Prevalence, Trend and Determining Factors of Gestational Diabetes in Germany

Prävalenz, Trend und Determinanten des Gestationsdiabetes in Deutschland

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Key words
- epidemiology
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- screening

Schlüsselwörter
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- Screening

Abstract

Purpose: The true prevalence of gestational diabetes in Germany is unknown. Thus, the study's purposes were to estimate the prevalence of gestational diabetes as well as to describe the temporal prevalence trend and to identify determinants.
Material and Methods: We calculated prevalence estimates based on two datasets: the register-based German perinatal statistic (n = 650 232) and the maternal self-reports from the German children and youth health survey (KiGGS; n = 15 429). Differences between prevalence estimates were analysed using χ^2 and trend tests, and determinants were identified using logistic regression.
Results: According to the perinatal statistic, gestational diabetes was present in 3.7% of pregnant women in Germany in 2010. The prevalence across the years 2001 to 2006 was estimated at 1.9% which differed significantly from the prevalence estimate derived from the KiGGS dataset for the same period of time (5.3%; 95% confidence interval: 4.6–6.1%). Both datasets show an increasing trend of gestational diabetes ($p < 0.001$). The risk for gestational diabetes was mainly associated with age, BMI and social class of pregnant women as well as with multiple pregnancies.
Conclusion: The lack of significant screening studies among representative samples hampers a sound estimation of the true prevalence of gestational diabetes in Germany. The increasing trend in gestational diabetes might continue due to the projected increase of important risk factors (e.g., maternal age, obesity). Our analyses support the current consensus recommendations regarding standardised gestational diabetes screening.

Zusammenfassung

Fragestellung: Die tatsächliche Prävalenz des Gestationsdiabetes ist hierzulande weitgehend unbekannt. Die Ziele der vorliegenden Studie waren daher, die Prävalenz des Gestationsdiabetes abzuschätzen sowie den zeitlichen Trend darzustellen und Determinanten zu identifizieren.
Material und Methodik: Es wurden Prävalenzberechnungen an 2 repräsentativen Datensätzen vorgenommen: an der registerbasierten deutschen Perinatalstatistik (n = 650 232) sowie an den maternalen Selbstberichten aus dem Kinder- und Jugendgesundheitssurvey (KiGGS; n = 15 429). Unterschiede zwischen Prävalenzwerten wurden mit χ^2- bzw. Trendtests beurteilt und Determinanten mittels logistischer Regression identifiziert.
Ergebnisse: Laut Perinatalstatistik lag im Jahr 2010 bei 3,7% der Schwangeren in Deutschland ein Gestationsdiabetes vor. Kumuliert für die Jahre 2001–2006 ergab sich aus dieser Datenquelle ein Wert von 1,9%, der sich signifikant von der auf Basis der KiGGS-Daten für diesen Zeitraum berechneten Prävalenz unterschied (5,3%; 95%-Konfidenzintervall: 4,6–6,1%). In beiden Datensätzen ist ein ansteigender Trend in der Gestationsdiabetesprävalenz zu beobachten ($p < 0,001$). Das Gestationsdiabetesrisiko war vor allem mit dem Alter, dem BMI und dem Sozialstatus der Schwangeren sowie mit Mehrlingsschwangerschaften assoziiert.
Schlussfolgerung: Das Fehlen aussagekräftiger Screening-Studien an repräsentativen Kollektiven erschwert eine fundierte Schätzung der wahren Gestationsdiabetesprävalenz. Der ansteigende Trend in der Gestationsdiabetesprävalenz könnte sich vor dem Hintergrund der projizierten Zunahme wesentlicher Risikofaktoren (z. B. maternales Alter, Adipositas) weiter fortsetzen. Unsere Berechnungen unterstützen die aktuellen Konsensus-Empfehlungen hinsichtlich eines einheitlichen Gestationsdiabetes-Screenings.

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Introduction

Gestational diabetes mellitus is one of the most common endocrine metabolic diseases during pregnancy and is associated with increased risks for both the pregnant mother and the foetus. The risks include diabetic foetopathy and macrosomia, premature labour with subsequent premature birth due to polyhydramnios, problems with the birth process for macrosomial children and increased (e.g. cardiovascular) malformations [1, 2]. These complications can require protracted treatments for both pregnant mothers and newborns. Consequently, the early diagnosis and treatment of gestational diabetes is essential for minimising risks and avoiding high treatment costs.

