

# Prevalence and risk factors for low birth weight in Ardabil, Iran.

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## Abstract

### Introduction

Low birth weight (LBW) is the most common cause of neonatal death in developing countries. The objective of our study was to determine the prevalence and risk factors associated with low birth weight in Ardabil, Iran from 2010 to 2011.

### Methods

In a case-control study all live newborns were weighted without clothing using a standard calibrated scale. Gestational age was calculated using either the first day of the last normal menstrual period or estimated by obstetric sonography. 358 neonates with birth weight of less than 2500 g were considered as case and 705 normal weight neonates as control groups. Data were collected through a self-designed questionnaire from review of prenatal and hospital delivery records. Kruskal-wallis, chi-square, and logistic regression were applied to analyze data using SPSS version 16.

### Results

Incidence of LBW was 6.3% and among these, 84.2% were preterm and 15.8% had intrauterine growth retardation. Hypertension (OR:8.64, CI: 2.63-28.31), multiple pregnancy (OR: 7.62, CI:3.09-13.32), leakage (OR:4.46, CI: 2.11-9.42), Oligohydramnios (OR:4.28, CI:1.90-9.76), history of preterm birth (OR:2.84, CI: 1.20-6.71), bleeding or spotting during pregnancy (OR:2.36, CI:1.41-3.95) were determined as important risk factors for preterm LBW. Risk of low birth weight in term infants increased by multiple pregnancy (OR:3.77, CI: 1.41-10.0), bleeding and spotting (OR:2.23, CI:1.22-4.07), and urinary tract infection in weeks 26-30 of pregnancy (OR:2.42, CI:1.11-5.26).

### Conclusion

Delivering quality health care for all pregnant women and early diagnosis and control of hypertension, urinary tract infection, and bleeding or spotting and leakage during pregnancy may significantly reduce the rate of low birth weight and improve public health in this area.

### Keywords

low birth weight, prematurity, growth retardation

### Introduction

Low birth weight (i.e. birth weight <2500 g) is significantly related to neonatal survival and postnatal morbidity<sup>1</sup>. The incidence of LBW has been estimated to be 15% worldwide with more than 95% of LBW infants being born in developing countries<sup>2</sup>. Low weight of infants at birth is either the result of preterm birth or of intrauterine growth retardation (SGA)<sup>2-4</sup>. However, LBW, SGA, or

combinations of these outcomes have been reported to be related to neonatal and long term morbidity. Neurological disability, chronic diseases, inhibited growth, and cognitive development are more common in low birth weight infants resulting in more frequent hospitalization and outpatient visits<sup>5</sup>. Such babies remain a burden on government expenses in developed countries and a permanent problem for their families in developing countries<sup>3,4</sup>.

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There have been a number of previous studies on risk factors associated with LBW in Islamic republic of Iran and other countries. In a study conducted in Zahedan, birth interval of less than 3 years, twin birth, no use of ferrous sulfate, and maternal disease were identified as risk factors for LBW, however, maternal age, maternal education, mother's occupation, and history of miscarriage had not significantly affected birth weight<sup>6</sup>. In a similar study in Zanzibar, maternal age of less than 20 years, maternal education level at secondary and below, and birth interval of higher than 3 years were found to be significant risk factors for LBW<sup>5</sup>. In other studies conducted in Spain, India, Germany, and Taiwan; maternal height, hypertension, febrile illness during pregnancy, prim parity, Oligohydramnios, preeclampsia, previous experience of LBW delivery, abruption of placenta, maternal age, occupational status, low pregnancy weight, and low family income have been considered as important risk factors for LBW<sup>7-10</sup>. Since, the prevalence of LBW is one of the most important health indices and is a function of social status and lifestyle; it is important to identify the prevalence and risk factors associated with LBW in different areas<sup>6</sup>. Since government of the Islamic republic of Iran has planned to decrease neonatal mortality rate to two thirds of the rate reported for the year 1990; this study was conducted to determine prevalence of LBW and its associated risk factors in maternity hospitals of Ardebil city.

## Methods

In a case-control study all live newborn infants in three maternal hospitals of Ardebil city were weighed without clothing in delivery rooms immediately after birth using a standard and calibrated scale with a precision of 10 g from Nov 2010 to July 2011. LBW infants, defined as those with birth weight of less than 2500 g, were considered as the study group (n=432), while 864 newborns with birth weight of 2500 g and higher served as the control group. 74 newborns from low birth and 159 from normal weight groups were excluded from the study due to missing or incomplete prenatal care records. In total, 358 low weight and 705 normal weight newborns were further investigated.

