ORIGINAL ARTICLE

Maternal Risk Factors Associated with Low Birth Weight among in Term Newborns in Abadan University of Medical Sciences: A Nested Case-Control Study

Neda Amoori[1], PhD;
Haydeh Ghajari[2], MSc;
Belghis Afkaneh[3], MSc

[1]Department of Epidemiology, Abadan University of Medical Sciences, Abadan, Iran
[2]Department of Health Education, Abadan University of Medical Sciences, Abadan, Iran
[3]Department of Social Sciences-demography, Abadan University of Medical Sciences, Abadan, Iran

Correspondence:
Haydeh Ghajari, MSc;
Department of Health Education.
Abadan University Of Medical Sciences, Abadan, Iran
Tel: +98 9370072887
Email: h.ghajari2012@yahoo.com
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Abstract

Background: Low birth weight (LBW) can cause complications and disorders in the future life of newborns. This study aimed to investigate maternal risk factors affecting low birth weight among term newborns in the affiliated cities of Abadan University of Medical Sciences based on a nested case-control study.

Methods: In this study, based on the nested case-control design, namely with the risk set sampling approach, the case and control groups were selected. All in-term newborns born since the beginning of 2018, with less than 2500g birth weight, were considered as the case group. Two were randomly selected as controls from newborns born in the same time frame and geographical location and with over 2500g birth weight. The selection ratio of the cases to control was 1:2. The questionnaires were completed from the beginning of 2019 to the end of 2020. To describe the data, descriptive statistical indicators including mean, standard deviation, frequency, and logistic regression were used in this method.

Results: The results of this study indicate that the factors affecting LBW are maternal age, number of pregnancies, number of abortions, history of stillbirth, history of bleeding, mother's BMI, number of births, twins, and gestational intervals.

Conclusion: It is suggested that health policymakers should pay special attention to the necessary interventions for mothers with special pregnancy care conditions. In addition, it is necessary to pay more attention to the continuation and improvement of the quality of educational programs for health and medical personnel to increase the mothers' awarenessregarding the maintenance of a healthy lifestyle during pregnancy.

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Introduction

A very sensitive index of children's health is birth weight. Low birth weight (LBW) can cause complications and disorders in the future life of infants.[1] The newborns' mortality rate is one of the most important health indicators of every society that is affected by various factors. LBW is one of the leading causes of mortality in suckling babies and infants.[2] For the first time in 1919, Ylppo named 2,500-gram newborns LBW, and this definition has been approved by the World Health Organization (WHO) for many years as a global

standard for low birth weight.[3] However, two critical factors, namely gestational age at delivery and the rate of fetal growth, are used to determine the birth weight[4] Subsequently, factors determining low weight may be different between preterm and term newborns because, in the case of the preterm newborn, usually prematurity explains low weight, while in the term newborn, the result of intrinsic and extrinsic factors influences the development potential.[4, 5]

LBW newborns are 24 times more likely to die than normal-weight newborns, and their mortality in infancy is even 40 times more than that in normal-weight newborns. These children are also at greater risk of death before the age of 15.[6] Although one of the goals set at the World Summit for Children in 1990 was to reduce the prevalence of LBW to less than 10 percent by 2000, the problem remains unresolved in the 21st century, according to WHO reports.[7] In terms of continental division, the prevalence of low weight in Africa is 18.3%, Asia 14.3%, Europe 6.4%, Latin America and the Caribbean 10%, North America 7.7%, and Oceania 10.5%; also, based on studies in Iran, it has been reported between 8 and 10%.[8] A study by Mehdi Shokri et al. reported the prevalence of low birth weight as 7.9% in Iran and 4.9% in Ahvaz city.[9]