On this background, the considerable importance from a medical and health economics perspective of detecting gestational diabetes becomes clear. Since a blood sugar test during pregnancy had not been included as a screening test in maternity guidelines by the time this study was completed, it has not so far been carried out in all pregnant women. As a result, the actual prevalence of gestational diabetes and the need for intervention is largely unknown. The German Federal Joint Committee (GBA), however, decided on 15 December 2011 that testing for gestational diabetes would become a service covered by health insurance, which is why – subject to verification by the German Ministry of Health – inclusion in maternity guidelines can be expected [3].

The goals of this study were to present the current prevalence of gestational diabetes and the temporal trend in Germany on the basis of two different sets of data. This data forms the basis for determining the current and estimating the future demand for diagnosis and treatment in daily practice. Maternal characteristics associated with gestational diabetes are also presented, which therefore offer starting points for interventional measures aimed at the relevant target group.

Material and Methods

The prevalence calculations are based on two representative data sets from Germany. The first set involved the German perinatal statistics from 2001 to 2010 (the most recent available year) [4]. These are the most extensive, register-based data records on gestational diabetes which represent over 99% of all hospital births in Germany [5]. In Germany, the number of home births continues to be at a constantly low level between 1 and 2% of all births and is not included in the perinatal data. Perinatal statistics document cases of gestational diabetes which have been coded in the patients's maternity record as a pregnancy risk or as an indication for inpatient admission. The perinatal statistics from the individual years (cohorts) allow temporal trends to be calculated. The authors have also, as part of a special evaluation commissioned by the GBA, been given access to all perinatal data records from 2006. Using the information on maternal risk factors and the mothers' demographic characteristics at the time of pregnancy, it was possible to reveal the determining factors for gestational diabetes.

Data from the German Health Survey for Children and Adolescents (KiGGS) was also evaluated. The KiGGS is a population based representative survey of more than 15000 German children and adolescents aged up to 17 (birth cohorts from 1985 to 2006). The parents of these children (in 90% of cases, these were the mothers) were asked as part of the KiGGS whether they had been found to have gestational diabetes (or new diabetes mellitus of any other kind) during pregnancy [6]. As per the definition by the "Diabetes and Pregnancy" working group within the German Diabetic Association (DDG) at the time of the survey, these cases were coded as gestational diabetes [1].

Prevalence estimates were calculated as a percentage proportion of mothers with gestational diabetes out of all the mothers surveyed in the years specified above. The prevalence estimates for the KiGGS are presented as usual with a 95% confidence interval (95% CI) since the KiGGS involves random sample data. The perinatal statistics, on the other hand, represent a complete survey of well over 99% of all births, which is why the presentation of 95% CIs can be omitted. Differences between individual prevalence values have been evaluated with χ^2 or trend tests. Associations with gestational diabetes were investigated for the perinatal statistics data using logistic regression analysis. A further evaluation of the KiGGS data in this regard, however, was not possible due to a lack of information regarding central risk factors at the start of pregnancy. The analyses were carried out using the statistics software SAS 9.2 (SAS Institute Inc., Cary, USA) and PASW 18 (SPSS Inc., Chicago, USA).

Results

According to the latest official register data from the perinatal statistics, 3.7% of pregnant women in 2010 (23872 out of 650232 women) had gestational diabetes (**Fig. 1**). Cumulatively for the years from 2001 to 2006, this is calculated as a prevalence of 1.9% for the register-based data. This value is significantly different from the prevalence calculated from the KiGGS data for mothers whose children were born between 2001 and 2006 ($p < 0.001$). During this period, 5.3% (95% CI: 4.6–6.1%) of mothers reported having had gestational diabetes (156 out of 2970 women; **Fig. 2**). Both the German perinatal statistics and the KiGGS data show a rising trend in the prevalence of gestational diabetes ($p < 0.001$). The KiGGS values are significantly higher than those from the perinatal statistics (**Fig. 1** and **2**).