Data were collected through the review of prenatal and hospital delivery records using a self-designed questionnaire containing socio-demographic factors and maternal, neonatal, and

prenatal care characteristics. Socio-demographic factors included age, education level, social class, and area of residence (rural/urban). Maternal and prenatal care characteristics covered, body mass index, history of smoking and opium use, use of ferrous sulfate and other supplements, suffering from pre-eclampsia, hypertension, urinary tract infection, chronic diseases, anemia, hyperemesis gravidarum, diabetes, unwanted pregnancy, abnormal weight gain, history of bleeding, leakage, birth interval, low birth weight delivery, history of miscarriage, twin or singleton birth, parity, location of placenta, and amniotic fluid volume. Neonatal factors included congenital malformation, fetal gender, and gestational age. Gestational age was calculated using either the first day of the last normal menstrual period or estimated by first trimester obstetric ultrasound.

If birth occurred in less than 37 weeks, it was classified as preterm. Stillbirths were excluded from the study. The term preeclampsia was used for any subject with hypertension (i.e. BP > 140/90 mm/Hg) and proteinuria of > 1 g/L urine; hypertension during pregnancy referred to blood pressure of higher than 140/90 mm/Hg with no proteinuria. Urinary tract infection was diagnosed by positive urine culture test, spouse abuse included verbal abuse or physical violence, premature rupture of membrane or leakage referred to a rupture that occurred before the onset of regular contraction or before 37 weeks of pregnancy. Treatment of infertility referred to the current pregnancy; maternal chronic disease referred to cardiovascular, hepatic, renal, and lung diseases. Hypotension was considered as blood pressure of less than 100/60 mm/Hg. We also defined hypermetric pregnancies as those labeled as complicated by hyperemesis gravidarum by the caregivers.

Quality of data collection was assured through monitoring visits scheduled for each hospital and reweighing all the infants with a weight of 2-3 kg. Chi-square was applied to compare distribution of variables between the groups using SPSS version 16. Multivariate logistic regression analysis was performed to obtain magnitude of association between the independent variables and low birth weight. Logistic regression results are reported as odds ratios and 95% confidence intervals (CI) along with P values.

## Results

Out of 6832 alive infants born in the maternity hospitals from Nov 2010 to July 2011, 432 (6.3%)

were low birth weight. 84.2% of LBW newborns were also preterm. Socioeconomic characteristics were analyzed to identify any association with low birth weight in term and preterm newborns. The likelihood of preterm low-weight birth in women with university degrees was significantly higher (OR=1.6,  $p=0.015$ ) than those with no university qualifications. Although the differences were not statistically significant; increased rates of preterm low birth weight were observed in women; from middle and low socioeconomic classes, aged over 35, employed, and whose partner had academic education. There has been an increase in odds of term low-weight birth in parents with low education level (i.e. 8 years or less), belonging to mid and low socioeconomic classes, and women aged less than 18 years, however, these associations were not statistically significant.

The odds of low-weight in term and preterm births were estimated from maternal and prenatal care characteristics in the present pregnancy of subjects and the results are summarized in Table 1. Significant increased odds of preterm low-weight birth were observed in women with hypertension, preeclampsia, hyperemesis gravidarum, chronic diseases, Oligohydramnios, spotting or bleeding, leakage, pregnancy through IVF, multiple pregnancies, spouse abuse, pre-pregnancy care, and receiving pregnancy care before week 10.

Although the differences were not statistically significant compared to reference groups; we observed higher incidence rates of preterm low-weight birth in women with; BMI  $<26$  Kg/m<sup>2</sup>, weight gain  $<250$  g per week after the 15th week of pregnancy, height  $<155$  cm, urinary tract infection during 26-30 weeks of pregnancy, anterior placenta, heavy work, infertile women, and those using ovular stimulating medicine and IUI. Rate of preterm low-weight birth in women with anemia during 26-30 weeks of pregnancy was significantly lower than the reference group (OR= 0.31,  $p=0.031$ ). Women with; urinary infection during 26-30 weeks of pregnancy, bleeding or spotting during pregnancy, experience of IVF, multiple pregnancies, and the women whose husbands were smokers displayed significant increase in odds of term low-weight birth delivery (Table 1).

The odds of low weight in term and preterm births in relation to previous pregnancy and reproductive characteristics are presented in Table 2. Odds of preterm low-weight birth in primigravid women (OR= 1.32,  $p=0.043$ ) and in those with previous experience of preterm birth (OR= 2.95,  $p=0.002$ )

were significantly higher than the reference groups. However, women with previous cesarean section are significantly less prone to deliver either term or preterm LBW infants. Such correlations were not observed for other variables studied (Table 2).

All the variables that displayed significant correlations with low birth weight in univariate analyses were entered into the model and their effects on the term and preterm low-weight births were investigated using multivariate regression analysis. Based on the model outcomes, high blood pressure, multiple pregnancies, leakage history, Oligohydramnios, pre-pregnancy care, early registration for pregnancy care, and history of previous cesarean delivery significantly increased odds of preterm low-weight birth by 8.6, 7.6, 4.4, 4.2, 1.5, 1.7, and 4.8 folds, respectively. However, multiple pregnancies, husband smoking, urinary infection in weeks 26-30, bleeding or spotting during pregnancy, and previous cesarean delivery influenced term low-weight births significantly.

