The relation of birth weight and gestational age to biological, occupational and socioeconomic factors

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Summary

The data of the 2,040 single births, born during 1987 at the "Saint Antoine" Hospital in Paris, were analysed in order to identify the impact of various biological, occupational, and socioeconomic factors on gestational age and birth weight.

Birth weight is associated with the height of the mother and the weight gained during pregnancy. It is lower for mothers with preeclampsia during the current or previous pregnancies or with urogenital infections during the current pregnancy and for mothers with one or more induced abortions. Girls weigh less than boys. Parity has a positive relation to the baby's weight, while manual work seems to have a negative one. ABGAR score and duration of the pregnancy are associated with the birth weight.

Placenta previa, preeclampsia and urinary infections affect the gestational age. A short pause period in work is related to a shorter gestational age. Weight gain is associated with a prolonged duration of the pregnancy. Gestational age and birth weight are associated with the nationality of the mother, especially in some ethnic groups, and with marital status.

Key words: Birth weight; Gestational age; Prematurity; Pregnancy; Socio-economic factors; Occupation.

Introduction

Many previous studies have demonstrated a relation of gestational age and birth weight to age, parity, height and weight of the mother, as well as to environmental socioeconomic, nutritional and occupational factors. Certain medical, surgical and obstetrical complications have also been assessed. These studies have several controversial issues and have not established a sufficient interpretation of the etiology of the action of various factors [11, 34]. In this study an analysis of routinely recorded data in French hospitals was attempted, in order to evaluate their contribution to gestational age and birth weight.

Materials and Methods

The data consisted of 2,040 single births, live or stillborn, during the year 1988, born to French or foreign women seeking prenatal and delivery care at the "Saint Antoine" Hospital in Paris, France. Detailed information on prenatal and delivery events are registered according to a pre-established procedure and computerized regularly.

The weeks of pregnancy were carefully established during the prenatal period and ultrasonography was routinely performed. Only women sure of the dates, with a regular cycle not exceeding 32 days and whose last menstrual period was not a withdrawal bleed from the pill were included. Gestational age is expressed in completed weeks. Maternal height was measured by the midwife at the first antenatal visit. Pre-pregnancy weight was reported by the patient at a personal interview. Net pregnancy weight gain was calculated by substracting pre-pregnancy, fetal and placental weight from the final weight. All women were classified in 8 categories according to their profession. According to the suggested fatigue of each profession all women were classified into two groups: manual or intelectual work. They were also classified into 8 ethnic groups. Women in this sample shared the same medical care and all lived in Paris.

Gestational age and birth weight were correlated with various variables such as mother's age, height, weight, weight gain during pregnancy, birth order, medical and obstetrical complications in the last or previous pregnancies, number of induced or spontaneous abortions, marital status, smoking before and during the pregnancy, alcohol consumption, sex of the child, ethnic group, occupation, and duration of pause of work before delivery. In order to indentify the impact of these factors on birth weight and gestational age the method of regression analysis was used. Different regression models were developed in which birth weight and gestational age were separately dependent variables and all the above-mentioned factors were considered as independent variables. In order to encompass the qualitative differences, we used models based on the "dummy variables approach" [16, 17].

Results

The results of the analysis show that birth weight is related to the height of the mother (p:0.010) and the weight gained during pregnancy (p:0.000). It is lower for mothers with pre-eclampsia during current pregnancy (p:0.000) or previous pregnancies (p:0.061) or urogenital infections during current pregnancy (p:0.008) and for

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mothers with one or more induced abortions (p<0.002). Girls have lower weight than boys (p:0.000). Parity is positively related to the child's weight (p:0.000), and manual work may be negatively related (p:0.056). APGAR score and duration of the pregnancy are related to birth weight (p:0.000).

Placenta previa (p:0.000), pre-eclampsia (p:0.008) and urinary infections (p:0.017) affect gestational age. A short pause-period in work is related to a shorter gestational age (p<0.015), and weight gain is related to prolonged duration of the pregnancy (p:0.001). Gestational age and birth weight are related to the nationality of the mother, especially in some ethnic groups, and to marital status (Table 1).

Discussion

The etiology of low birth weight is generally unknown, although the contribution of maternal weight and height is reasonably well established [34]. Birth weight is associated with net weight gain during pregnancy. It has been shown that the risk of a large-for-date infant when net weight gain was low, was only slightly reduced, but a small-for-date infant was very unlikely in association with relatively light weight gain [22, 23]. The positive relationship between weight gain and duration of pregnancy was also detected in other studies [29].

In all studies the sex differences in proportion were dominated by the consistently larger dimensions of boys compard with girls [25].

It was believed that mother's age is a factor predisposing to low birth weight. Considering further age-dependent factors (parity, weight of the mother) no statistically significant influence of the mother's age on the birth weight of her child could be found. It seems that high rates of prematurity occur mothers less than 20 and mainly under 16 years of age [4, 18, 29, 34].