The multiple logistic regression analysis based on the perinatal statistics (**Tab. 1**) shows that the risk of gestational diabetes rises almost linearly with the pregnant mother's age. Consequently, the risk for pregnant women over the age of 35 is more than four times that of pregnant women under the age of 20. A significant constant relationship is also seen between the likelihood of gestational diabetes occurring and the body mass index (BMI) at the start of pregnancy. Accordingly, women with an initial BMI of over 35 kg/m^2 have an increased risk almost five times greater than women of normal weight. For multiple pregnancies, the risk of developing gestational diabetes is also increased. The at-risk groups further include pregnant women with low social status. Other associations can be seen in **Tab. 1**.

Discussion

The lack of informative studies on representative samples makes a detailed estimation of the true prevalence of gestational diabetes in Germany considerably difficult [7]. The ideal scenario would be comprehensive screening for gestational diabetes offered to all women, which would yield a true prevalence value. However in Germany there are no such comprehensive surveys. Consequently, alternative methods had to be applied in this study in order to estimate prevalence. The prevalence from the German

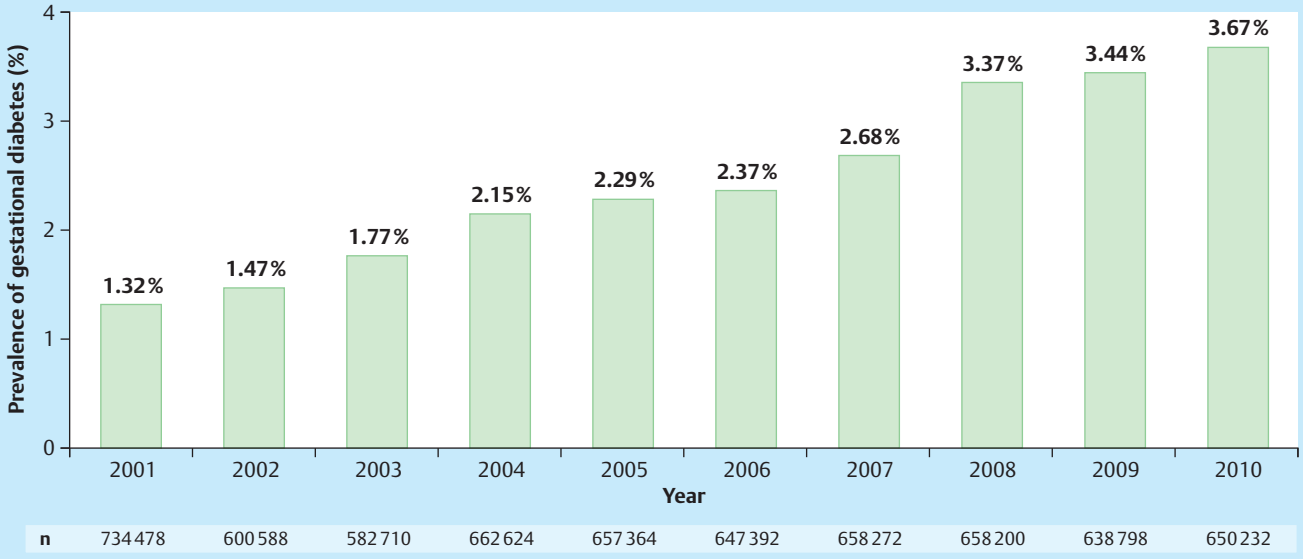

Fig. 1 Prevalence of gestational diabetes based on the German perinatal statistics (%) [4].