In Iran, 48% of mortalities in children under age 5 occur in the first month of life, and more than half of these deaths were due to low birth weight.[10] Factors affecting fetal growth and intrauterine weight may also affect the baby's health outcomes in later life. LBW leads to an increase in childhood mortality, disability, and disease.[11] Increased risk of ischemic heart disease, hypertension, diabetes in later life, hearing impairment, neurological and ocular complications, mental retardation, inadequate brain development, cerebral hemorrhage, decreased life expectancy, increased infectious and respiratory diseases, hypothermia, anemia, chromosomal abnormalities, disproportion of body organs, and nutritional and care problems are other complications of LBW.[12] Metabolic disorders in LBW newborns are 2 to 3 times more than normal-weight newborns.[13] Factors that affect LBW in newborns include maternal age at gestation, gestational intervals, maternal blood pressure, maternal blood type, body mass index, maternal RH, parental kinship, violence against women (physical and verbal violence), maternal depression, and its effect on maternal inattention to weight gain and care during pregnancy, marital satisfaction, infant gender, birth order, history of multiple births, poor nutritional status, inattention to proper diet and supplementation during pregnancy, birth season, number of prenatal cares, maternal anemia, which in turn causes preterm delivery and adverse effects on fetal intrauterine growth, and bleeding during pregnancy, all of which greatly increase the risk of LBW.[14-20] A nested case-control study is a kind of reserach based on the existence of a cohort. That is, it is a replacement for a prospective cohort. In this method, information about the exposure is collected from the beginning of the study and made available to researchers. Whenever the cases are identified, the controls are simultaneously selected from the same study population which has no consequences. If the controls are selected as a random sample based on the time each item was identified, this research method is called nested case-control design, incidence density sampling, or risk set sampling.[21] Although Iran has had significant success in reducing newborn mortality in the last two decades, LBW is still recognized as a major risk factor for infant mortality. In our country, LBW and investigating its causes are of great importance in the health system of the country. The present study was performed to determine the risk factors affecting the LBW in term newborns.

Methods

Thisis a nested case-control study. The proposal was approved by Abadan University of Medical Sciences with the ethics code of IR.ABADANUMS.REC.1397.025. Our study population consisted of pregnant mothers living in the affiliated cities of Abadan University of Medical Sciences who were followed up during pregnancy. As to the method of sample selection, firstly the separate statistics of low birth weight newborns born in the last few years in comprehensive centers of urban and rural health services of three cities affiliated to Abadan University of Medical Sciences were received from the newborn health expert in the vice-chancellery of health. Comprehensive urban and rural health service centers in these three cities, which had the highest number of LBW newborns in the last few years, were selected. In this study, based on the nested design, namely with the risk set sampling approach, the case and control groups were selected. All term newborns born since the beginning of 2018, with less than 2500g birth weight, were enrolled as the case group. Two were randomly selected as controls from among the newborns who were born in the same time frame and geographical location and with over 2500g birth weight. The selection ratio of the cases to the controls was 1:2. The questionnaires were completed from the beginning of 2019 to the end of 2020.

In this study, the inclusion criteria for the case group were pregnant mothers who gave birth to an LBW newborn during the project. Inclusion criteria in the control group were pregnant mothers who gave birth to a normal-weight newborn at the same time the LBW newborn in the case group was born. Exclusion criteria included LBW premature newborns (less than 37 weeks) or abortion or stillbirth in pregnant women or refusal to participate in the project. In the current study, the questionnaire of Khazaei et al.'s study in Kurdistan was used.[22] Considering all the variables

and related factors for both case and control groups, an interviewer in each health center completed the questionnaire according to the pregnancy records available in the centers. The required questions were asked by the interviewer to the mothers and recorded in the questionnaire according to the mothers' statements. The questionnaire consists of 5 sections with 12 questions about demographic information in the first section, 10 questions about the history of the mother in the second section, 12 questions about the mother's history or illness during pregnancy in the third section, 4 questions about the results of mother's tests and routine care in the fourth section, and 6 questions about the condition of the newborn in the fifth section.

