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## Low birth weight in a heterogenic population

Shlomo Mor-Yosef, Yossef Ezra, Arnon Samueloff, Fuad Moussa, and Joseph G. Schenker

Department of Obstetrics and Gynecology, Hadassah University Hospitals, Ein-Kerem, Jerusalem, Israel

### 1 Introduction

Low birth weight (LBW) infants have the greatest risk of permanent disability and are associated with most deaths during the first year of life.

Perinatal complications as well as long term sequelae, such as learning disabilities, cerebral palsy, and various degrees of mental retardation require a great deal of the social and economical resources of todays modern society [2].

The rate of LBW may serve as a marker of the degree of development of a society [4, 11, 14, 15, 20, 22, 25, 26]. Starvation, infections, and physical stress, all of which are characteristics of the disadvantaged strata of the society, increase the LBW rate [13, 29 31]. Some other factors also thought to be associated with LBW, are maternal age, ethnic origin, parity, and narcotic addiction [23]. Hence, estimation of the LBW rate has been of interest in almost every developed country in the world and form the basis of many published reports.

The Israeli population is composed of two main groups of residents, Jews and non-Jews. A proportion of the Jewish population consists of immigrants who come from diverse social, cultural and geographical backgrounds, though the younger generation are Israeli born. The study of such a population enables us to clarify some epidemiological aspects that are associated with heterogeneity in general.

Three interesting reports in the last year [7, 16, 18], gave conflicting explanations for the substantial differences in premature delivery rates of LBW infants between whites and blacks.

### Curriculum vitae

SHLOMO MOR-YOSEF was born in 1951 in Jerusalem. In 1980 he graduated at the Hebrew University Medical school and received the M.D. degree. In 1986 he completed his residency training in the obstetric and gynecological ward at the Hadassah Medical Center, Jerusalem and passed the Board examination. In 1983 he conducted a national survey of deliveries for the Israeli Ministry of Health. Since 1986 he has been a chief physician of the Obstetric and Gynecological department of the Hadassah Medical Center and of the Hebrew University Medical School.



The purpose of our nationwide study was to find out if there are any differences in the LBW rate among the ethnic subgroups which comprise our heterogeneous population. In addition, we have evaluated some other parameters, such as parity, age, and the existence of hypertensive disorders during the pregnancy, in order to establish whether our population has similar obstetric problems to these of other developed countries.

### 2 Material and methods

In Israel 99.8% of all deliveries take place in hospital [7]. The study population included all the Israeli women delivered between November 1st, 1983 and January 31st, 1984. Data were retro-

spectively, obtained from three sources: antenatal charts, delivery room registers and neonatal records.

The relevant parameters which were collected were: Birth weight, maternal age, parity, ethnic reference (Jews or non-Jews with subdivision of the Jews by continent and country of birth), address (rural or urban), and the existence of hypertensive disease or preeclampsia.

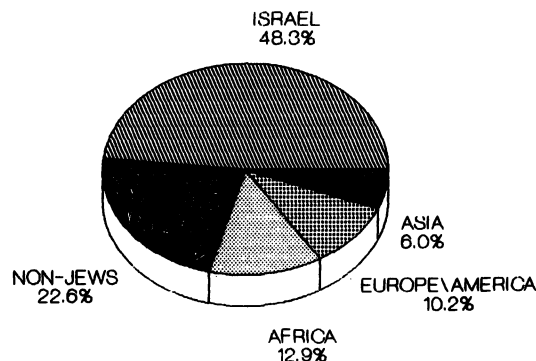
The data was divided into certain subgroups as follows:

1. **Maternal age:** between 14–24, 25–29, 30–34, 35–39, and more than 40 years.
2. **Parity:** primiparity, 2–4, 5–6 and > 7.
3. **Ethnic reference:** non-Jews or Jews, with subdivision of the Jewish population into the continent of their birth.
4. **Address:** rural or urban.
5. **Hypertensive disease:** chronic hypertension, pregnancy induced hypertension (PIH), or preeclampsia (mild, moderate, or severe).

