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Investigating Risk Factors of Low-Birth-Weight among Mothers visiting Community Health Centers in the City of Yazd

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ABSTRACT

Introduction: One of the most valuable indicators determining the health status of a community is the birth weight of infants. Thus, the purpose of this study was to investigate risk factors affecting low-birth-weight infants born to mothers visiting community health centers in the city of Yazd in Iran.

Methods: The present study was a retrospective cohort research on 280 mothers visiting to community health centers in two groups of mothers with infants weighing less than 2500 grams (case) and those with babies weighing more than 2500 grams (control). The data were also collected by interviewing mothers and reviewing the information inserted in their health records. Such data were then entered into the SPSS software (Version 19) and analyzed through Chi-square test, independent t-test, as well as logistic regression analysis.

Results: The mean and the standard deviation of birth weight in the case group were 2171.4 ± 339.85 grams and they were equal to 3222.5±390.78 grams in the control group. Besides, the results of the analysis revealed that maternal education (P= 0.05), type of delivery (P= 0.02), birth order (P= 0.02), maternal occupation (P= 0.03), pregnancy-induced hypertension (P= 0.008), and gestational age (P= 0.000) were correlated with low-birth-weight infants.

Conclusion: Considering that low birth weight was related to factors that could be controllable in most circumstances, measures such as training mothers, promoting quality of prenatal care, and planning for childbearing among mothers are recommended.

Keywords: Low Birth Weight, Risk Factors, Community Health Centers, Infants

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Introduction

One of the most valuable indicators determining the health status of a community is the birth weight of infants which is highly associated with neonatal deaths as well as natural growth and development processes in children [1]. For the first time, Ylppo, in 1919, called infants weighing less than 2500 grams (g) low-birth-weight (LBW) ones, and such a definition has been approved by the World Health Organization (WHO) for more than 40 years [2]. Accordingly, LBW is considered to be one of the most serious health problems in the world [3]. Based on their birth weight, LBW infants are classified into groups, such as: moderately low birth weight (MLBW) infants, from 1500 to 2499 g; very low birth weight (VLBW) ones, less than 1500 g; and extremely low birth-weight (ELBW) babies, less than 1000g [4]. In 2000, the WHO also released a report, stating that LBW infants made up 14% of all births throughout the world, and such a value accounted for 56.11% of all births in Iran [5]. The incidence of LBW in different parts of the world is similarly varied; in other words, LBW rates in Africa, Asia, Europe, and Latin America have been reported to be 14.3%, 18.3%, 4.6%, 10%; respectively [6]. This amount has been also reported by 10% and 4.4% in Iran, and in the city of Yazd, respectively [7]. Moreover; LBW occurring in developed and developing countries can impose heavy burdens on family members, and health systems [8]. With the advancement of science in recent decades, LBW infants' survival rates have also witnessed an upward trend. Unfortunately, this increase in survival has added to LBW-related complications, including an increasing population of children with cerebral palsy (CP), epilepsy, hydrocephalus, blindness, deafness, as well as cognitive disorders [9] which can impose heavy socioeconomic and emotional costs on communities, health systems, and families [10]. Recent research studies have also revealed that adolescents born with LBW are three times more likely to suffer from psychiatric and behavioral disorders including attention deficit hyperactivity disorder (ADHD) [8]. Likewise, it has been reported that LBW infants have lower intelligence quotient (IQ) scores than normal babies [11]. Furthermore, recent epidemiological studies have shown that LBW can augment the risk of mortality during infancy and other life stages; it is even associated with diseases, such as hypertension, atherosclerosis [12], diabetes, stroke, and obesity in adulthood [13]. In Iran, infants constitute the most common age group affected with child mortality [14], and 50% of these cases are due to LBW [9]. It should be also noted that LBW infant mortality and those weighing less than 1500 g (VLBW) are respectively 40 times and 20 times more than normal-birth-weight babies [2]. Therefore, infant health at the community level is known as one of the significant health indicators in terms of evaluating neonatal routine care [8] which reflects the quality of nutrition and social environment of mothers giving birth to LBW babies [11]. It should be noted that various factors including genetic, environmental, fetal, maternal, and paternal ones can affect LBW [5]. In addition, factors such as hyperglycaemia, history of pregnancy-induced hypertension, types of obstetric violence, maternal age, birth season, use of iron supplements during pregnancy, birth order, gestational age, and maternal education can have an impact on birth weight [1, 2, 5, 11, 12, 15, 17]. As well, low weight in the Black breed is twice that of the White [15]. According to the results of a study done on mothers aged below 19, and those over 35 years, the high prevalence of LBW was also observed [2]. Moreover, the mean birth weight in infants of mothers with preeclampsia was lower than those without this condition [18]. Thus, the health status of pregnant women and newborns can have long and short-term effects on individuals, families, communities, and health systems. Accordingly, paying attention to their health is an important issue, worldwide [19]). On the other hand, identification of factors affecting LBW can improve neonatal mortality rate (NMR) [13]. Therefore, it is essential to recognize these factors and correct some of those that can be modified, such as appropriate gestational age, pre-pregnancy weight, etc. It is also required to carry out activities in the domain of decreasing LBW infants, and