In this method, from the beginning of the research,information was collected, recorded, and provided to the researcher. By the time the case was identified in the study, the control which was a newborn weighing more than 2500 grams was selected from the same population under study.

The collection of data and information required for the case and control participants in this study was performed by reviewing their household records available in the health centers. Data were collected from the beginning of 2019 to the end of 2021.

Considering 95% confidence, 80% test power, control ratio to case 2, and a correlation coefficient of 20%, the exposure between case and paired controls[23] as well as the odds ratio of at least 2,[24] and the exposure rate 20 percent in the control group, finally the minimum sample size was estimated 155 (low birth weight newborns) in the case group and 310 (normal weight newborns) in the control group. Therefore, the minimum sample size in this study was equal to 465 newborns. In this study, descriptive statistical indicators including mean, standard deviation, and frequency as well as tables and graphs were used to describe the data. The analysis of the nested control case was performed using SPSS software.

Results

The results of this study showed that most of the mothers in the case group (80%) and the control group (75.8%) were in the age group of 20-35 years, and the highest level of education in both case (32.5%) and control groups (30.8%) was the middle school. On the other hand, most mothers in the case (92.6%) and control groups (92.3%) were housewives. Also, 43.9% of mothers in the case group and 40.1% in the control groups were related to their spouse before marriage, and only 2.3% of mothers in the case group and 1.6% of controls had a history of divorce (Table 1). There was no statistically significant difference between the case and control groups in any of the studied variables (P>0.05).

According to the results of the univariate analysis, factors affecting LBW were maternal age, number of pregnancies, number of abortions, stillbirth, history of bleeding, maternal BMI, twins, and gestational intervals. The results of multivariate analysis showed that the risk of LBW in normal-weight mothers (18.5≤BMI<24.9) was almost 4 times lower than in low-weight mothers (BMI<18.5), [OR=0.4, 95% CI: (0.1,1.6)]; however, the risk was lower in overweight mothers (BMI≤25) than in low-weight ones. Also, the risk in mothers with a history of stillbirth [OR=2.3, 95% CI: (0.3,5.8)], gestational intervals [OR=2.7, 95% CI: (1.8,3.6)], and twins [OR=2.3, 95% CI: (1.4,4.6)] was about 2 times more than other pregnant mothers (P<0.05).

Other variables examined in this study, such as the mother's level of education and occupation, relatives, parental divorce history, number of deliveries, IVF, history of smoking, history of exposure to cigarette smoke, self-medication or arbitrary use of drugs, drug use under medical supervision, psychological tension, RH, number of visits to the doctor, infant gender, birth order, birth season, history of maternal diseases during pregnancy was not significantly effective in birth weight. The results are shown in Table 2.

Table 1: Maternal demographic variables in the case and control groups

Variable		Case	Control	Chi-2	P
Maternal age	19<	8 (5.1)	14 (45)	4.1	0.51
	2035	124 (80)	235 (75.8)		
	35≤	26 (16)	61 (19.6)		
Maternal education	Illiterate	18 (11.6)	16 (5.1)	5.6	0.23
	Elementary	36 (23.2)	86 (27.6)		
	Middle school	50 (32.5)	96 (30.8)		
	High school	41 (26.5)	85 (27.2)		
	Academic	9 (5.8)	25 (8)		
Maternal job	Housewife	143 (92.3)	289 (92.6)	0.32	0.85
	Employee	9 (5.8)	19 (4.8)		
Relative	No	84 (54.2)	178 (57.1)	0.5	0.47
	Yes	68 (43.9)	125 (40.1)		
Parental divorce history	No	149 (96.1)	301 (96.5)	0.51	0.47
	Yes	4 (2.6)	5 (1.6)		

Table 2: Univariate and multivariate analysis of risk factors affecting LBW in the case and control group