The data were analyzed by the digital Vax 781, using the SPSS X 21 package. Statistical analysis was performed by the “chi square test”.

### 3 Results

Of the 22,815 women included in the analysis, 22.6% were non-Jews and 77.4% were Jews. 62.4% of the Jews were born in Israel, 7.8% were from Asia, 16% from Africa, and 13.2% from Europe/America (figure 1). The mean birth weight



**Figure 1.** The study population is represented according to religion (Jews and Non-Jews); the different countries of origin of the Jewish women are also presented.

**Table I.** Mean birth weight and the incidence of LBW by ethnic-origin groups.

Group	LBW	Mean birth weight g
Non-Jews	7.1	3222 ± 541
Jews (Total)	6.9	3222 ± 554
Israeli born	6.9	3212 ± 541
Asia	7.2	3207 ± 554
Africa	5.5	3315 ± 575
Europe/America	5.6	3303 ± 495
Total population	6.9	3222 ± 551

was 3222 ± 551 g. The small differences between the ethnic groups had no medical or statistical significance (table 1). Rates of LBW did not vary by ethnic grouping (table I). The rate was 6.9% in Jews and 7.1% in non-Jews (non-significant).

LBW has been shown to be associated with several factors:

1. **Maternal age:** LBW rate was higher in the youngest age group (8.4%) and in the oldest (9.5%). The total population rate was 6.9% ( $p < 0.001$ ), (figure 2).
2. **Parity:** primiparity was associated with a high LBW rate (10.1%). This rate was significantly reduced in the multiparous (figure 3).
4. **Living directory:** no significant differences have been detected between rural and urban populations.
5. **Hypertensive disease:** chronic hypertension was associated with higher rates of LBW (23%), even more than that in pregnancy induced hypertension (15.8%) ( $p < 0.0001$ ) (figure 4). Mild to moderate preeclampsia doubled the rate of LBW to 15% (as compared with the normal population), and severe preeclampsia increases this rate by 7–8 fold (47.1%), ( $p < 0.0001$ ) (figure 5).

### 4 Discussion

By estimating the LBW rate one may elucidate the developmental and social status of a given society and gain an impression of its medical and health services. Birth weight may be associated with many factors such as ethnicity, membership of an urban or rural population socioeconomic status and whether the pregnancy is complicated by illness.

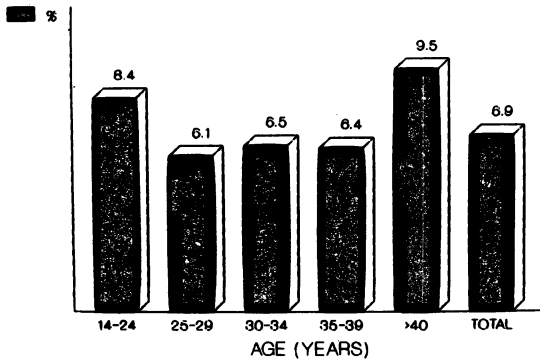


Figure 2. Maternal age and LBW rate.

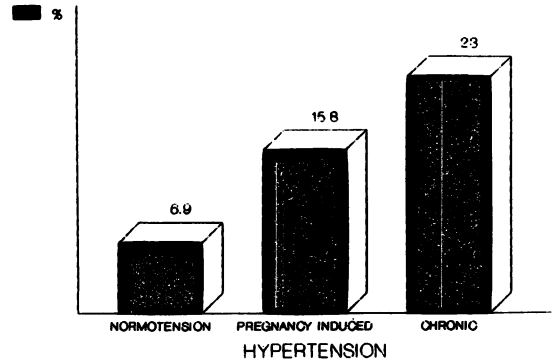


Figure 4. Hypertension and LBW rate.

