnancy BMI ≥ 25 doubled over the 18-year period (from 15.9

to 30.1%). In 1986 only 2.6% of all pregnant women gained more than 20 kg, while in 2004 14.2% ($p < 0.0001$) did so. The caesarean section rate was significantly higher in 2004 than 18 years earlier (28.3 and 9.3%, $p < 0.0001$).

Conclusions: We found a significant increase in all parameters between these two groups. Pregnant women are today heavier at the booking visit, are more overweight, and gain more weight during pregnancy. A similar trend is seen in the newborn babies, who have a higher birth weight than those born 18 years ago.

Key words: pre-pregnancy weight; weight gain; body mass index

Introduction

Obesity, a modern epidemic [1], is the fastest-growing health problem in the United States, where approximately one third of all US women are obese, defined as having a body mass index (BMI) of 30 or higher [2]. The same development can be observed in Europe, e.g., in western Sweden, where in 2002 the prevalence of overweight and obesity in women was 38% and 11% respectively [3]. Similar trends have been observed in Switzerland, where in 2002 37% of the population of all age groups had a BMI of more than 25 [4].

Between 1992 and 2002 the incidence of overweight in women of childbearing age increased from 6.8% to 8% for women aged 14–24 years, from 11.8% to 19.3% for those aged 25–34 and from 18.0% to 24.8% for those aged 35–44. Overweight and obesity in pregnancy are known

to be risk factors for a number of serious complications [5–10]. A higher incidence of intrauterine fetal demise and preeclampsia has been observed with increasing BMI [11, 12]. Not only is pre-pregnancy obesity associated with obstetrical problems, but excessive weight gain during pregnancy also increases the risk of caesarean delivery [13, 14]. Furthermore, increased weight gain during pregnancy reduces the success rate of vaginal birth after caesarean delivery [15]. Excess pregnancy weight gain is a step towards obesity later in life [16]; it also involves a higher risk of cardiovascular problems and of developing breast cancer after the menopause [17].

The aim of our study was a comparison of the years 1986 and 2004. The incidence of women with pre-pregnancy overweight, obesity and excess weight gain during pregnancy was analysed.

Material and methods

In this retrospective study we compared maternity records of pregnant women who gave birth in our department in the years 1986 and 2004. The reason why we chose these fixed points was that in 1986 a new hospital recording system was introduced in our clinic and data collection was started in 2004. All women with singleton pregnancy and complete information were included in the analysis. Data extraction included booking weight at first consultation in the first trimester, usually below 15 weeks' gestation, height, weight gain, maternal age and information on mode of delivery, gestational age at delivery and ethnicity. Gestational age was calculated on the basis of a reliable recollection of the last menstrual period and corrected where necessary on the basis of an ultrasonographic examination in the first 20 weeks of gestation. We also collected data on neonatal weight. Macrosomia was defined as birth weight above 4000

grams. BMI was calculated as booking weight (kg), divided by height (cm) squared. Overweight (BMI 25–29) and obesity (BMI ≥ 30) were defined as proposed by the World Health Organization (WHO). Weight gain during pregnancy was dichotomised into gains of >15 kg and >20 kg. For further comparison the two populations were compared according to ethnicity (1. German speaking countries, 2. Italy, Spain, France, Portugal, 3. Eastern Europe, 4. other European countries and 5. non-European countries).

Statistical analysis was performed with GraphPad Prism version 4.00 for Windows, (GraphPad Software, San Diego CA). Student t-test or Mann Whitney U test were used to compare continuous variables, while proportions were analysed with chi-square or Fisher's exact test where appropriate. Statistical significance was considered achieved when *p* was less than 0.05.

Results

The clinical characteristics of the two groups are presented in table 1. Table 2 summarises and compares the prevalence of various weight disorders between the two populations.

During the years 1986 and 2004 a total of 926 and 715 patients respectively gave birth at our institution. Of those, 690 from 1986 and 668 from 2004 were included in the study (236 and 46 patients respectively were excluded due to incom-

plete datasets, multiple pregnancies or gestational age above 15 weeks at enrolment).

