Incidence and determinants of low birth weight in Syrian government hospitals

S. Wannous[1] and S. Arous[2]

معدلات وقوع الولادات الناقصة الوزن ومحدّداتها في المستشفيات الحكومية في سورية

شادية ونوس وسامر عروس

خلاصة: درست معدلات وقوع الولادات الناقصة الوزن ومحدداتها في عينة متعددة الطبقات من 10585 من الولادات في 18 من المستشفيات الحكومية السورية، وتمّت مقارنة كل مولود ناقص الوزن بمولودين اثنين من ذوي الوزن الطبيعي عند الولادة. ووزعت استبيانات على الأمهات مع إجراء الفحص السريري (الإكلينيكي) على المواليد. واتضح أن معدل حدوث نقص الوزن عند الولادة يبلغ 6.6٪، وأنه يختلف باختلاف المناطق الجغرافية والمستشفيات. أما العوامل التي تدفع إلى التدخّل مثل الفترات الفاصلة بين الولادات، وتغذية الأمهات، ووزنهن، وموقفهن من التدخين، فقد كان لها أثر واضح في إنقاص الوزن عند الولادة.

ABSTRACT The incidence and determinants of low birth weight were studied in a stratified sample of 10 585 deliveries at 18 Syrian government hospitals. For each low-birth-weight baby born, two normal-birth-weight babies were recruited as a comparison group. A questionnaire was given to mothers and clinical examinations were performed on the neonates. The incidence of low birth weight was 6.6%. It varied according to geographic region and hospital. The study confirmed that low birth weight could be the result of prematurity. Factors amenable to intervention, such as birth interval, maternal nutrition, maternal weight and smoking, appeared to have a role in low birth weight.

Incidence et déterminants de l'insuffisance pondérale à la naissance dans des hôpitaux gouvernementaux syriens

RESUME L'incidence et les déterminants de l'insuffisance pondérale à la naissance ont été étudiés dans un échantillon stratifié de 10 585 accouchements dans 18 hôpitaux gouvernementaux syriens. Pour chaque nourrisson présentant une insuffisance pondérale à la naissance, deux nourrissons de poids de naissance normal ont été recrutés comme groupe de comparaison. Une série de questions a été posée aux mères et des examens cliniques ont été réalisés chez les nouveau-nés. L'incidence de l'insuffisance pondérale à la naissance était de 6,6 %. Elle variait en fonction de la région géographique et de l'hôpital. L'étude a confirmé que l'insuffisance pondérale à la naissance pouvait résulter de la prématurité. Des facteurs qui peuvent faire l'objet d'interventions, tels que l'intervalle entre les naissances, la nutrition de la mère, le poids de la mère et le tabagisme, semblaient jouer un rôle dans l'insuffisance pondérale à la naissance.

[1]Reproductive Health Division; [2]Nutrition Division, Ministry of Health, Damascus, Syrian Arab Republic.

Received: 06/11/00; accepted: 02/08/01

Introduction

Birth weight is one of the most important individual factors influencing the neonatal death rate [*1*]. It also affects the infant mortality rate, especially in premature babies. Infant mortality rates are 6 times higher if the birth occurs between weeks 34–36 of gestation, and 57 times higher if the birth occurs before week 34 of gestation. Birth weight is also important in infant and child morbidity [*1–5*]. For these reasons, birth weight has for a long time been the subject of much clinical and epidemiological research, often directed towards establishing the causes and determinants of low birth weight (LBW) in order to identify factors that can be targets for public health interventions [*5*].

The World Health Organization has defined LBW as a weight at birth of less than 2500 g [*2,3*]. Many factors may contribute to LBW and there is considerable debate about which of these have independent effects and about the qualitative importance of these effects. Basically, two major factors are thought to control LBW: the duration of pregnancy (gestational age) and intrauterine growth rate [*5*]. Therefore, LBW may result from short gestation (prematurity) or from intrauterine growth retardation, or a combination of both. Prematurity is more common in industrialized countries, while intrauterine growth retardation is common in developing countries. It is estimated that of the 22 million cases of LBW that occur every year, 20 million are in developing countries [*4,5*].