## Discussion

Different studies have estimated the incidence rate of LBW in different countries. A low birth weight incidence of 6.8% has been reported for Iran where 52.3 and 47.8% of these were preterm and the result of intrauterine growth restriction, respectively<sup>5</sup>. Prevalence of low birth weight in Pakistan was 9.9% with 59.4% being preterm and 40.6% intrauterine growth restriction<sup>3</sup>. LBW rate of 7.4% has been reported for Japan with preterm and intrauterine growth restriction accounting for 42 and 58%, respectively<sup>4</sup>. The rate of 6.3% found in the present study is relatively similar to the above mentioned studies, however, preterm was the main reason for low weight birth (84.2%) and low percentage of LBW babies suffered from intrauterine growth restriction (15.8%). In a global survey conducted by UNICEF in 2004, the prevalence of low birth weight in the United States, Europe, Asian and African countries were 10, 6.4, 18.3, and 14.3 percent, respectively<sup>11</sup>.

Unlike the developing countries where intrauterine growth restriction is the most important factor related to low weight birth<sup>12</sup>, in the United States and other developed countries prematurity is responsible for LBW. The results obtained in the present study revealed that the prevalence and distribution of the main factors for low weight birth in Ardebil are similar to that of developed countries.

High blood pressure was identified, as the most

important risk factor for preterm low-weight birth in our study and odds of low birth weight delivery in women with high blood pressure was 8.6 times higher than those with normal blood pressure. Hypertension causes resistance of uterine vessels and reduction in uterine blood circulation leading to intrauterine growth restriction<sup>13</sup>. In addition, placenta abruption and preeclampsia are more common in hypertensive women<sup>14</sup>, which may lead to surgical interference and preterm delivery. The likelihood of LBW delivery in hypertensive women found in the present study was relatively higher than the values observed in recent studies (i.e. odds ratio of 1.6-3.7)<sup>2,3,5</sup>. These findings might reflect the large number of high risk pregnancies in Ardebil and failure of health care system to control the exact risk factors in such pregnancies, since high blood pressure and preeclampsia occur more frequently in high risk women (e.g. age of under 18 and over 35 years, with chronic diseases and obesity, and those having multiple pregnancies)<sup>14</sup>. The probability of low weight birth increases in multiple pregnancies which is caused by intrauterine growth restriction or preterm delivery<sup>14</sup>. The main reason for spontaneous preterm delivery in multiple pregnancies is not clear yet, but the high prevalence of disorders such as pregnancy induced hypertension and vessel anastomosis in placenta and insufficient access of multiple fetuses to nutrients are related to intrauterine growth restriction in twin embryos<sup>13,14</sup>. Compared to other causes of low-weight birth, multiple pregnancies were more prevalent in the present study and odds of low-weight birth in preterm and term twins were 7.6 and 3.7, respectively. However, these figures are much lower than the values reported by Roudbari et al. (2007), where twin pregnancy, with the odds ratio of 18.8, was identified as the most important risk factor for low-weight birth<sup>6</sup>. Further study is recommended to identify risk factors for multiple pregnancies and reduce prevalence of LBW.

Odds of preterm low-weight birth in women with history of leakage and Oligohydramnios were 4.4 and 4.2, respectively. Preterm rupture of membrane was responsible for 30 to 35 percent of preterm births. Preterm birth might be related to a wide range of risk factors including intra amnion infection, low socioeconomic status, BMI <19.8, dietary shortages, and smoking and might also occur without any discernible reasons<sup>14</sup>. Oligohydramnios may appear due to various reasons; e.g. embryonic abnormalities, high

blood pressure, preeclampsia, twinto twin blood transfusion, and chronic leakage of amnion in ruptured areas of the membrane, which in turn, may lead to preterm delivery or low birth weight<sup>14</sup>. Chin lo et al (2007) reported that preterm rupture of membrane and Oligohydramnios, increase risk of preterm birth by up to 1.6 and 10 folds, respectively<sup>15</sup>. In another study the likelihood of preterm birth in the fetuses developing Oligohydramnios before week 37 was increased by up to three folds<sup>16</sup>. We found the prevalence of most of the factors leading to preterm rupture of the membrane/Oligohydramnios to be significantly higher in the low-weight group than the normal weight. This might have occurred due to disorders like high blood pressure, urinary infection, and multiple pregnancies.