Variable		Groups		Unadjusted OR (95% CI)	P	Adjusted OR (95% CI)	P
		Case (n=155)	Control (n=310)				
Maternal age	19<	8 (5.1)	14 (45)	1	--	1	--
	2035	124 (80)	235 (75.8)	0.9 (0.9-1.0)	0.001	1.0 (0.9-1.0)	0.6
	35≤	26 (16)	61 (19.6)	0.4 (0.1-1.5)	0.2	1.4 (0.5-2.3)	0.1
Maternal education	Illiterate	18 (11.6)	16 (5.1)	1	--	1	--
	Elementary	36 (23.2)	86 (27.6)	0.8 (0.1-1.8)	0.4	1.3 (1.8-3.5)	0.1
	Middle school	50 (32.5)	96 (30.8)	1.6 (0.9-3.2)	0.6	1.1 (0.6-2.9)	0.5
	High school and diploma	41 (26.5)	85 (27.2)	1.8 (0.6-3.8)	0.1	1.7 (0.8-3.6)	0.8
	Academic	9 (5.8)	25 (8)	2.3 (1.5-4.3)	0.2	1.2 (0.3-2.9)	0.9
Maternal job	Housewife	143 (92.3)	289 (92.6)	1	--	1	--
	Employee	9 (5.8)	19 (4.8)	0.67 (0.69-6.53)	0.7	1.14 (0.87-1.51)	0.3
Paternal job	Unemployed	14 (9)	10 (3.2)	1	--	1	--
	Employee	8 (5.2)	19 (6.1)	0.55 (0.50-6.18)	0.6	1.3 (0.6-3.5)	0.8
	Freelance	122 (78.8)	266 (85.3)	0.9 (0.9-2.8)	0.4	1.8 (0.8-3.6)	0.4
Relative	No	84 (54.2)	178 (57.1)	1	--	1	--
	Yes	68 (43.9)	125 (40.1)	1.15 (0.77-1.70)	0.47	3.15 (1.30-7.65)	0.1
Number of pregnancies	The first	53 (34.2)	80 (25.6)	1	--	1	--
	2≤	98 (63.2)	220 (70.9)	1.1 (0.97-1.26)	0.03	1.6 (0.84-2.3)	0.01
Number of deliveries	The first	105 (67.7)	204 (65.8)	1	--	1	--
	2≤	50 (32.2)	106 (34.1)	1.2 (1.04-1.45)	0.01	1.8 (1.3-2.9)	0.6
Number of abortions	0	119 (76.7)	236 (75.6)	1	--	1	--
	1≤	29 (18.8)	52 (17.2)	1.0 (0.88-1.20)	0.1	1.0 (0.42-2.66)	0.8
Stillbirth	No	73 (4.5)	294 (94.2)	1	--	1	--
	Yes	143 (92.3)	9 (2.9)	1.3 (0.61-2.83)	0.01	2.3 (0.34-5.8)	0.03
Gestational interval	2<	70 (45.2)	126 (40.6)	1	--	1	--
	≤2	55 (35.5)	136 (43.6)	1.3 (1.01-1.81)	0.04	2.7 (1.83-3.64)	0.01
IVF	No	153 (98.7)	303 (97.1)	1	--	1	--
	Yes	1 (0.6)	3 (1)	0.8 (0.4-1.2)	0.1	0.9 (0.6-1.4)	0.9
BMI Maternal	18.5<	32 (20.6)	42 (13.5)	1	--	1	---