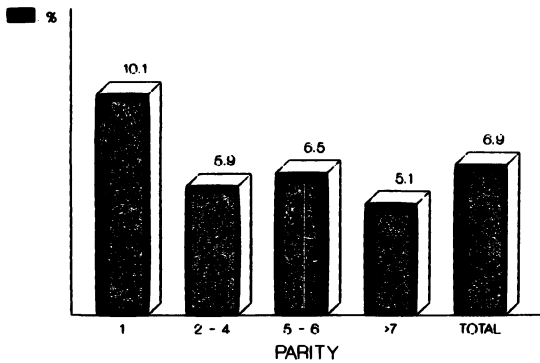


Figure 3. Parity and LBW rate.

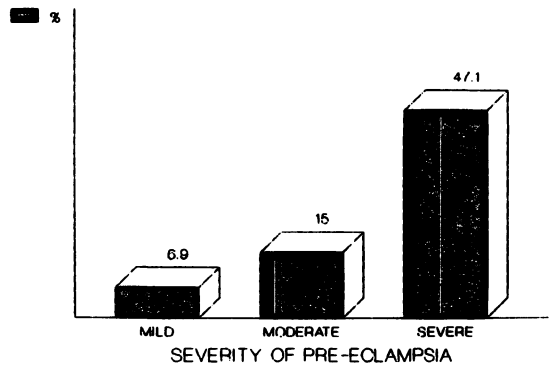


Figure 5. Pre-eclampsia and LBW rate.

The overall LBW rate found in our study (6.9%) was similar to that of Denmark (6.4%), Canada (6.5%), France (6.5%), Britain (7%), and the USA (7.4%) [31].

The LBW rate was highest in the youngest and the oldest age groups in our study. Such a tendency has been previously reported by other investigators. EISNER et al [12], in their study of the United States population in 1974, found that younger women (less than 18 years) or older women (more than 35) had a greater tendency of deliver LBW babies than had all other age groups. Similar observations were reported in 1978 from Australia [28]. HEDAYAT et al [14] from Iran, ODUNTAN [22] from Nigeria and DECLERCQ [9] from the United States found the high risk group comprised older women aged 30–34 years. In contrast to these reports, SOYSA [27] found no association between

maternal age and birth weight. Parity, which was higher in the oldest age group correlated well with higher birth weights.

In our study, primiparity was associated with lower birth weights. The literature since 1943 agrees with this observation. BROMBERG et al [3] found a low incidence of LBW in multiparous women. DECLERCQ [9] in 1978 has shown that first deliveries occurring in hospital were associated with a higher rate of LBW than second deliveries, and that this difference was even more marked in home deliveries [9]. Similar observations have been reported by others [5, 10, 14, 15, 21, 22, 27].

WARBURTON and NAYLOR [30] tried to explain the differences between the birth weight of first and second deliveries immunologically. According to their theory the mother would be maximally sen-

sitized against paternal antigens during her first pregnancy, and every consecutive pregnancy will desensitize her to these antigens, thus leading to an increase in birth weight. MAGNUS et al [19] did not confirm this theory, but did not exclude an immunological basis as an explanation of this phenomenon.

The effect of preeclampsia and hypertension on birth weight is apparent, especially when severe preeclampsia ensues. The LBW rate is increased significantly from 6.9% in normotensive women to 15.8% in pregnancies which were complicated by pregnancy induced-hypertension, and to 23% when chronic hypertension was involved. Preeclampsia had an even worse effect (from 6.9% in mild to 15% in moderate preeclampsia and to 47.1% in severe preeclampsia). These observations are in accordance with many other reports. ARIAS [1] found a definite association between chronic hypertension and LBW rates. CHIN CHU LIN [8] emphasized the role of preeclampsia as an important factor associated with LBW. SIBAI et al [24], found a sevenfold increase in LBW rate when preeclamptic women were compared to hyperten-

sive ones (from 5.3% to 32%). In contrast to the majority of authors who have reported on this subject, PAGE and CHRISTIANSON [21], stated that all types of hypertension, except PIH, have been associated with poorer outcome of pregnancy.