We found the odds of preterm low-weight birth in women with history of preterm delivery to be 2.8, which is in line with the results reported by different studies where history of preterm delivery has been identified as an important risk factor for prematurity 14, 15, 17-19. Probability of recurrent preterm delivery was estimated to be 15-50 percent based on the number and age of previous preterm babies 17. Other studies found odds ratios of 3.4<sup>19</sup>, 5.6<sup>18</sup> and 16.5<sup>15</sup> for preterm delivery among women with the history of preterm birth.

Vaginal bleeding during pregnancy increased the likelihood of preterm low-weight birth by 2.3 and term low-weight birth by 2.2 folds. This is in agreement with previous findings where respective odds of 1.7 and 6.4 have been reported for low-weight birth and preterm delivery for women with vaginal bleeding history during their pregnancy<sup>20</sup>. Similarly, odds of 2.6 for LBW<sup>21</sup> and 1.6 for preterm deliveries<sup>22</sup> have been reported by other studies. Vaginal bleeding is a predicting factor for serious consequences of pregnancy in pregnant women. The main cause of vaginal bleeding during the first half of pregnancy is unknown for most cases. However, around 50% of women with bleeding during their second half of pregnancy have placenta abruption<sup>13</sup>.

Developing and improving life styles and formulating proper preparations for pregnancy can reduce the undesirable defects of pregnancy<sup>14</sup>. Since pregnancy health is influenced by the individual's health prior to the pregnancy period, pre-pregnancy care is considered as an important factor for prenatal care. 80% of women with pre-pregnancy care had normal deliveries compared with 40% in the women with no such records<sup>14</sup>.

However, we found that pre-pregnancy care increases rate of low-weight birth. The exact reasons for this finding is not known but might be related to the fact that the Iranian health network has not been able to give pre-pregnancy care to all target women and that high risk pregnancies are more likely to be covered by pre-pregnancy care programs.

Some researchers believe that previous caesarean may prompt disorders in placenta replacement and consequently lead to an increase in the probability of low weight birth and preterm delivery<sup>18, 19</sup>. A study conducted in Taiwan found no relationships between preterm delivery and history of caesarean section<sup>15</sup>. However, we saw a dramatic decrease in the rate of preterm and term low weight birth in women with previous caesarean delivery.

Prevalence of smoking among pregnant women was very low and the effect of environmental tobacco exposure on LBW was investigated. Similar to other studies<sup>23, 24</sup>, smoking partners increased odds of LBW delivery by 2.2 folds.

Some micro-organisms can pass through the placenta and make infections in the fetus. If such infections occur during developmentally growing process of the embryo, these may affect fetal cells and result in low birth weight<sup>13</sup>. Schieve et al. (1994) reported the odds of term and preterm birth to be 1.9 and 1.8 in women with urinary infections, respectively<sup>25</sup>. However, no significant relationship was observed between low birth weight and urinary infection in a study conducted in Iran<sup>26</sup>. In the present study urinary infection in the first three months of pregnancy did not correlate with low birth weight. However, women with a history of urinary infection during weeks 26 to 30 of pregnancy experienced term low-weight birth by 2.4 folds.

### Conclusion

High blood pressure, spotting, preterm rupture of the membrane, urinary infection, treatment for sterility, and smoking were identified as the most influential factors for low birth weight. Therefore, implementing health education programs and improving health care quality delivered to pregnant women are recommended in order to control these risk factors and consequently promote public health in the Ardebil province

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**Table: Logistic regression analysis for risk factors of LBW in term and preterm deliveries**

	Term and low birth weight	Preterm and low birth weight
High blood pressure in pregnancy	NS*	OR=8.64, CI: 2.63-28.31, P=0.000
Number of fetus $\geq 2$	OR=3.77, CI: 1.41-10.0, P=0.008	OR=7.62, CI: 3.09-13.32, P=0.000
Leakage during pregnancy	NS	OR=4.46, CI: 2.11-9.42, P=0.000
Oligohydramnios	NS	OR=4.28, CI: 1.90-9.76, P=0.000
History of preterm birth	NS	OR=2.84, CI: 1.20-6.71, P=0.017
Bleeding or spotting pregnancy	OR=2.23, CI: 1.22-4.07, P=0.009	OR=2.36, CI: 1.41-3.95, P=0.001
Early pregnancy care ( $\leq 10w$ )	NS	OR=1.72, CI: 1.0-2.97, P=0.049
Pre-pregnancy care	NS	OR=1.58, CI: 1.0-2.44, P=0.039
History of cesarean delivery	OR=0.311, CI: 0.10-0.96, P=0.043	OR=0.488, CI: 0.29-0.88, P=0.019
Spouse smoking	OR=2.24, CI: 1.07-4.68, P=0.031	NS
Urinary tract infection in weeks 26-30	OR=2.42, CI: 1.11-5.26, P=0.026	NS
Term and normal weight newborns were considered as reference point for regression analysis *NS = Not significant		