FACTORS INFLUENCING BIRTH WEIGHT IN NEWBORNS OF DIABETIC AND NON-DIABETIC WOMEN
A POPULATION BASED STUDY

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Maternal diabetes is known to be related to an increase in birth weight of the offspring. However, the mechanism of the association is not entirely clear. In addition, the contribution of the demographic, obstetric and metabolic factors to birth weight in diabetic mothers is not well defined. All the diabetic women (68 requiring insulin-treatment and 403 on diet alone) and a random sample of 1 in 12 of all non-diabetic women (893 women) who delivered in one regional hospital between March 1987 and June 1988 inclusive, were included in the study. Tests for gestational diabetes are routinely performed in our pregnant women population, thus, the study is a population based one. The mean birth weight of infants of diabetic mothers adjusted for gestational age was higher than in those of non-diabetic mothers. However, no relationship was found between maternal glycosylated hemoglobin measured at delivery and the infants birth weight. Furthermore, at each week of gestation, infants born to diabetic mothers were heavier than the infants of non-diabetic mothers (for weeks 37 to 40, p < 0.05), while no differences were found in glycosylated hemoglobin levels between the two groups at any time. In a multivariate model we showed that after controlling for gestational age, the only factors which independently and significantly affected birth weight in our population were diabetes, ethnic origin, and the parity of the mother. Our findings support the possibility that substances which induce hyperinsulinemia, other than glucose, may be related to the higher birth weight of infants of diabetic mothers.

INTRODUCTION

Maternal diabetes is known to be related to increased birth weight of the offspring (8). The biochemical and hormonal factors related to maternal diabetes and the specific role of maternal hyperglycemia during the last trimester of pregnancy have been described (10). However, epidemiological data are scarce regarding the independent contribution of metabolic, obstetric and demographic factors in determining birth weight of newborns of diabetic as compared to non-diabetic women. The aim of the present study was to examine these interrelationships from an epidemiological viewpoint.

In this work we use data obtained from the entire population of diabetic women and a representative sample of non-diabetic women all of whom deliver at one regional facility. The population in our area is unique in that screening for diabetes is performed routinely on all pregnant women attending pre-natal clinics, and thus the vast majority of the women in the population, with gestational diabetes are diagnosed and treated. Specifically, the objectives of this study were: to determine the relationship between maternal
glucose level during the last trimester of pregnancy (as measured by glycosylated hemoglobin at delivery) and birth weight of the offspring, and to identify demographic and obstetric factors which are related to birth weight.

**POPULATION**

The population of the Negev area of Israel is about 300,000, about 55,000 of them are Bedouins. The “Soroka” Medical Center is the only tertiary facility and furthermore, no private delivery facilities exist. Annually, about 8,500 deliveries take place in this Center (100% of the deliveries among Jewish and around 98% of the Bedouin women). Prenatal care is provided by the Ministry of Health Maternal and Child Health Stations, which are situated in all settlements. This service is used by all the Jewish and around 70% of the Bedouin women as a source of prenatal care (Regional Office, Ministry of Health data). The obstetrical staff of the Maternal and Child Centers is affiliated with the “Soroka” Medical Center, ensuring continuity of care from the prenatal to the delivery period.

**METHODS**

All diabetic and a systematic random sample of every twelfth non-diabetic woman delivering between March 1, 1987 and June 30 1988 were included in the study. Multiple births were excluded. The intake into the study was performed by scrutinizing the births registered in the previous 24 hr period, in the delivery room diary. A standard delivery discharge form containing demographic information, medical and obstetric history, as well as data on prenatal care, characteristics of the delivery and its maternal and newborn outcome, is routinely filled out by midwives and obstetricians. This coded form served as the main source of information for the present study.

Women were classified as diabetics according to the data registered in the delivery form which was based on the patient’s history and the results of screening for diabetes. Each day, half of the women were randomly selected for analysis of glycosylated hemoglobin.

The study population was divided into three groups: women were defined as having Gestational Diabetes (GDM) if they had an abnormal 1hr. blood glucose level after a 50 gr. oral glucose challenge (performed between 24-28 weeks of pregnancy), and following it, an abnormal oral glucose tolerance test according to the O’Sullivan and Mahan criteria (9). This screening for diabetes has been performed for all pregnant women attending the Maternal and Child Health Centers since 1985, according to accepted recommendations (12). The second group were women requiring insulin (ITDM). In this group we included Type 1 (Insulin Dependent Diabetes Mellitus) patients as well as all other diabetic women who needed insulin during pregnancy (4). The third group included non-diabetic (ND) women.

Since birth weight is related to week of pregnancy, we used in the analysis birth weight ratio. For this measure, the weight of each newborn was divided by that of the 50th percentile of a standard population of newborns of the same gestational age and sex (6).

Glycosylated hemoglobin (GHB) measurements were performed in the Laboratory of Metabolic Diseases which belongs to the Department of Pediatrics. Blood samples were collected on the morning following the delivery, in tubes containing EDTA and transferred within two hours to the laboratory, where they were kept at 4°C until analyzed. Analysis was performed twice a week using the affinity chromatography method (Glyc-Affin, Isolab, Inc., USA). Only half the women were sampled for GHB determination owing to technical limitations in the laboratory.

**STATISTICAL ANALYSIS**

Chi-square analysis was used for contingency tables, the Student’s t-test to compare the means of continuous variables and one way analysis of variance to compare means of continuous variables between three groups or more. When a statistically significant result (p < 0.05) was obtained, the LSD tests were performed to compare the group means a-posteriori. Pearson correlation was used to estimate the relationship of individual continuous variables with birth weight. Multivariate logistic regression analysis was carried out to estimate the independent effect of various factors on the risk of delivering babies with birth weight ratios greater than 1, and odds ratios and 95% Confidence Intervals were determined. P-values < 0.05 were considered to be statistically significant.

**RESULTS**

During the study period 11,003 deliveries occurred at the “Soroka” Medical Center, of these 68 (0.6%) were in ITDM and 414 (3.8%) in GDM patients. Complete information was obtained for 471 diabetic (97.7%) and 893 non-diabetic (99.1%) purperal women and their infants out of the 482 diabetics and 901 non-diabetics who were in the original sample. One infant in each of the diabetic groups died within the delivery hospitalization period. The infants birth weight was 1710 g and 3310 g for the infants from the ITDM and GDM groups respectively. In the ND group there were three antepartum, two intrapartum, and three early neonatal deaths in infants with birth weights ranging from 940 g to 3000 g. All infants were included in the analyses.

Maternal and infant characteristics at delivery by diabetic status are shown in Table 1. ITDM women