Original Article

Associated factors of birth weight outcomes in the south of Iran: A cross-sectional survey

Zahra Hassanzadeh-Rostami[1], Elham Kavosi[2], Mohammad Reza Heidari [2*], Aliasghar Nasihatkon[3], Iman Hafizi-Rastani[3]

[1] Department of Community Nutrition, School of Nutrition and Food Sciences, Shiraz University of Medical Sciences, Shiraz, Iran

[2] Vice Chancellor for Health, Shiraz University of Medical Sciences, Shiraz, Iran

[3] Fars Petroleum Industry Health Organization, Shiraz, Iran

Corresponding author and reprints: Mohammad Reza Heidari. Vice Chancellor for Health, Shiraz University of Medical Sciences, Shiraz, Iran.

Email: heydari280@yahoo.com

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Abstract

Background: Adverse birth outcomes are serious health problems that increase morbidity and mortality in neonates. Socioeconomic inequities are linked with Low Birth Weight (LBW) and High Birth Weight (HBW); however, the associations of these factors differ in various groups. The present survey aimed to estimate the prevalence of LBW and HBW and also to determine the associated demographic and socioeconomic factors.

Methods: A population-based, cross-sectional survey was conducted on 6495 children, aged 0-2 years, selected through cluster and multistage sampling methods in 30 cities of Fars province, Iran, from December 2012 to January 2013. Determinants were assessed using a questionnaires including demographic, health parameters, and socioeconomic variables. Also, birth weights were recorded from health report cards. We examined the association between probable factors related to LBW and HBW, and analyzed the data using multinomial regression model.

Results: Among the study population, 636 (9.7%) were LBW and the rate of HBW was estimated to be 152 (2.3%). In multinomial regression, the odds ratio of LBW was significantly higher in girls (OR=1.38, 95%CI=1.17-1.63), and the first (OR=1.7, 95%CI=1.25-2.31) and the second born child (OR=1.4, 95%CI=1.06-2.02); this ratio was lower in families with the father as the head of the family (OR=0.31, 95%CI=0.13-0.68) or mother (OR=0.43, 95%CI=0.11-1.64), and children from low populated families (OR=0.54, 95%CI=0.42-0.68). Moreover, the lower maternal education (OR=2.52, 95%CI=1.36-4.70) was significantly associated with increased HBW; however, girls (OR=0.56, 95%CI=0.39-0.79), low populated families (OR=0.60, 95%CI=0.37-0.96), and fathers as family head (OR=0.19, 95%CI=0.05-0.71) lowered the odds of HBW.

Conclusion: LBW was identified at a relatively high level. The prevention of adverse birth outcomes may be applicable by targeting demographic and social determinants like gender, birth order, family size, mother's education, and family head as predictors of birth weight in public health interventions.

Keywords: Birth weight; Infant; Low Birth Weight; Prevalence

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Introduction

Birth weight is considered as an important health index to predict intrauterine growth and prenatal morbidity and mortality (1, 2) not to mention its role in determining the community health development. Other than prenatal disorders, low or high birth weight threatens the child's life in later years via higher risk of disease such as diabetes and cardiovascular disease (2, 3).

The normal birth weight is in a range of 2500-3999 grams. The weight at birth lower than 2500 grams is categorized as Low Birth Weight (LBW), and higher than 4000 grams is macrosomia (2). Abnormal weight infants are exposed to clinical failure and even death. Also, due to the risk of various diseases, it can financially cost a lot for the family and society (3), especially in the developing countries where its large financial burden is considerable. Overall, LBW infants may face some disorders, such as problems with hearing, vision, cerebral palsy, mental retardation, respiratory diseases, learning and behavioral disorders, and increased mortality (4). On the other hand, High Birth Weight (HBW) or macrosomia may result in respiratory distress syndrome, birth injuries, etc. Furthermore, it can enhance the risk of obesity, diabetes, and cardiovascular disease from childhood (5).

Birth weight is affected by a group of genetic, biological, and environmental factors. The maternal determinants like preeclampsia, diabetes, thyroid malfunction, anthropometric impairments, inadequate nutrition, and also socio-economic factors are the underlying determinants of inappropriate birth weight (2, 6).

World Health Organization (WHO) estimated the prevalence of LBW as 15-20% comprising more than 20 million births a year. The global health policy aimed to reduce LBW incidence as 30% till 2025 (2). LBW is more prevalent in low and middle income countries. However, some high-income countries are also faced with this global concern. LBW is highly dependent on socio-economic status of the resident area and it is more important to find at risk population. Furthermore, the underlying factors of LBW are multiple and differ in each region and group. Given the importance of birth weight in health promotion and lack of comprehensive studies to identify its determinants in Fars population, we aimed to estimate the prevalence of LBW and HBW, and also to determine the associated factors among new born infants in Fars province, Iran.