No clear relation was established in our study between birth weight or pregnancy duration and the occupation of the mother. A negative relation between birth weight and manual work was indicated. It could be explained as being associated with the occupational fatigue of the work. Nowadays, in western countries working pregnant women do not register less favourable perinatal outcomes; on the contrary, some studies have established that the preterm delivery rate of those women is lower than that of non-working women [30].

A study of a national sample in France proved that manual, service and shop workers had a higher preterm delivery rate than professional, administrative, or clerical workers. The relation between physically arduous working conditions and outcome of pregnancy, in particular a higher preterm delivery rate, has often been reported [7, 31]. If the elements of occupational fatigue were studied in detail, there would be a significant relationship between the prematurity rate and the number of high fatigue scores observed on the job [20]. The association of low birth weight with specific occupations has also been indicated in recent studies [2].

The association of a short period of work interuption before delivery to the duration of the pregnancy can reflect an etiological relation, but it can also be related to the fact that prematurity imposes an early interruption of the work.

Parity exerts an important influence on the birth weight; women with multiple pregnancies are at higher risk for low birth weight. Birth order did not exert a significant influence on the incidence of prematurity [11, 27, 34]. Our findings suggest that gestational age could be influenced by multiparity, especially after the 5th delivery. It is not possible to determine if it is associated with socioeconomic factors affecting parity or to a biological reason.

As was shown by Donald in 1939 [10], and confirmed by more recent studies [3, 22], one factor related to birth weight is the birthweights of previous sibblings. Our data show a strong association of birth weight to the existence of a previous small-for-date baby.

It is clear that pathological factors during pregnancy contribute greatly to low birth weight. The presence of preeclampsia markedly increases the chance of having a small-for-date baby [27]. According to the results of our study preeclampsia not only in the current but in previous pregnancies is associated with low birthweight. Preeclampsia also predisposes to prematurity [11]. Such a relation of lower birth weight to pelvic or genital tract infections observed in this study is not well documented in other studies [6, 12, 13]. The known contribution of pathological diseases like diabetes or hypertension can not be confirmed in our study because of the small number of cases. The association of bleeding before pregnancy to pregnancy duration must be due to uterus or hormonic abnormalities which could influence the evolution of the pregnancy.

Whether or not prior induced abortion is a risk factor for low birth weight has been a controversial issue. Because of the well known increase in birth weight in second deliveries, it is important to control for both gravidity and parity when examining effects of induced abortion [5, 6, 9, 15, 34]. From the effected analysis we have considered separately the contribution of parity, induced and spontaneous abortions. It can reasonably be concluded, therefore, that one or more prior induced abortions had a meaningful effect on the low birth weight rate in our study population. A similar conclusion was not established for spontaneous abortions.

Cigarette smoking during pregnancy is associated with an increased risk of spontaneous abortion and perinatal mortality and reduced maternal weight gain, gestational age and birth weight is highly dependent on the average number of cigarettes smoked per day during pregnancy [1, 14]. Recent studies have proven the effect of the passive smoking on birth weight [28]. Heavy maternal alcohol use during pregnancy has been linked to decreased intrauterine growth in numerous studies, while the relationship of moderate alcohol use to fetal growth is less clear and conflicting results have been reported [19, 21, 33]. The failure to confirm an association of alcohol consumption in this study may be a result of the small

Table 1. — *Relation of birth weight and gestational age to the various studied factors*

	Dummy variable	ß Birth weight	S.E.	P	ß	S.E. Gestational age	P
Age 16-19 years	–	–30.378	72.05	0.673	0.298	0.31	0.339
» 20-24 »	DV						
» 25-29 »	–	–10.559	25.89	0.683	0.032	0.11	0.775
» 30-34 »	–	–0.401	29.63	0.989	0.113	0.13	0.378
» 35-45 »	–	21.325	37.03	0.989	0.657	0.16	0.682
Pathology of previous pregnancies							
Nothing	DV						
Preeclampsia	–	–79.426	42.27	0.061•	–0.151	0.18	0.408
Previous small-for-date baby	–	–127.559	52.84	0.116	–0.282	0.23	0.218
Bleeding	–	–14.880	33.11	0.654	–0.288	0.14	0.044*
Infections	–	–51.084	88.81	0.561	0.207	0.38	0.590
Weight gain (during pregnancy)		111.165	12.94	0.000*	0.191	0.06	0.001*
Previous diseases							
Nothing	DV						
Respiratory or circulatory	–	–18.683	35.95	0.603	0.145	0.16	0.350
Mental	–	–77.759	62.25	0.212	0.321	0.27	0.233
Urinary Infections	–	–9.201	42.34	0.828	0.063	0.18	0.732
Others	–	–14.783	24.18	0.541	0.031	0.11	0.774
Parity (order of pregnancy)							
1	DV						
2	–	142.638	25.82	0.000*	–0.181	0.11	0.104
3	–	182.087	33.66	0.000*	–0.211	0.14	0.147
4	–	239.375	43.85	0.000*	–0.140	0.12	0.462
5 or more	–	255.148	49.71	0.000*	–0.590	0.21	0.006
Induced abortions							
0 (none)	DV						
1	–	–84.571	27.07	0.002*	0.171	0.17	0.143
2 or more	–	–164.262	48.03	0.001*	0.162	0.21	0.434
Spontaneous abortions							
0 (none)	DV						
1	–	–47.727	28.761	0.097•	0.039	0.12	0.751
2 or more	–	–71.036	57.26	0.215	0.260	0.25	0.293
Marital status							
Unmarried	–	–44.676	24.43	0.068•	–0.411	0.16	0.012*
Married	DV						
Pathology of current pregnancy							
Nothing	DV						
Placenta previa, Premature separation of the placenta	–	–12.286	36.34	0.641	–1.084	0.11	0.000*
Preeclampsia, Hypertention	–	–195.587	36.80	0.000*	–0.422	0.16	0.008*
Bleeding	–	–65.483	53.83	0.224	–0.211	0.15	0.147
Urogenital infections	–	–120.439	44.97	0.008*	–0.313	0.13	0.017*
Kind of work							
Not working	DV						
Intellectual-work	–	–2.121	2.23	0.343	0.063	0.18	0.731
Manual-work	–	4.307	2.25	0.056•	0.071	0.20	0.719