The most important approach to the problem of LBW is prevention. This could be done through improving the living standards among the general population, and by systematic care of pre-pregnant women, including improvements in nutrition, medical care and work conditions [*6*].

Neonatal and infant mortality rates are very high in the Eastern Mediterranean Region (EMR) [*6*] and child morbidity resulting from malnutrition and susceptibility to infection is also high. Birth weight in the EMR has not been studied on a national scale in the individual countries because deliveries in many of these countries occur at home, often attended by traditional birth attendants (TBAs) or by village midwives who do not weigh the baby. Even the records of deliveries that occur at hospitals are not always complete [*6*]. This situation applies to the Syrian Arab Republicwhere an average of 64% of all deliveries occur at home, 20% attended by TBAs. This percentage is higher among illiterate and rural women. Neonatal and infant mortality rates are also relatively high (18.0 and 34.6 per 1000 live births respectively) [*7*].

No studies of LBW have been conducted in the Syrian Arab Republic on the national level. The Papchild survey in 1993 revealed that 10% of babies were LBW according to their mothers [*7*]. Only two local studies have focused on LBW in the two major teaching hospitals: these showed an incidence of LBW of 10.0% in Damascus hospitals [*8*] and 7.7% in Lattakia hospitals [*9*].

The objectives of this study were: to record the incidence of LBW in the Syrian Arab Republic; to identify the important determinants of fetal weight; and to recommend suitable preventive actions. A wide range of variables thought to be risk factors for low birth weight were studied by comparing their distribution in LBW and normal-birth-weight (NBW) babies.

Methods

Of the 131 hospitals that provide delivery services in Syrian Arab Republic, 18 were selected for inclusion in the study, stratified by region and by number of deliveries. The aim was to study 8% of the annual number of 130 000 deliveries at government hospitals [7], giving a target sample of 10 585 births. This number was divided across the 18 hospitals according to the workload at each hospital. A total of 82 obstetricians and 21 midwives were recruited and trained for the study. They were chosen from all provinces and were familiar with the hospitals' routines and procedures.

When a LBW case was reported (< 2500 g), health personnel carried out clinical examinations on the baby and administered a questionnaire to the mother. For each LBW baby, two NBW babies (2500 g or more) born immediately afterwards were recruited as a comparison group, and the same procedures were carried out. The study continued until the target sample size of births for each hospital was achieved (a period from March to September 1996). The study methods and materials were field-tested in a number of hospitals that were not included in the study, and modifications were made accordingly. After the data were gathered from all hospitals, local trained supervisors made follow-up visits and the principal investigators checked the quality and validity of data.

The clinical examinations included: measurement of the neonate parameters (weight, height and head circumference); examination of the placenta (appearance, weight and size); clinical examination the neonate (birth abnormalities and the need for resuscitation); measurement of the mother's haematocrit.

The questionnaire to mothers covered the most important variables thought to influence LBW: genetic and constitutional factors (baby's sex, mother's height and weight); obstetric factors (e.g. parity, birth interval, obstetric history); nutritional factors (anaemia, vitamin supplementation); maternal morbidity during pregnancy; exposure to toxic substances such as cigarettes and caffeine; attendance at antenatal care.

The data were analysed using standard statistical programs.

Results

During the period of the study, 698 LBW babies were delivered out of a total of 10 585 deliveries at the hospitals studied, an incidence of 6.6%. The rate of LBW varied by geographic region from 8.6% in Damascus to 3.2% in the south of the country (Table 1). It also varied by hospital from 10.8% to less than 1%. The highest rates were in the three major teaching hospitals, although the rates in three non-teaching hospitals were close to these.