	18.524.9	81 (52.2)	189 (60.2)	0.9 (0.4-1.3)	--	0.4 (0.1-1.6)	0.04
	25≤	41 (26.5)	73 (23.4)	0.5 (0.1-0.8)	0.01	0.2 (0.06-0.8)	0.01
Bleeding	No	139 (89.7)	289 (92.6)	1	--	1	--
	Yes	13 (8.4)	14 (4.5)	1.3 (0.7-2.3)	0.03	4.3 (0.42-6.4)	0.02
History of smoking	No	151 (97.4)	300 (96.2)	1	--	1	--
	Yes	1 (0.3)	5 (1.5)	1.5 (0.4-5.2)	0.5	1.7 (0.2-2.4)	0.8
History of contact with cigarette smoke	No	39 (25.2)	90 (28.8)	1	--	1	--
	Yes	4 (2.6)	5 (1.5)	1.0 (0.9-1.1)	0.9	1.5 (0.9-2.7)	0.5
Disease history	Diabetes	3 (1.9)	10 (3.2)	2.1 (0.4-9.2)	0.3	1.8 (0.2-3.6)	0.6
	Hypertension	11 (7.1)	8 (2.6)	0.4 (0.1-1.5)	0.1	0.2 (0.01-2.64)	0.8
	Anemia	27 (17.4)	59 (18.9)	1.3 (0.5-3.3)	0.5	2.2 (0.8-6.6)	0.08
	Urinary and genital infections	4 (2.6)	7 (2.2)	1.0 (0.2-4.6)	0.9	0.7 (0.2-2.4)	0.4
	Hypothyroidism	7 (4.5)	5 (1.6)	0.4 (0.1-1.7)	0.2	0.7 (0.4-1.1)	0.6
	Hyperthyroidism	2 (0.4)	1 (0.3)	2.1 (0.81-5.66)	0.6	2.8 (1.9-7.8)	0.7
	Thalassemia	6 (3.9)	9 (2.9)	0.9 (0.2-3.3)	0.8	0.7 (0.08-0.7)	0.1
	Oral and dental	3 (1.9)	4 (1.3)	0.8 (0.1-4.4)	0.7	0.9 (0.6-1.9)	0.9
Self-medication arbitrary use of drugs	No	145 (93.5)	296 (94.9)	1	0.8	1	0. 4
	Yes	3 (1.9)	1 (0.3)	1.8 (1.1-3.2)		2.6 (1.4-3.8)	
Drug use under medical supervision	No	121 (78.1)	245 (78.5)	1	0.6	1	0.1
	Yes	29 (18.7)	59 (18.9)	0.5 (0.2-1.1)		1.8 (0.6-2.3)	
Psychological tension	No	130 (83.9)	283 (90.7)	1	--	1	--
	Yes	19 (12.3)	22 (7.1)	0.6 (0.2-1.1)	0.7	0.9 (0.2-4.3)	0.9
RH	Rh+	110 (71)	253 (81.8)	1	--	1	0.6
	Rh-	17 (11)	17 (5.4)	2.0 (1.2-3.5)	0.4	1.3 (0.4-4.2)	0.6
Number of visits to the doctor	≤5	103 (66)	203 (65)	1	--	1	----
	6-9	20 (13)	54 (17)	1.0 (0.9-1.0)	0.7	0.8 (0.1-2.5)	0.6
	10≤	4 (2.6)	5 (1.6)	0.9 (0.8-1.1)	0.9	0.5 (0.04-1.8)	0.1
Infant gender	Girl	78 (50.3)	149 (47.8)	1	--	1	--
	Boy	73 (47.1)	160 (51.3)	1.1 (0.7-1.6)	0.4	1.5 (1.2-2.8)	0.8