improve the health status of mothers during pregnancy. So, the present study was to investigate factors affecting LBW infants born to mothers visiting community health centers in the city of Yazd in Iran.

Methods

This study with code of ethics (IR.SSU.SPH.REC.1395.157), was conducted as a retrospective cohort research in the city of Yazd. The statistical population of the study consisted of all one-year-old babies including LBW and normal weight, along with their mothers living in this city. At first, two community health centers were randomly selected from each geographical region of the North, the South, the East, the West, and the Central. Then, according to the lists of one-year-old children archived in 10 community health centers, 14 one-year-old LBW babies were randomly selected from each center, followed by the same number of normal-weight children from the same center to control lots of variables, including geographical and economic conditions.

Finally, 140 mothers of LBW infants, and 140 mothers of normal-birth-weight infants paying regular visits to the selected community health centers to receive their baby's one-year-old vaccinations with health records in the city of Yazd were selected as the final samples, and they were evaluated in terms of the study variables. It should be noted that the given samples were selected using a random sampling method, sample size formula (Z-score), as well as taking a coefficient alpha of 0.05, and test power of 80%. The inclusion criteria in this study were the city of Yazd as the birthplace of infants, with birth weight of less than 2500 g for the case group, and above 2500 g for the control group. The exclusion criteria were obvious congenital malformations and non-Iranian nationality.

Explaining the objectives of the study and obtaining informed consent from mothers to participate in the present study, the given mothers were assured of anonymity, confidentiality of data, and privacy. The research instrument in this study was a researcher-designed questionnaire comprised of two parts including the characteristics of babies, and mothers which was developed considering the related literature, in order to collect the underlying variables. The part associated with the characteristics of mothers included information about maternal age, gestational age, type of delivery, maternal education, maternal occupation, family size, prenatal difficulties (pregnancy diabetes, pregnancy-induced hypertension, repeated nausea and vomiting, pregnancy longings and cravings, hypothyroidism, preeclampsia, and so on), and the part related to infants included age, birth weight, birth height, head circumference, and birth order.

In this study, hypertension was responsible for the first cases in pregnancies diagnosed with high blood pressure. The data was also collected through conducting structured interviews with mothers as well as reviewing listed information in health records, and then inserting it into the study questionnaires. Given the research objectives, Data was entered into SPSS Software (Version 19) and analyzed through descriptive and inferential methods including Chi-square test, t-test, and logistic regression analysis, considering $p< 0.05$ as the significance level. It should be noted that the independent variables that had a significant level below 0.2 in the univariate analysis were entered simultaneously into the logistic regression model, and their combined effect was evaluated in this study to investigate the simultaneous effect of different factors on the dependent variable.

Results

In this study, 140 mothers having LBW infants, and 140 mothers with normal-birth-weight babies were investigated. All of the mothers had received prenatal care from community health centers and urban bases. The results of this study showed that the mean and the standard deviation of birth weight of the control group were 3222.5 ± 390.8 g, and these values were 2171.4 ± 339.8 g in the case group. The case group had 29.37 ± 5.9 years as the mean age of mothers at delivery, of which 93.6% were housewives, 49.3% were boys, and 55% were breastfeeding. The mean age of mothers at delivery was 29.95 ± 5.2 years in the control group, of which

85.7% were housewives, 47.9% were girls, and 71.4% were breastfeeding. As well, the mean and the standard deviation of gestational age in the case and control groups were 36.64 ± 2.8 and 39.05 ± 3 weeks, respectively. The highest frequency of normal delivery was observed in NBW neonates, whereas the highest frequency of cesarean section was related to the LBW group. In addition, both groups were significantly different in terms of type of delivery, maternal occupation, birth weight, birth height, head circumference, gestational age, and birth order. Table 1 and Table 2 illustrated the demographic characteristics of the studied samples.