Table 1 **Incidence of low birth weight by region of the Syrian Arab Republic**

Region	No. of births	LBW babies No.	LBW babies %
Damascus and rural Damascus	3522	304	8.6
North	1667	139	8.3
East	1583	89	5.6
Central	2087	103	4.9
Coast	1030	41	4.0
South	696	22	3.2
Total	10585	698	6.6

LBW = low birth weight

All the neonate parameters studied (weight, length and head circumference) were significantly higher in NBW babies than in LBW babies (Table 2). The differences were not statistically significant comparing mature LBW babies and mature NBW babies. The mean birth weight for LBW babies was 2042 ± 411 g, compared with 3885 ± 525 g for the NBW babies (for the whole sample the mean birth weight was 3529 ± 468 g). More than half of the LBW babies (51.7%) were born premature (at 37 weeks or less) compared with only 4.4% of NBW babies. Table 2 also compares the parameters of the neonates in relation to maturity.

Table 3 compares the characteristics of LBW and NBW babies in relation to pregnancy outcome. Significantly more LBW than NBW babies were twins. LBW babies were significantly more likely to have birth abnormalities and abnormal placentas, and to need resuscitation, compared with NBW babies.

Table 4 shows that many of the characteristics of the mothers had an association with LBW. More mothers of LBW babies had anaemia, haematocrit less than 33%, weight less than 50 kg and height less than 150 cm.

Obstetric factors also appeared to have a relationship to LBW. Significantly more LBW mothers had had a previous LBW baby, a history of infertility and a birth interval of less than 18 months compared with mothers of NBW babies. Maternal morbidity (hypertension, anaemia and haemorrhage) also showed a relationship with having a LBW baby.

Smoking seemed to affect LBW. Significantly more LBW mothers smoked than NBW mothers (19.2% compared with 10.5%), and one-third of LBW mothers smoked more than 10 cigarettes per day compared with less than a quarter of NBW mothers.

Consumption of iron and folic acid supplements appeared to affect birth weight. More mothers taking supplements appeared to have LBW babies, a small but statistically significant difference. The use of any medication by the mother during pregnancy was associated with having a LBW baby, the association being statistically significant. Three-quarters of LBW mothers had attended antenatal care compared with only one-tenth of NBW mothers, but few mothers of premature babies had attended antenatal care.

Table 2 **Neonate parameters by birth weight category and maturity**

Parameter	LBW babies			NBW babies		
	Premature (n = 361)	Mature (n = 337)	Total (n = 698)	Premature (n = 61)	Mature (n = 1326)	Total (n = 1387)
Mean weight ± s (g)	1868	2230	2042 ± 411	2984	3403	3885 ± 525
Mean length ± s (cm)	42	45	43 ± 4	48	50	50 ± 6
Mean head circumference ± s (cm)	30	33	31 ± 6	32	35	35 ± 6

LBW = low birth weight. *NBW = normal birth weight.*
s = standard deviation.

Table 3 **Characteristics of neonates by birth weight**

Characteristic	LBW babies No.	%	NBW babies No.	%	Total No.	%	Statistical tests
Sex							
Male	327	46.8	727	52.4	1054	50.6	
Female	371	53.2	660	47.6	1031	49.4	$\chi^2 = 5.75$, $P < 0.05$
Gestational age							
38 weeks +	337	48.3	1326	95.6	1663	79.8	
≤ 37 weeks	361	51.7	61	4.4	422	20.2	$\chi^2 = 643.8$, $P < 0.01$
Type of pregnancy							
Single	546	78.2	1348	97.2	1894	90.8	
Twin	152	21.8	39	2.8	191	9.2	$\chi^2 = 200.6$, $P < 0.01$
Abnormality							
Yes	27	3.9	16	1.2	43	2.1	
No	671	96.1	1371	98.8	2042	97.9	$\chi^2 = 16.93$, $P < 0.01$
Placenta condition							
Normal	392	56.0	1257	90.6	1649	79.1	
Abnormal	306	44.0	130	9.4	436	20.9	$\chi^2 = 333.4$, $P < 0.01$
Need for resuscitation							
Yes	259	37.1	95	6.9	354	17.0	
No	439	62.9	1292	93.1	1731	83.0	$\chi^2 = 301.4$, $P < 0.01$

LBW = low birth weight. *NBW = normal birth weight.*

Discussion

LBW is considered to be an indicator not only of the health and nutritional status of the pregnant woman but also of the social development of a population [*10,11*]. The incidence of LBW varies from as low as 3% in industrialized countries such as Norway to as high as 30% in some developing countries in Asia and Africa [*2,3*].