Women seen in 2004 were significantly older at delivery and a larger number of those were nulliparous than the women delivered in 1986. Moreover, gestational age at delivery was significantly lower and the mode of delivery more surgical (caesarean section or vaginal operative) than in the women seen 1986. It is of interest to note that, although women in 2004 were delivered earlier, the newborns had a higher birth weight than babies born in 1986. However, no difference was noted between groups in the prevalence of newborns weighing more than 4000 gr. (table 2).

A significant shift in ethnicity was observed between 1986 and 2004. While in 1986 more than 80% of the attending women originated from German-speaking countries, 18 years later this number had fallen significantly to 50.9%. On the other hand, the percentage of women from ethnic groups 3 and 5 had increased significantly.

The booking BMI of women giving birth in 2004 was significantly higher than in 1986. This was not due to higher stature of women but was influenced by heavier body weight (table 2). Similarly, a larger proportion of these women were overweight or obese at first consultation. Moreover, women seen in 2004 gained more weight than those giving birth in 1986 (table 2).

Table 1

Characteristics	Year 1986 (N = 690)	Year 2004 (N = 668)	Significance
Age (year \pm SD)	28.3 \pm 4.4	29.8 \pm 5.1	<i>p</i> <0.0001, OR 0.75, 95%CI 0.65–0.92
Nulliparity (n,%)	265, 38.4	304, 45.5	<i>p</i> = 0.0083, CI 0.77–0.96
Group 1 ethnicity (n,%)	560, 81.2	340, 50.9	<i>p</i> <0.0001, CI 1.87–2.55
Group 2 ethnicity (n,%)	60, 8.7	69, 10.4	ns, CI 0.74–1.10
Group 3 ethnicity (n,%)	57, 8.3	207, 30.9	<i>p</i> <0.0001, CI 0.29–0.47
Group 4 ethnicity (n,%)	5, 0.7	13, 1.9	ns, CI 0.25–1.14
Group 5 ethnicity (n,%)	8, 1.1	39, 5.9	<i>p</i> <0.0001, CI 0.17–0.61

N: number of all without the excluded patients

n,%: number and percentage of patients in the collective

Discussion

Comparing the year 1986 with 2004, our results show a significant increase in pre-pregnancy weight, BMI and weight gain during pregnancy. The proportion of women with BMI ≥ 25 at the

beginning of pregnancy doubled to 30%, and of those with BMI ≥ 30 to 9%. Lack of clear guidelines in this country, where up to the present a weight gain of up to 15 kg has been considered

Table 2

Characteristics	Year 1986 (N = 690)	Year 2004 (N = 668)	Significance
Booking weight, kg (median, range)	58.9, 45–118	63.6, 46–104	p <0.0001, CI 3.47–5.93
Height, cm (median, range)	163.12, 142–179	164.42, 150–181	ns
BMI (median, range)	21.5, 15.2–46.1	22.5, 15–44.4	p <0.0001
Weight gain (mean \pm SD)	11.6 \pm 3.91	14.8 \pm 5.47	p <0.0001, CI 2.49–3.55
BMI \geq 25 (n,%)	110, 15.9	201, 30.1	p <0.0001, CI 0.54–0.74
Overweight (n,%)	86, 12.4	141, 17.0	p <0.0001, CI 0.59–0.84
Obesity (n,%)	24, 3.5	60, 8.9	p <0.0001, CI 0.38–0.76
Weight gain >15 kg (n,%)	125, 18.1	300, 44.9	p <0.0001, CI 0.41–0.56
Weight gain >20 kg (n,%)	18, 2.6	95, 14.2	p <0.0001, CI 0.19–0.45
Gestational age at delivery (weeks \pm SD)	40.33 \pm 1.8	39.8 \pm 1.7	p <0.0001, CI -0.73–0.22
Birth weight \geq 4000 grams (n,%)	69, 10	69, 10.3	ns
Caesarean section (n,%)	64, 9.3	189, 28.3	p <0.0001, CI 0.35–0.55
Vaginal operative deliveries (n,%)	63, 9.1	87, 13.0	p <0.05, CI 0.66–0.98
Birth weight, g (median, range)	3350, 1180–4840	3405, 720–4970	p <0.05