Multiple births	Single twin	120 (77.4)	297 (95.2)	1	--	1	--
	Twin	33 (21.3)	9 (2.9)	1.9 (1.1-2.8)	0.001	2.3 (1.4-4.6)	0.02
	More than two	1 (0.6)	306 (98.1)	0.1 (0.5-0.2)	0.9	0.5 (0.1-1.4)	0.3
Birth order	2<	90 (58)	175 (56.4)	1	--	1	--
	2≤	57 (36.7)	126 (40.6)	1.0 (0.9-1.2)	0.2	0.8 (0.5-1.3)	0.6
Birth season	Spring	46 (29.7)	95 (30.4)	1	--	1	---
	Summer	67 (43.2)	117 (37.5)	2.3 (1.0-5.2)	0. 3	0.8 (0.02-2.5)	0.1
	Autumn	24 (15.5)	81 (36)	1.9 (0.9-4.3)	0.05	1.1 (0.5-3.6)	0.8
	Winter	16 (10.3)	14 (4.5)	3.8 (1.6-9.0)	0. 1	2.4 (1.2-4.6)	0.3

Discussion

LBW affects the physical and mental development of children and causes serious complications and mortality in newborns. Studies have shown that the prevalence of LBW in Iran is 8%.[25] This study aimed to determine the factors affecting the low birth weight among term newborns in the affiliated cities of Abadan University of Medical Sciences (nested case study). According to the results, factors affecting LBW were maternal age, number of pregnancies, number of abortions, stillbirth, history of bleeding, maternal BMI, twins, and gestational intervals. Other variables examined in this study, such as the mother's level of education and occupation, relatives, parental divorce history, number of deliveries, IVF, history of smoking, history of exposure to cigarette smoke, self-medication or arbitrary use of drugs, drug use under medical supervision, psychological tension, RH, number of visits to the doctor, infant gender, birth order, birth season, history of maternal diseases during pregnancy were not significantly effective in birth weight.

In the present study, the highest rate of LBW newborns was in mothers aged 20 to 35 years old. The rate of LBW newborns in mothers aged 35 and above was more than that of those under 19 years old, which is consistent with a study[26] in which the highest prevalence of LBW newborns was in mothers aged 18 to 35.

The results of the present study show that there is no statistically significant difference between the control and case groups in terms of mothers' education level, and more than 80% of the mothers in the control and case groups had school education. Only 8% in the control group and 5.8% in the case group had academic education. This result shows that mothers' education does not show a statistically significant relationship with the birth of a low birth weight newborn, which is consistent with the study of Mohammadi et al.[26] Although the results of Shokri et al.'s study[9] showed that the mother's job was one of the factors affecting the birth of a low birth weight newborn, the results of the present study showed that most of the mothers were housewives (92%), and no significant relationship was observed between the mothers' jobs and low birth weight newborns. This result is consistent with the study of Mohammadi et al.,[27] and that conducted in Qatar.[28]

Gestational age is another factor influencing the birth of LBW newborns. A study by Mosayebi et al. showed that more than 50% of LBW newborns were preterm.[29] Also, Momeni et al. found that in 75% of LBW cases, low gestational age and preterm delivery were the only effective factors.[30] Due to the clear impact of preterm delivery on birth weight, in the current study we only examined newborns who were over 37 weeks and term.

This study shows that twin births are the factors influencing LBW newborns, and the mothers who have a history of twin births are twice as likely as other mothers to have an LBW newborn. The results of the studies by Mirzarehimi et al.[31] and Asgharian et al.[32] showed that twins and multiple gestations are known as effective factors for low birth weight. This is consistent with the results of the current study.

The present study showed that mothers whose gestational intervals were 2 years or less were twice as likely to have LBW newborns. The results of the study by Shokri et al. are consistent with those of the current study,[9] showing that the birth order and gestational intervals over 2 years affect the birth weight of the newborn.

According to the results of the present study, the number of LBW newborns born to normal-weight mothers was 4 times lower than those born to mothers with a body mass index of less than 18.5. The risk of an LBW newborn in mothers with an overweight body mass index was lower than that in low-weight mothers. This finding is consistent with the results of a study by Khazaei et al.,[22] Nahar et al., Safari et al.,[33] Yuda et al.[34] and a study in India.[35] Maternal anthropometric characteristics such as weight and body mass index, which indicate sufficient energy intake, influence the placenta size and directly affect the newborn weight.[22]

The results of the present study showed that mothers with a history of bleeding during pregnancy were 4 times more likely than other mothers to have LBW newborns. The results of some studies,[8, 30, 36-38] also confirm the association between bleeding history and newborns' low weight. Bleeding or spotting in the second and third trimesters of pregnancy can cause conditions such as placental abruption, miscarriage, or preterm birth, resulting in an LBW newborn.[39]