We attempted to identify the incidence and determinants of LBW in the Syrian Arab Republic, and provide suggestions for future interventions to tackle the problem. It is the first study to deal with the problem of LBW at the national level in the country. Due to the difficulties in carrying out a household study or including private hospitals, the study was conducted only in government hospitals. Multivariate analysis was not used in analysing the data, and thus it was not possible to control for confounding variables. Despite these limitations in the research methods, the study provides good basic information on the national level and it is hoped will draw policy-makers' attention to the issue of LBW.

The results show that the incidence of LBW in the Syrian Arab Republic is very low compared with other developing countries in the Middle East such as Sudan and the Republic of Yemen but is similar to countries such as Saudi Arabia, Tunisia and Bahrain [*12*].

More than half of the LBW babies were born premature, suggesting that gestational age plays a major role in LBW. More female babies were of LBW, which suggests that sex influences the duration of pregnancy or the intrauterine growth rate or both.

Table 4 **Characteristics of mothers by baby's birth weight**

Characteristics of mother	LBW babies No.	%	NBW babies No.	%	Total No.	%	Statistical tests
Weight							
< 50 kg	54	18.6	36	6.3	90	10.5	
50 kg +	236	81.4	536	93.7	772	89.5	$\chi^2 = 31.24$, $P < 0.01$
Missing values[a]	408	–	815	–	1223	–	
Parity							
1	198	28.4	254	18.3	452	21.7	
2 +	500	71.6	1133	81.7	1633	78.3	$\chi^2 = 27.63$, $P < 0.01$
Birth interval							
< 18 months	207	41.4	319	28.2	526	32.2	
18–35 months	169	33.8	503	44.4	672	41.2	
36 months +	124	24.8	311	24.4	435	26.6	$\chi^2 = 29.3$, $P < 0.01$
Missing values[a]	198	–	254	–	452	–	
Previous LBW baby							
Yes	161	24.7	117	9.1	278	14.4	
No	490	75.3	1164	90.9	1654	85.6	
Missing values[a]	47	–	106	–	153	–	$\chi^2 = 85.2$, $P < 0.01$
Previous abortion							
Yes	259	37.1	533	38.4	792	38.0	
No	439	62.9	854	61.6	1293	62.0	$\chi^2 = 0.34$, $P = 0.55$
Previous infertility							
Yes	63	9.0	91	6.6	154	7.4	
No	635	91.0	1296	93.4	1931	92.6	$\chi^2 = 4.12$, $P < 0.05$
Morbidity							
Hypertension	87	12.5	110	7.2	197	9.4	$\chi^2 = 11.15$, $P < 0.01$
Haemorrhage	143	20.5	102	7.4	245	11.8	$\chi^2 = 77.19$, $P < 0.01$
Anaemia	328	47.0	557	40.2	885	42.4	$\chi^2 = 8.87$, $P < 0.01$
Haematocrit (%)							
< 33	162	34.5	239	25.0	401	28.0	
33 +	308	65.5	719	75.0	1027	72.0	
Missing values[a]	228	–	429	–	657	–	$\chi^2 = 14.14$, $P < 0.01$
Used folic acid and iron supplements							
Yes	479	68.6	867	62.5	1346	64.6	
No	219	31.4	520	37.5	739	35.4	$\chi^2 = 7.6$, $P < 0.01$
Duration of supplementation							
< 1 month	109	39.3	176	38.3	285	38.7	
1–3 months	91	32.8	163	35.3	254	34.5	
> 3 months	77	27.7	120	26.0	197	26.8	$\chi^2 = 0.58$, $P > 0.05$
Missing values[a]	202	–	928	–	1130	–	
Used medication							
Yes	160	22.9	203	14.6	363	17.4	
No	538	77.1	1184	85.4	1722	82.6	$\chi^2 = 22.16$, $P < 0.01$