N: number of all without the excluded patients

n, %: number and percentage of patients in the collective

ns: not significant

normal. In 2004 45% had a weight gain of more than 15 kg, and a third of these women gained more than 20 kg. In the US the Institute of Medicine (IOM) recommends for normal-weight women a weight gain of 11.4–15.9 kg and for overweight women an even lower weight gain (8–11.4 kg) [18]. In a cohort study from San Francisco 24.1% of overweight women with a pre-pregnancy BMI 26.1–29.0 reported a target weight gain above this guideline, compared with only 4.3% of normal weight women [19]. Overweight women are often advised to gain more than recommended by IOM [20]. In Finland, similarly to our results, an increase of pre-pregnancy BMI from 21.9 to 23.7 between the 1960s and 2000 was observed, as well as the average pregnancy weight gain [21]. Further, in the USA an increase of pre-pregnancy BMI was reported in a 5-year period from 1999 to 2003 [22]. The US situation is thus much more dramatic than in our country, with doubling of the number of women with BMI \geq 30 16.3% in 1980 to 36.4% in 1999.

We have looked for bias in our analysis. Our birth population has changed, with a significant increase in people of foreign origin and a decrease

in women from Switzerland, Germany or Austria (group 1) from approx. 81% to 51%. This development exceeds the similar trend in Switzerland, with 72.97% births for Swiss women in 2003 [23]. We therefore analysed this group's data separately: the results remained unchanged. Since the rate of primiparae increased significantly from 38.41% to 45.51%, we restricted our study to the primiparae and found nearly the same results. Over time the rate of caesarean section has increased 3-fold. There are many possible explanations for this. The birth population has changed, and thus women who have a normal pregnancy in their own country may now gain too much weight because of our food range, resulting in bigger babies with the attendant problems in giving birth. There is of course a medico-legal aspect too.

A weakness of our study is the exclusion of 236 patients with incomplete data sets in 1986, but only 46 in 2004 due to the retrospective character of the study. We have analysed the patients excluded with the available data and found no differences from our study groups. The strength of our study lies in the fact that the patients are from one hospital with the same staff over the period.

In the study period not only the weight of the mothers increased, but also the newborns weighed significantly more in 2004 than eighteen years ago. But, in contrast, the rate of babies weighing more than 4000 g remained stable (approx. 10%). This was also found in the primipara group. One important factor in the trend towards increasing mean birth weight could be the increase in maternal BMI [24].

That prevention of excessive weight gain can be successful was shown in a group with normal BMI, but not in overweight women [18]. The intervention group received education concerning weight gain, healthy eating and exercise, beginning before 20 weeks, and even received additional education when the weight gain was too rapid. Intervention to prevent obesity in overweight women should start prior to pregnancy. Pre-pregnancy factors in excessive weight gain are more important than pregnancy-related health conditions and modifiable health factors [25]. To prevent long-term obesity it is important to breastfeed and exercise [14].

A clear prediction of future developments is not possible. With data from only two points (year 1986 and 2004), a linear increase can only be assumed. However, our study documents a significant increase in pre-pregnancy weight, BMI, weight gain during pregnancy and neonatal weight when comparing the years 1986 and 2004. We suggest that women be advised about the recommended weight gain at the beginning of the pregnancy, and that their weight be monitored to render dietary intervention possible.