Asian and European Jews have been separated for many generations and they exhibit marked anthropological differences, being culturally and genetically closer to the gentile populations among whom they have lived [17]. As a result the Jewish population in Israel is heterogeneous since it has been gathered from all countries of the world. It is surprising that no differences are apparent between Asian, Western and Israeli-born groups in our study. We can conclude from these data that environmental factors have the most critical influence on LBW incidence and not genetic factors. These observations are well supported by LIEBERMAN et al [18], who found that specific medical and socioeconomical characteristics, were the main contributing factors to the racial difference in prenatal births rate in the USA. CARR-HILL et al [6], showed that genetic factors have a very small role in determining birth weight.

### Abstract

In order to elucidate some of the factors which influence the low birth weight rate, 22,815 deliveries were studied. It is already known that low birth weight (LBW) underlies the majority of infant deaths. It is also associated with an increased risk of permanent disability such as cerebral palsy, learning difficulties, and mental retardation of various degrees in survivors. In modern society these problems require major resources from the health budget. The Israeli population is composed of Jews and non-Jews, who differ not only in their religion but also in their customs. Most of the Jews are immigrants from many parts of the world who still retain many of the habits, customs and lifestyles of the societies they had lived in for many generations. We evaluated the LBW rate in these different groups. Jews and non-Jews have similar rates of LBW and similar mean birth weights. Other factors such as maternal age, parity, and hyper-

tensive disorders of pregnancy showed some statistically significant differences. LBW rates increase from 6.9% in the babies of women aged 24–40 years to 8.5% in those < 24 years, and 9.5% in those over 40. The risk of LBW was increased in primiparae to 10%. The highest rates were found in babies of mothers with hypertension. Pregnancy induced hypertension is associated with a LBW rate of 15.6% and chronic hypertension with a rate of 23%. Moderate and severe preeclampsia are important risk factors since they increase the rate to 15% and 47.1%, respectively. In the light of this data and after reviewing the literature, we can conclude that environmental factors have no effect on birth weight. However maternal age, parity, and hypertensive disorders especially when associated with preeclampsia increase the LBW rate significantly.

**Keywords:** Low birth weight, preeclampsia, pregnancy induced hypertension.

### Zusammenfassung

#### Niedriges Geburtsgewicht in einer heterogenen Bevölkerung

Um einige Faktoren, die Einfluß auf ein niedriges Geburtsgewicht haben, näher zu bestimmen, haben wir ein Kollektiv von 22 815 Geburten untersucht. Bekannt ist,

daß ein niedriges Geburtsgewicht hinsichtlich der perinatalen Sterblichkeit im ersten Lebensjahr den höchsten Risikofaktor darstellt. Auch das Risiko von bleibenden Schäden wie cerebrale Lähmungen, Lernschwierigkeiten und mentale Retardierung unterschiedlichen Ausmaßes

ist erhöht. In der modernen Gesellschaft werden dadurch Gesundheitsdienste und auch Gelder in starkem Maße beansprucht. Die Bevölkerung in Israel setzt sich aus Juden und Nichtjuden zusammen, die sich in Bezug auf die Religion und Gebräuche unterscheiden. Die meisten Juden sind eingewandert und behalten die Lebensgewohnheiten der gesellschaftlichen Umwelt, in der Generationen gelebt haben, bei. Wir untersuchten die Rate an niedrigem Geburtsgewicht in diesen beiden Gruppen, wobei sie sowohl hinsichtlich des niedrigen Geburtsgewichtes wie auch des durchschnittlichen Geburtsgewichtes miteinander vergleichbar waren. Andere Faktoren wie mütterliches Alter, Parität und Blutdruckerhöhungen während der Schwangerschaft ließen statistisch signifikante Unterschiede erkennen. In der Gesamtbevölkerung stieg der Prozentsatz an untergewichtigen Kindern von 6.9% auf 9.5%, wenn die Mütter älter als