Given that in this study only a few mothers stated that they had a history of smoking (6 people) or were exposed to cigarette smoke (9 people), the results showed low birth weight in newborns was not associated with drug use or exposure to cigarette smoke. This result is in the same line with that of the study conducted by Mohammadi[27] and Mirza Rahim et al.[31]

Also, the examination of the results in this study showed that there was no significant relationship between the mothers suffering from diseases such as diabetes, blood pressure, hypothyroidism or hyperthyroidism, anemia, thalassemia, oral and dental diseases, urinary infection during pregnancy and low birth weight newborn, which is consistent with the studies of Badshah et al.,[40] Feresu et al.,[41] and Sharma et al.[37] However, in a study by Moradi et al.,[15] the results showed that the rate of preterm newborns born to mothers with the disease was three times higher. Therefore, the investigation of diseases that are related to the birth weight of the newborn requires further studies to be conducted; considering the spread of the COVID-19 pandemic, the impact of this disease on the newborn weight can be investigated in future studies. The results of the current study showed that among the studied samples, only 4 mothers had used drugs arbitrarily and no significant relationship was observed between arbitrary use of drugs by the mother or under the supervision of a doctor during pregnancy and the low birth weight newborn; this is consistent with the study of Mohammadi et al.[27] However, given that many drugs cross the placenta and affect the fetus, this result needs further investigation.

The number of deliveries is one of the known factors in LBW among newborns. In this study, the number of pregnancies was significantly associated with low birth weight newborns. In a study by Yadav,[34] fourth or subsequent gestations were associated with low birth weight newborns. The results of a study on maternal determinants of low birth weight newborns in central India[42] indicated that in multiparous women whose gestational intervals were less than two years, a significant relationship was observed with low birth weight.

According to the results of the current study, mothers who had a history of stillbirth were twice as likely as other pregnant mothers to have a history of LBW newborns. The results of the study by Takai IU et al.[43] revealed that the history of stillbirth in the mother was one of the factors affecting the birth of LBW, which is consistent with the finding of the current study.

Another factor affecting LBW among newborns is the history of abortion in pregnant women. According to the results of Brown's study,[44] the history of previous abortion in a mother is an important risk factor for low birth weight. As the number of previous abortions increases, the risk of LBW is increased, too.

Some studies conducted in Iran regarding pregnancy with IVF have shown that IVF is effective on LBW newborns,[45] but considering that only 4 people in our study had IVF pregnancies, no significant relationship was observed between IVF and LBW newborns.

Conclusion

Based on the results of this study, the factors affecting the LBW newborns were variables such as the age of the pregnant mother, failure to observe the appropriate interval between births, number of pregnancies, and special care conditions in pregnant mothers (such as bleeding, history of abortion, history of stillbirth, and twins). It is suggested that health policymakers should pay special attention to the necessary interventions for mothers with special pregnancy care conditions. In addition, it is necessary to pay more attention to the continuation and improvement of the quality of educational programs for the health and medical personnel to increase the awareness of mothers regarding the maintenance of a healthy lifestyle during pregnancy.

Limitation

The long-term process of the project implementation and the completion of the questionnaire for LBW newborns and numerous sample sizes were the limitations of this study.

Acknowledgment

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Ethical Consideration

The proposal was approved by Abadan University of Medical Sciences with the ethics code of IR.ABADANUMS.REC.1397.025. Due to the coordination of the Deputy of Education and Research with the Deputy of Health of Abadan to coordinate the health centers of the three cities of Abadan, Khorramshahr, and Shadegan, the necessary explanations about the objectives and process of the study were provided in correspondence by Abadan University of Medical Sciences. Written consent was obtained for all the study participants to review their household records.

Conflict of Interest: None declared.

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