Table 4 **Characteristics of mothers by baby's birth weight** *(concluded)*

Characteristics of mother	LBW babies No.	%	NBW babies No.	%	Total No.	%	Statistical tests
Attended antenatal care							
Yes	526	75.4	935	10.5	1461	70.1	
No	172	24.6	452	89.5	624	29.9	$\chi^2 = 13.8$, $P < 0.01$
Cigarette smoker							
Yes	134	19.2	145	10.5	279	13.4	
No	564	80.8	1242	89.5	1806	86.6	$\chi^2 = 30.6$, $P < 0.01$
Number of cigarettes per day							
< 10	90	67.2	113	77.9	203	72.8	
10+	44	32.8	32	22.1	76	27.2	$\chi^2 = 4.06$, $P < 0.05$
Number of cups of coffee per day							
≤ 3	292	85.9	623	92.3	915	90.1	
4+	48	14.1	52	7.7	100	9.9	$\chi^2 = 10.51$, $P < .01$

LBW = low birth weight. NBW = normal birth weight.
**Missing values were not included in the analysis.*

Maternal factors were very important determinants in LBW. Women with low pregnancy weight (less than 50 kg) were more likely to deliver small babies. Low maternal weight may also increase the risk of prematurity [*5*]. However, maternal height seemed to have no relationship to LBW.

LBW was associated with the birth of twins. Poor maternal nutritional status, short birth intervals and other obstetric factors could lead to LBW in twin pregnancies. Parity also had an effect, as LBW babies were more likely to be first babies and slightly less likely to be the second or more births. A short birth interval since the last baby (less than 18 months) showed a relationship to LBW. This might be due to nutritional deficiencies and the incomplete return of the maternal physiology to normal levels [*5*].

Previous delivery of a LBW baby had a significant association with LBW, which might be expected since the factors that led to the previous LBW baby might still exist. Previous abortion had no statistical association with LBW. This may be because no distinction was made between induced and spontaneous abortion, or because information was not available on abortion procedures used (whether dilation and curettage or vacuum extraction) or on the number of abortions [*13*]. Women were reluctant to reveal abortion experiences due to the sensitivity of this topic. Previous infertility showed a small relationship to LBW. Ambiguity over the terminology of infertility could affect this result. We used the WHO definition of infertility namely: inability to conceive over a 13-month period of unprotected intercourse.

Nutritional supplementation with folic acid and iron was associated with LBW. This might be due to the lack of adherence to supplementation regimes throughout the second half of pregnancy, or due to the

variations in the length of taking supplements. The relationship between taking supplements and the women's nutritional and socioeconomic status was not examined.

Maternal anaemia was associated with a high proportion of LBW cases. The maternal haematocrit was also measured and revealed that anemia existed in a large proportion of mothers of LBW babies. Anaemia can interfere with the duration of pregnancy or intrauterine growth. However, because of the natural decrease in the haemoglobin level in pregnancy, the haematocrit measurement should have been carried out prior to pregnancy [5].

A history of hypertension and haemorrhage seemed to have a relationship to LBW. This information was collected by asking mothers about illness rather than by reviewing medical records. Blood pressure was not measured prior to pregnancy [5].

Cigarette smoking also showed an association with LBW perhaps because smoking influences the duration of pregnancy or intrauterine growth rate. Nicotine also decreases appetite, which can lead to nutritional problems [14]. No information was collected on smoking history, dose and duration of smoking. Of those who drank coffee, mothers of LBW babies drank more than control mothers and the relationship was statistically significant.