40 Jahre waren. Bei jungen Müttern (< 24 Jahre) betrug die Rate 8.5%. Unter Erstgebärenden war die Rate untergewichtiger Kinder auf 10% erhöht. RR-Erhöhungen sind in besonders hohem Maße mit einem niedrigen Geburtsgewicht assoziiert. Beim schwangerschaftsinduzierten Hypertonus steigt die Rate auf 16.6%, bei chronischem Hypertonus auf 23%. Mittelschwere und schwere Präeklampsien stellen erhebliche Risikofaktoren dar. Die Raten untergewichtiger Kinder liegt bei 15% bzw. 47.1%. Auf dem Hintergrund dieser Daten und nach Durchsicht der Literatur schließen wir, daß soziale Faktoren wie Religionszugehörigkeit, Gebräuche etc. keinen Einfluß auf das Geburtsgewicht haben. Mütterliches Alter, Parität und Blutdruckerhöhungen, speziell, wenn sie mit Präeklampsien einhergehen, sind jedoch Faktoren, die die Rate an untergewichtigen Kindern deutlich ansteigen lassen.

**Schlüsselwörter:** Niedriges Geburtsgewicht, Präeklampsie, schwangerschaftsinduzierter Hypertonus.

## Résumé

### Faible poids de naissance dans une population hétérogène

On a étudié 22 815 accouchements afin d'élucider certains facteurs influençant le taux de faible poids de naissance. On sait déjà qu'un faible poids de naissance entraîne le risque le plus élevé de mort périnatale au cours de la première année de vie. Il s'accompagne également d'un risque accru d'infirmité permanente telle que paralysie d'origine cérébrale, difficultés d'apprentissage et retard mental d'importances diverses. Dans la société moderne, ces problèmes nécessitent beaucoup de ressources tant au niveau de la santé que budgétairement. La population israélienne est composée de juifs et de non juifs, qui diffèrent au niveau de la religion et des habitudes. La plupart des juifs sont des immigrants en provenance de tout le globe et ils conservent beaucoup des habitudes des sociétés où ils ont vécu depuis des générations. Nous avons évalué le taux de faible poids de naissance au sein de ces différents groupes. Les juifs et les non juifs ont des taux similaires de faible poids de naissance comme de poids de naissance moyen. D'autres facteurs tels que l'âge maternel, la parité et la pathologie

hypertensive de la grossesse montrent des résultats significatifs sur le plan statistique. Le pourcentage de faible poids de naissance s'élève de 6,9% dans la population générale à 9,5% quand l'âge maternel dépasse 40 ans. Lorsque l'âge maternel est inférieur à 24 ans, ce pourcentage s'élève à 8,5%. La primiparité élève le risque de faible poids de naissance à 10%. C'est la pathologie hypertensive qui entraîne les taux les plus élevés de faible poids de naissance. L'hypertension induite par la grossesse s'accompagne d'un taux de 15,6% de faible poids de naissance, et l'hypertension chronique d'un taux de 23%. La prééclampsie qu'elle soit modérée ou sévère est un facteur de risque important puisqu'elle élève le taux de faible poids de naissance de 15% à 47,1%.

A la lumière de ces données et après avoir passé en revue la littérature, nous pouvons conclure que les facteurs d'environnement n'ont pas d'effet sur le poids de naissance. L'âge maternel, la parité et la pathologie hypertensive, tout particulièrement la prééclampsie augmente de façon significative le taux de faible poids de naissance.

**Mots-clés:** Faible poids de naissance, hypertension induite par la grossesse, prééclampsie.

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Dr. Yossef Ezra  
Department of Obstetrics and Gynecology  
Hadassah University Hospital  
P. O. Box 12000  
Jerusalem 91120  
Israel