References

- 1 Rubenstein AH. Obesity: a modern epidemic. *Trans Am Clin Climatol Assoc.* 2005;116:103-11.
- 2 ACOG committee opinion. Number 319, October 2005. The role of obstetrician-gynecologist in the assessment and management of obesity. *Obstet Gynecol.* 2005;106(4):895-9.
- 3 Berg C, Rosengren A, Aires N, Lappas G, Toren K, Thelle D, Lissner L. Trends in overweight and obesity from 1985 to 2002 in Göteborg, West Sweden. *Int J Obes (Lond).* 2005;29(8):916-24.
- 4 Pressemitteilung Bundesamt für Statistik: Schweizerische Gesundheitsbefragung 2002. Stress und Arbeitsplatz-Unsicherheit belasten die Gesundheit. 2003, Nr. 0350-03310-90.
- 5 Kabiru W, Raynor BD. Obstetric outcomes associated with increase in BMI category during pregnancy. *Am J Obstet Gynecol.* 2004;191(3):928-32.
- 6 Fiala JE, Egan JF, Lashgari M. The influence of body mass index on pregnancy outcomes. *Conn Med.* 2006;70(1):21-3.
- 7 Robinson Heather E, O'Connell CM, Joseph KS and McLeod NL. Maternal outcomes in pregnancies complicated by obesity. *Obstet Gynecol.* 2005;106(6):1357-64.
- 8 Rosenberg TJ, Garbers S, Chavkin W, Chiasson MA. Prepregnancy weight and adverse perinatal outcomes in an ethnically diverse population. *Obstet Gynecol.* 2003;102(5 Pt 1):1022-7.
- 9 Ramachenderan J, Bradford J, McLean M. Maternal obesity and pregnancy complications: a review. *Aus N Z J Obstet Gynaecol.* 2008;48(3):228-35.
- 10 Guelinckx I, Devlieger R, Beckers K, Vasant G. Maternal obesity: pregnancy complications, gestational weight gain and nutrition. *Obes Rev.* 2008;9(2):140-50. Epub 2008 Jan 21.
- 11 Cnattingius S, Bergström R, Lipworth L, Kramer MS. Prepregnancy weight and the risk of adverse pregnancy outcomes. *N Engl J Med.* 1998;338(3):147-52.
- 12 Nohr EA, Bech BH, Davies MJ, Frydenberg M, Henriksen TB, Olsen J. Prepregnancy obesity and fetal death: a study within the Danish National Birth Cohort. *Obstet Gynecol.* 2005;106(2):250-9.
- 13 Stotland NE, Hopkins LM, Caughey AB. Gestational weight gain, macrosomia, and risk of cesarean birth in nondiabetic nulliparas. *Obstet Gynecol.* 2004;104(4):671-77.
- 14 Weiss JL, Malone FD, Emig D, Ball RH, Nyberg DA, Comstock CH, et al. Obesity, obstetric complications and cesarean delivery rate: a population-based screening study. *Am J Obstet Gynecol.* 2004;190(4):1091-7.
- 15 Juhász G, Gyamfi C, Gyamfi P, Tocce K, Stone JL. Effect of body mass index and excessive weight gain on success of vaginal birth after cesarean delivery. *Obstet Gynecol.* 2005;106(4):741-6.
- 16 Rooney BL, Schauburger CW. Excess pregnancy weight gain and long-term obesity: one decade later. *Obstet Gynecol.* 2002;100(2):245-52.
- 17 Hilakivi-Clarke L, Luoto R, Huttunen T, Koskenvuo M. Pregnancy weight gain and premenopausal breast cancer risk. *J Reprod Med.* 2005;50(11):811-6.
- 18 Polley BA, Wing RR, Sims CJ. Randomized controlled trial to prevent excessive weight gain in pregnant women. *Int J Obes Relat Metab Disord.* 2002;26(11):1494-502.
- 19 Stotland NE, Haas JS, Brawarsky P, Jackson RA, Fuentes-Afflick E, Escobar GJ. Body mass index, provider advice, and target gestational weight gain. *Obstet Gynecol.* 2005;105(3):633-8.
- 20 Cogswell ME, Scanlon KS, Fein SB, Schieve LA. Medically advised, mother's personal target, and actual weight gain during pregnancy. *Obstet Gynecol.* 1999;94(4):616-22.
- 21 Kinnunen TI, Luoto R, Gissler M, Hemminki E. Pregnancy weight gain from 1960s to 2000 in Finland. *Int J Obes Relat Metab Disord.* 2003;27(12):1572-7.
- 22 Yeh J, Shelton JA. Increasing prepregnancy body mass index: analysis of trends and contributing variables. *Am J Obstet Gynecol.* 2005;193(6):1994-8.
- 23 Tönz O. Stirbt die Schweiz aus? Demographische Fakten und Perspektiven zur heutigen Reproduktionssituation in Europa. *Gynäkol Geburtshilfliche Rundsch.* 2005;45(2):93-106.
- 24 Surkan PJ, Hsieh CC, Johansson AL, Dickman PW, Cnattingius S. Reasons for increasing trends in large for gestational age births. *Obstet Gynecol.* 2004;104(4):720-6.
- 25 Brawarsky P, Stotland NE, Jackson RA, Fuentes-Afflick E, Escobar GJ, Rubashkin N, Haas JS. Pre-pregnancy and pregnancy-related factors and the risk of excessive or inadequate weight gain. *Int J Gynaecol Obstet.* 2005;91(2):125-31.