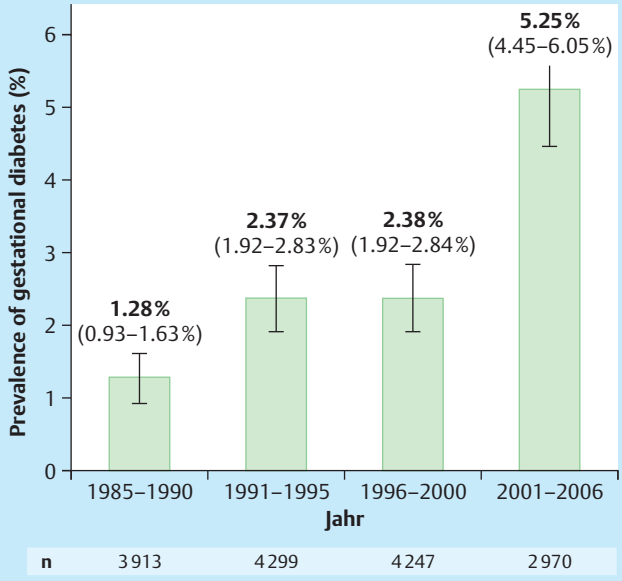

Fig. 2 Prevalence of gestational diabetes in Germany based on reports by mothers in the Health Survey for Children and Adolescents (% and 95% confidence interval) [6].

perinatal statistics – at 3.7% for the most recent available year – is below the figure provided by the KiGGS, which even for the years 2001 to 2006 led to a value of 5.3%. Self-reported information can lead to significantly higher values than register-based data, as two studies from the USA have also shown: in these cases, prevalences were 9.0 and 8.7% for self-reported information, versus 4.8% in each case for medically validated and centrally-registered diagnoses, equivalent to differences of 4.2 or 3.9 percent points [8, 9]. The comparison of the data sources used in this study indicates that the diagnosis of gestational diabetes was obviously not entered into the documentation program by the maternity hospitals in all cases. This tallies with clinical experience.

One cause for the incomplete data on gestational diabetes in Germany is in part the non-standardised practice of screening. Many gynaecologists, for example, often forego screening or carry it out primarily among at-risk groups, whereas other clinicians investigate a large proportion of their patients for gestational diabetes. The oral glucose tolerance test (oGTT) [2] is often offered as an individual healthcare service (IGeL), which favours selective uptake. Consequently, this service may be utilised in particular by patients at below-average risk. A second cause for the hitherto difficult determination of prevalence was the lack of a standardised and binding definition of gestational diabetes, complete with its determination and cutt-off values. The current guidelines, "GDM – Evidence-based guidelines on diagnosis, treatment and aftercare by the German Diabetes Association (DDG) and the German Society for Gynaecology and Obstetrics (DGGG)" were published recently [10]. These guidelines recommend a standardised definition of gestational diabetes and standardised cut-off values in venous plasma in accordance with the new consensus recommendations of the International Association of Diabetes and Pregnancy Study Groups (IADPSG). From an epidemiological and methodical perspective, the fact that a pre-existing and undetected diabetes mellitus which is only diagnosed during pregnancy will no longer be categorised under the diagnostic class of gestational diabetes should be welcomed [10]. As a result, diabetes mellitus of another kind diagnosed for the first time during pregnancy will in future be clearly and reliably distinguished from cases of gestational diabetes. The future exclusion of manifest, pre-existing cases of diabetes from the definition of gestational diabetes will need to be taken into account in the interpretation of future prevalence values based on the new guidelines.

The data available to date indicate a rising trend in the prevalence of gestational diabetes in Germany, and this may well continue over the next years. There are several reasons to make this assumption: On the one hand, the projected trends of central risk factors for gestational diabetes provide plausible explanations for a rise in the prevalence over recent years, such as the rising

Table 1 Prevalence and adjusted odds ratios for gestational diabetes by maternal risk factors and socio-demographic characteristics in the German perinatal statistics from 2006 [14].