Table 1. Frequency distribution of qualitative demographic characteristics in the studied samples

Variable		Case group (less than 2500 grams)		Control group (more than 2500 grams)		P-value
		Frequency	Percentage	Frequency	Percentage	
Maternal education	Lower than high school diploma	24	17.1%	19	13.6%	0.05
	Diploma	71	50.7%	59	40%	0.9
	University education	45	32.1%	65	46.4%	0.09
Maternal occupation	Housewife	131	93.6%	120	85.7%	0.03
	Employed	9	6.4%	20	14.3%	
Infant's gender	Male	69	49.3%	73	52.1%	0.6
	Female	71	50.7%	67	47.9%	
Type of delivery	Cesarean section(C-section)	89	63.6%	69	49.3%	0.02
	Vaginal (natural)	51	36.4%	71	50.7%	
Prenatal complications	No	50	35.7%	38	27.1%	0.1
	Yes	90	64.3%	102	72.9%	

Table 2. Distribution of mean and standard deviation of quantitative demographic characteristics in studied samples (case and control groups)

Variable	Mean score in the group weighing less than 2500 grams	Mean score in the group weighing more than 2500 grams	P-value
Birth weight of infants	339.8±2171.4	3222.5±390.8	< 0.0001
Head circumference at birth	32.01±2	34.84±1.3	< 0.0001
Birth height of infants	50.91±2.4	46.20±3.4	< 0.0001
Gestational age	36.64±2.8	39.05±1.3	< 0.0001
Maternal age	29.37±5.9	29.95±5.2	0.38
Family size	3.88±1	3.89±0.9	0.4
Birth order	1.67±0.9	1.85±0.8	0.02

Considering different prenatal complications, only pregnancy-induced hypertension showed a significant difference between both study groups. Figure 1 presents the prevalence of various pregnancy-induced problems among these two groups.
*thrombocytopenia: platelet count less than 150 thousand
*anemia: hemoglobin less than 10

In this research study, the effect of different variables, such as infant's gender, maternal occupation, type of delivery, maternal education, various prenatal complications, maternal age, gestational age, family size, and birth order on LBW were investigated. The results of the univariate logistic regression model to examine factors influencing LBW were illustrated in Table 3. Based on these findings; type of delivery (odds ratio; OR= 0.56, confidence interval; CI= 0.898-0.345), maternal occupation (OR= 0.41, CI= 0.940-0.181), birth order (OR= 0.48, CI= 0.830-0.279), gestational age (OR= 0.51, CI= 0.616-0.425), and pregnancy-induced hypertension (OR= 7.67, CI= 34.399-1.709) were significantly correlated with LBW.

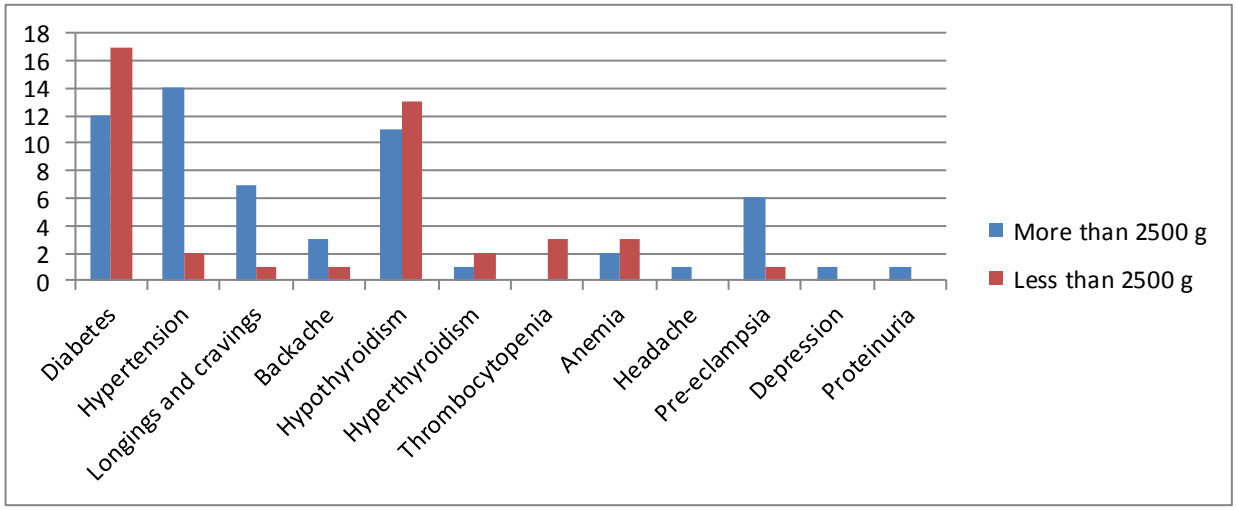

Figure 1. Frequency of various prenatal problems in the case and control groups

Table 3. Results of univariate analysis of factors associated with LBW using a two-level logistic regression model