A much higher proportion of LBW mothers had attended antenatal care. This has to be correlated with maternal morbidity. Almost all mothers of premature babies (76.2%) did not attend antenatal care compared with mothers of full term babies not attending prenatal care (7.3%). This indicates that women usually seek antenatal care at the later stages of pregnancy, and thus they will not have the opportunity to have antenatal care if they had had an early birth. Not attending antenatal care or attending very late will delay its beneficial effects on the early detection and treatment of complications or risk factors for LBW.

Abnormalities of the neonate and placenta were associated with LBW. This might be the result of the high percentage of premature LBW babies. If the intrauterine growth retardation was the cause of LBW, then abnormalities might be present more frequently.

Conclusions

LBW could be the result of prematurity, since around half of LBW babies (51.7%) were premature compared with only 4.4% of NBW babies, and this result was highly significant. The study showed some evidence that factors amenable to intervention, such as birth interval, maternal nutrition, maternal weight and smoking, could have an important role in LBW. The recommendations of the study are as follows:

- Further well-designed research is needed into prematurity and factors amenable to change.
- Future research should distinguish between duration of pregnancy and intrauterine growth rate, and also between kinds of intrauterine growth retardation.
- Future research must consider the costs and outcome of caring for LBW babies.
- Community-based research is needed to cover the high percentage of births that take place at home.
- Interventions should be targeted at high-risk groups and regions.
- Possible short-term interventions could address maternal nutrition and smoking,

while long-term interventions should address the indirect causes of LBW such as age at first pregnancy, birth intervals, socioeconomic status and mothers' education. In addition, maternal morbidity, such as anaemia, hypertension and haemorrhage should be addressed.

Acknowledgements

The authors acknowledge with thanks the active participation of all involved hospitals in the study, the support of the Health Directorates in all provinces and the Primary Health Care Director in the Ministry of Health for his continuous help and support.

References

1. Evans S, Alberman E. International collaborative effort (ICE) on birth weight, plurality and, perinatal and infant mortality. II. Comparison between birth weight distributions in births in Member Countries from 1970 to 1984. *Acta obstetrica et gynecologica scandinavica*, 1989, 68:11–7.
2. World Health Organization Division of Family Health. The incidence of low birth weight. A critical review of available information. *World health statistics quarterly*, 1980, 33:197–224.
3. World Health Organization Division of Family Health. The incidence of low birth weight: an update. *Weekly epidemiological record*, 1984, 59:205–11.
4. Kiely JI. Preterm birth, intrauterine growth retardation, and perinatal mortality. *American journal of public health*, 1992, 82:344–6.
5. Kramer MS. The LBW determinants. *Bulletin of the World Health Organization*, 1991, 1:1–377.
6. *The state of child health in the Eastern Mediterranean region*, 2nd ed, revised. Geneva, World Health Organization, 1995.
7. Syrian Arab Republic Central Bureau of Statistics. *The final report of the national survey on maternal and child (Papchild).* Damascus, Central Bureau of Statistics, 1993.
8. Yousef AH. *LBW in Damascus teaching hospitals*. Damascus, University Publications, 1993.
9. Yousef AH. *LBW in Lattakia teaching hospitals*. Damascus, University Publications, 1993.
10. Bhargava V et al. Fetal growth variations. 1. Influence of maternal size and nutrition on identification of fetal growth retardation. *Indian pediatrics*, 1983, 20: 549–59.
11. Delegado H et al. Nutrition and length of gestation. *Nutrition research*, 1982, 2: 117–26.
12. Regional demographic and socioeconomic data. *Eastern Mediterranean health journal*, 1996, 2(2):347–53.
13. Schoenbaum SC et al. Outcome of the delivery following an induced or spontaneous abortion. *American journal of obstetrics and gynecology*, 1980, 136: 19–24.
14. Papoz L et al. Maternal smoking and birth weight in relation to dietary habits. *American journal of obstetrics and gynecology*, 1982, 142:870–86.