Variable	n	GDM	OR (95% CI)
Parity			
▸ Nulliparous	321563	2.1%	1.00 (reference)
▸ Multiparous	325822	2.5%	0.83 (0.80–0.86)
Multiple pregnancy			
▸ No	636837	2.3%	1.00 (reference)
▸ Yes	10548	2.9%	1.13 (1.01–1.27)
Age at birth of child			
▸ < 20 years	18175	0.7%	1.00 (reference)
▸ 20 to < 25 years	98264	1.4%	1.76 (1.47–2.12)
▸ 25 to < 30 years	186818	2.0%	2.56 (2.14–3.07)
▸ 30 to < 35 years	193453	2.5%	3.46 (2.89–4.15)
▸ ≥ 35 years	150676	3.3%	4.69 (3.91–5.62)
BMI at the start of pregnancy			
▸ 20 to < 25 kg/m²	305438	1.7%	1.00 (reference)
▸ < 20 kg/m²	84400	1.1%	0.70 (0.65–0.75)
▸ 25 to < 30 kg/m²	128644	3.0%	1.80 (1.73–1.88)
▸ 30 to < 35 kg/m²	46776	4.9%	3.01 (2.86–3.17)
▸ ≥ 35 kg/m²	24933	7.7%	4.96 (4.70–5.24)
Weight increase during pregnancy			
▸ < 20 kg	501673	2.5%	1.00 (reference)
▸ 20 to < 25 kg	61904	1.6%	0.75 (0.70–0.80)
▸ 25 to < 30 kg	15140	1.9%	0.90 (0.80–1.01)
▸ ≥ 30 kg	4936	2.2%	0.97 (0.80–1.17)
Tobacco consumption during pregnancy			
▸ Non-smoker	473048	2.2%	1.00 (reference)
▸ 1 to 5 cigarettes per day	20921	2.3%	1.18 (1.08–1.30)
▸ 6 to 10 cigarettes per day	25181	2.2%	1.11 (1.02–1.21)
▸ 11 cigarettes per day and more	19165	2.0%	0.90 (0.81–1.00)
Nationality of the mother			
▸ German	524289	2.1%	1.00 (reference)
▸ Eastern European (former Eastern bloc)	34154	2.5%	1.37 (1.27–1.47)
▸ Mediterranean	20906	2.8%	1.43 (1.31–1.56)
▸ Other nationality	68036	3.5%	1.77 (1.69–1.86)
Mother's profession			
▸ Higher qualification/ management role	77036	2.1%	1.00 (reference)
▸ Educated/medium qualification	192366	2.3%	1.14 (1.07–1.21)
▸ Uneducated	21079	2.5%	1.16 (1.05–1.28)
▸ Student/trainee	20671	1.3%	1.05 (0.92–1.20)
▸ Housewife	220653	2.6%	1.21 (1.14–1.28)
Total number of pregnancies	647385	2.3%	

BMI: Body Mass Index; GDM: Gestational diabetes mellitus; OR: Odds Ratio; CI: Confidence interval

age of the mother when she has her first child, the growing trend towards obesity and the increase in multiple pregnancies as a result of in vitro fertilisation [11–13]. Each of these factors increases the risk of gestational diabetes considerably, as the regression analysis has been able to demonstrate. On the other hand, an increase in the number of diagnoses could also be explained by the more widespread use of oral glucose tolerance tests and an increased awareness of symptoms among clinicians and expectant mothers.

Conclusion

This study shows how patchy our knowledge of the distribution of gestational diabetes still is in Germany. It is possible, using the nationwide perinatal statistics as the basis, to confirm that the internationally recognised risk factors must be regarded as important and therefore clinically significant among German pregnancies too. However the current situation makes it difficult to make a valid estimation of the absolute annual case numbers and temporal trends for the following reasons. First, any estimate is dependent on the forwarding of standardised and complete documentation on the part of the maternity hospitals. Second, the change in the diagnostic definition of gestational diabetes, which is essentially to be welcomed, makes temporal comparisons more difficult. Third, the extent of unknown cases of gestational diabetes (and pre-existing cases of diabetes) remains a hitherto unknown variable. Only representative screening studies with corresponding comparison groups or comprehensive screening for gestational diabetes would be able to provide such data. The practical issues of such comprehensive screening using oral glucose tolerance tests have been much debated between gynaecologists, diabetologists, health politicians, health economics and representatives of the health insurance funds, and this has recently led to the maternity guidelines being augmented. Subject to verification by the German Ministry of Health, screening for gestational diabetes will in future be included in the maternity guidelines following the decision by the GBA [3]. Soon, every pregnant woman in Germany without manifest diabetes will be offered an oGTT as a result of this decision. Scientific support for this altered situation should be provided so that valid prospective data will also soon be available. Our study adds to the debate and highlights previous epidemiological data on the distribution, development and the groups at risk for gestational diabetes.

Conflict of Interest

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