	OR	95% CI	P-value
Maternal education			
Lower than high school diploma	-	-	-
High school diploma	1.004	0.5-0.14	0.99
University education	0.548	0.269-1.117	0.09
Birth order			
First-born	-	-	-
Second-born	0.48	0.279-0.830	0.009
Third-born and more	0.57	0.305-1.072	0.08
Gender (female vs. male)	1.121	0.702-1.792	0.63
Type of delivery (vaginal (natural) vs. C-section)	0.56	0.345-0.898	0.02
Gestational age (term vs. preterm)	0.11	0.058-0.212	0.00
Maternal occupation (housewife vs. employed)	0.41	0.181-0.940	0.03
Family size	0.992	0.776-1.268	0.95
Maternal age	0.982	0.941-1.024	0.39
Gestational complications (yes-no)	1.491	0.897-2.479	0.12
Hypertension (yes-no)	7.67	1.709-34.399	0.008
Gestational diabetes (yes-no)	0.68	0.31-1.48	0.33
Longings and cravings (yes-no)	7.3	0.89-60.27	0.06
Backache (yes-no)	3.04	0.31-29.62	0.3
Hypothyroidism (yes-no)	0.83	0.36-1.93	0.7
Hyperthyroidism (yes-no)	0.49	0.04-5.53	0.6
Thrombocytopenia (yes-no)	0.000	0.000	0.9
Anemia (yes-no)	0.67	0.1-4.02	0.6
Headache (yes-no)	1.63	0.00	1
Pre-eclampsia (yes-no)	6.22	0.74-52.39	0.09
Depression (yes-no)	1.63	0.000	1
Proteinuria (yes-no)	1.63	0.000	1

In order to evaluate the simultaneous effect of different factors on LBW, variables whose significance level was less than 0.2 in the univariate analysis were inserted in the logistic regression model, and their combined effect was evaluated at the same time (Table 4). According to the results, infants born to mothers with a gestational age of more than 37 weeks, compared to those of mothers with a gestational age of less than 37 weeks, were less at the risk of being underweight, i.e. a gestational age of more than 37 weeks was considered as a protective factor against LBW of infants (OR= 0.11, CI= 0.23-0.06). Moreover, babies whose mothers had university education were less likely to be underweight than infants whose mothers had degrees lower than high school diploma (OR= 0.24, CI= 0.6-0.09). Neonates as third-born ones or more were also less at the risk of LBW than first-born infants (OR= 0.38, CI= 0.87-0.17).

Table 4. Results of multivariate analysis of factors related to LBW using a two-level logistic regression model

	OR	95% CI	P-value
Gestational age	0.11	0.06-0.23	0.00
Gestational longings and cravings	6.14	0.62-60.49	0.1
Hypertension	5.17	0.93-28.8	0.06
Maternal education			
lower than high school diploma	-	-	-
high school diploma	0.67	0.29-1.55	0.3
university education	0.24	0.9-0.6	0.00
Birth order			
first-born	-	-	-
second-born	0.4	0.2-0.76	0.00
third-born and more	0.38	0.17-0.87	0.02

Discussion

The results of this study indicate that some of the demographic characteristics of mothers in both groups were significantly different, reflecting the probability of their effects on birth weight in infants. The results also showed that 56.3% and 43.7% of deliveries in the case group and in the control group, respectively, were related to C-section, and such a difference between both groups was statistically significant. Also, the findings of the univariate analysis revealed a significant relationship between type of delivery and LBW; however, this relationship was not observed in the results of the multivariate analysis. In the study by Karimi et al., no significant relationship was found between LBW and type of delivery, [12] while Bahrami reported, in his study, that type of delivery could have the greatest impact on LBW [20]. Thus, it is important to note that vaginal (natural) delivery could play an important and effective role in preventing diseases and adverse consequences in infants at birth [12].

Moreover, the results of univariate analysis showed a significant correlation between pregnancy-induced hypertension and LBW in a way that, mothers suffering from higher blood pressure had a 7.8 times lower chance of giving birth to LBW infants than mothers who had no pregnancy-induced hypertension which was consistent with the results of the study by Taheri et al. [15]. In the study by Firoozi et al., a significant relationship was also found between high blood pressure and LBW [19], but Zahed Pasha et al. did not report such a relationship [2].