p = significance for two-tail test
* = $p<0.05$, statistically significant
• = $p<0.10$, statistically not clear
S.E. = Standard error
D.V. = Dummy variable

Segue Table 1. — *Relation of birth weight and gestational age to the various studied factors*

	Dummy variable	ß Birth weight	S.E.	P	ß	S.E. Gestational age	P
Sex of child							
0+	DV						
0+	–	–126.655	18.05	0.000*	0.052	0.08	0.503
Mothers' height		4.407	1.70	0.010*	–0.002	0.01	0.761
Mothers' weight		9.137	1.09	0.000*	0.015	0.01	0.640
Job classification							
Lawyers, engineers, managers, scientists.	–	51.161	44.98	0.256	–0.286	0.19	0.142
Storestaff, storekeepers	–	10.551	37.99	0.781	–0.223	0.16	0.176
Clerical.	DV						
Teachers, educators	–	–2.824	39.45	0.943	0.247	0.17	0.148
Medicosocial, laboratory staff	–	20.670	33.34	0.535	0.125	0.14	0.387
Skilled workers, qualified workers	–	3.492	46.90	0.941	0.223	0.20	0.272
Cleaning staff, unskilled workers	–	10.600	40.77	0.795	–0.015	0.18	0.934
Unemployed	–	–48.947	32.66	0.134	–0.122	0.14	0.388
Alcohol consumption							
No	DV						
Yes	–	–58.671	58.52	0.316	0.099	0.25	0.696
Duration of pause of employment before delivery							
0-7 days	–	2.813	38.85	0.942	–0.407	0.17	0.015*
8-14 »	–	–31.725	44.42	0.475	–0.604	0.19	0.002*
15-21 »	DV						
22-28 »	–	31.88	55.72	0.567	0.443	0.24	0.660
29-60 »	–	–4.144	43.25	0.924	0.222	0.19	0.235
>61 »	–	–29.653	48.49	0.541	0.108	0.21	0.607
Smoking during pregnancy							
No	DV						
Yes	–	–4.452	2.93	0.019*	–0.013	0.13	0.069
Smoking before pregnancy							
No	DV						
Yes	–	–0.451	1.13	0.731	0.011	0.01	0.146
APGAR							
score		14.011	5.127	0.006*	0.157	0.22	0.000*
Duration of pregnancy		158.224	5.88	0.000*			
Nationality							
France, Central North Europe	DV						
South Europe	–	48.008	39.41	0.223	–0.058	0.17	0.732
North Africa	–	68.477	3.25	0.024*	–0.045	0.13	0.731
Rest of Africa	–	–121.210	39.74	0.002*	–0.197	0.17	0.253
South America	–	14.064	94.48	0.882	–0.023	0.41	0.956
Middle East	–	57.077	94.61	0.548	0.103	0.25	0.681
Far East	–	–72.247	58.21	0.215	0.658	0.41	0.107
Antillean Polynesian	–	–34.959	37.03	0.351	–0.593	0.16	0.000*

p = significance for two-tail test
* = $p<0.05$, statistically significant
• = $p<0.10$, statistically not clear
S.E. = Standard error
D.V. = Dummy variable

number of women with intermediate or high alcoholic consumption during the pregnancy, in our sample.

It has been established that pregnancy duration is shorter among black women in comparison to white women. Low birth weight fractions vary widely by ethnic group. Social, demographic, nutritional and other life style factors presumably account for some of these differences. Genetically-determined physiological differences in pregnancy duration and birthweight may also count [11, 26, 32]. The findings of this study do not permit strong conclusions about the ethnic group differences because of the lack of the analysis of the various social confounding factors. The fact that babies of unmarried women have lower birth weights could be interpreted as reflecting all these social factors.

Low birthweight has been implicated as one of the single most important predictors of perinatal death. This study shows that the APCAR score of the baby was strongly influenced by the birth weight and duration of the pregnancy. The type of analysis done did not permit us to explore the limits of the gestational age and birth weight which are unfavorable for APCAR scores.

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