In addition, the results of the multivariate regression analysis indicated that gestational age less than 37 weeks could significantly increase the rate of LBW infants. Other studies also reported gestational age less than 37 weeks (premature) as one of the factors affecting LBW [2, 18, 20, 21], so that Delaram in his study, reported that gestational age less than 37 weeks could augment the chance of LBW infants by 10 times [21]. The results of a path analysis in the study by Khalilian et al. showed that

the probability of LBW babies could decrease with the rise in gestational age [11]. Zahed Pasha and Sareer Badshah et al. in Pakistan also confirmed these results [2, 22].

Among the other relevant factors in this study was birth order in which babies at higher orders had higher mean weight, and this relationship was also statistically significant and in line with similar studies [1, 16, 23]. Karimi et al. also reported in their research that LBW could decrease as the birth order went up [12]. Similar findings have also been seen in other studies, Zeighami et al. for instance, found the first pregnancy as a risk factor for LBW, and pointed out that women could finish their pregnancy with more care at their later pregnancies. Obviously, there is the probability of occurrence of prenatal complications in the first pregnancy due to inadequate maternal experience and higher levels of sensitivity [1]. A study in Jordan also confirmed these findings, and considered first-born infants as a factor affecting LBW [24]. Other researchers similarly reported that birth weight of infants, among multiparous women, was greater than that in nulliparous [18, 20] ones. Delaram also reported that the chances of having LBW infants in primiparous women were about 4 times higher than in multiparous women [21]. In their research study conducted in the city of Yazd, Islami et al. considered first-born infants as one of the effective factors of LBW [25]. Moreover, a study in Japan reported a significant relationship between LBW and birth order [26]. Vaktskjold et al. in their study in Vietnam, similarly reported a direct relationship between number of deliveries and birth weight in a way that means birth weight in mothers who had two deliveries was greater than the weight of newborns in the mother's first delivery [27].

Another finding of this study revealed that mothers with degrees lower than high school diploma, had a higher chance of having LBW infants. In other words, risk of having LBW babies in mothers with university education was less than those with degrees lower than high school diploma. Findings from a meta-analysis by Daliri et al. also showed that the probability of LBW infants in illiterate mothers was 1.16 times higher than that among educated ones, and such a relationship was statistically significant [5]. In a study in 2005, the rate of LBW infants were reported higher in low-educated women [28]. In Jordan, lower-educated mothers had infants with LBW; this was statistically significant also [24]. However, the results of the study conducted by Delaram et al. did not confirm the findings in the present study, since no relationship was observed between LBW and maternal education in their study [21].

In this study, like the investigation by Hosseini et al. [29], no significant relationship was found between maternal age and LBW. However, most studies reported significant correlations [16, 19, 23, 30]. Moreover, in a study in Pakistan, it was found that if a mother's age was less than 20 years, it had a major impact on the occurrence of LBW [22]. In the study by Adl Shoar et al., there was a similar relationship between the maternal age of less than 20 and over 35 years, and LBW infants [13]. Zarbakhsh Bahri et al. also considered pregnancy at ages less than 20 years and over 35 years to be a determining factor related to LBW infants [31]. This difference would be due to the fact that there was no difference in the mean maternal age between the two groups in the present study and that most of the participating mothers were in the age group between 20 and 30 years.

In this research, there was also a significant relationship between maternal occupation and LBW, based on the results of univariate analysis, so that mothers' employment was shown as a protective factor for LBW infant, but such a relationship was not observed according to the findings of the multivariate analysis of maternal occupation. Likewise, in the study by Daliri et al., no significant relationship was found between LBW and mothers' employment [5]. On the other hand, in a case control research by Deshpande et al. in India, The proportion of farm-laborer mothers were significantly higher among the LBW newborns [32], However, with the increase in infant growth, especially in developed countries, the prevalence of obesity and overweight in children is high and increases the risk of hypertension and

cardiovascular disease [33-39]. But attention to low birth weight in infants and Children, especially in developing countries, should be given more attention.

Conclusion

In this study, no relationship was reported between LBW infants and other variables such as baby's gender, family size, as well as other prenatal problems, probably due to the distribution of approximately the same variables among the two groups which led to a lack of relationship between these variables and LBW. Ultimately, it was concluded that the incidence of LBW could be prevented by taking actions in terms of preventing early pregnancy, holding educational courses and programs for mothers, especially high-risk groups, such as young and primiparous mothers and also improving the quality of routine prenatal care.

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Conflict of Interest

Authors have no conflicts of interests.

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