Methods

We collected the data from a survey conducted on children under 6 years of age in Fars province, Iran (7). The sampling was done using cluster and multistage methods in urban and rural areas of all 30 cities of Fars province from December 2012 to January 2013. Next, we selected all 0-2 year-old children from the primary population of 6495 children. The child's parents or caregivers were informed about the study and their verbal consent was obtained. The study protocol was approved by the Ethics Committee of Shiraz University of Medical Sciences, Shiraz, Iran, under Registration No. 91-6309.

Data were collected through in-home interviews using a data gathering sheet containing demographic and health parameters: child's age and gender, birth order, family size, family head (categorized in three groups; father, mother, and others, i.e. individuals other than parents), parental education and occupation, family income (categorized in five groups: <4000000, 4000000-6000000, 6000000-10000000, and >10000000 Iranian Rial (IRR)), type of settlement, ethnicity, and household facilities and furniture including access to freezer, washing machine, dish washing machine, microwave, computer, cell phone, and personal car. The child's birth weight was also recorded from the health report card complied for all new born infants by trained staff, showing the birth weights.

Data were analyzed using IBM SPSS Statistics for Windows, Version 19.0. Armonk, NY: IBM Corp. Multinomial stepwise logistic regression analysis was used to determine the underlying factors related to birth weight outcome, which was categorized as LBW (<2500 grams), normal birth weight (2500-3999 grams), and HBW (≥4000 grams), with normal birth weight selected as base. In addition, we used chi-square test to identify the differences between normal and low or high birth weight groups. The results were expressed as frequency and percentage. The significance level was considered as $P<0.05$.

Results

Among 6495 young children, 3408 (52.5%) were male and 3653 (56.2%) were residents in urban areas. Baseline characteristics of the participants are reported in Table 1. The rate of LBW (<2500 grams) and HBW (≥4000 grams) were 9.7% and 2.3%, respectively.

Table 2 demonstrates the differences of the underlying factors across three birth weight categories. As shown, the prevalence of LBW was higher in girls than in boys. Furthermore, the rate of HBW in boys was more than that in girls ($P<0.001$). It also reported the family head, mother's education, family size, and birth order as determinants of abnormal birth weight ($P<0.05$).

Table 3 presents the results of multinomial regression analysis. The risk of LBW was greater among girls as compared with boys (OR=1.38, 95%CI=1.17-1.63). It was greater in the first (OR=1.7, 95%CI=1.25-2.31) and second born children (OR=1.4, 95%CI=1.06-2.02) than in the third and higher. Besides, the risk of LBW was lower in families with the father as the head of the family (OR=0.31, 95%CI=0.13-0.68) or mother (OR=0.43, 95%CI=0.11-1.64). In addition, infants from low populated families (≤4 members) were less probable to suffer from LBW (OR=0.54, 95%CI=0.42-0.68).

The multinomial regression model also showed girls (OR=0.56, 95%CI=0.39-0.79), low populated families (OR=0.60, 95%CI=0.37-0.96), and fathers as family head (OR=0.19, 95%CI=0.05-0.71), as protective factors of HBW. Also, mother's level of education as diploma or lower increased the risk of high birth weight (OR=2.52, 95%CI=1.36-4.70).

Discussion

The present study estimated the prevalence of LBW and HBW to 9.7% and 2.3%, respectively. The significant demographic and socioeconomic factors resulting in adverse birth outcomes included sex, maternal education, birth order, family size, and family head.

WHO reported a wide range of LBW prevalence in different regions of the world, as follows: 28% in south Asia, 13% in Sub-Saharan Africa, and 9% in Latin America (2). This rate in Iranian infants was reported to be 6.8 to 11.8% in regions with different developmental status (8-11). The rate of HBW in the present study was found to be 2.3%. The previous studies among Iranian neonates investigated a higher rate of macrosomia as 5.8 and 9% (12, 13). The maternal characteristics, and biological, familial, and environmental factors were found to affect birth weight. Literature in developing countries concluded that maternal obesity, diabetes, age, high parity, and fetal sex are the main causes of HBW progression (14). This variety in the underlying factors between population groups, regions, and in a time trend may cause this inconsistent rate of adverse birth outcome.

The current study demonstrated that female newborns had a higher LBW rate compared to males, as also reported in other studies (11, 15). However, Silva et al. could not find a significant association between birth weight and fetal sex (16). On the other hand, in our study the rate of HBW in male sex was found to be higher than in females.

Table 1. Socio-demographic characteristics of the participants

Variables	N (%)
Child's sex	
Male	3408 (52.5)
Female	3087 (47.5)
Type of settlement	
Urban	3653 (56.2)
Rural	2842 (43.8)
Mother's education	
Lower than diploma	3334 (51.4)
Diploma	2022 (31.2)
Academic education	1126 (17.4)
Lower than diploma	3639 (56.3)
Diploma	1799 (27.8)
Academic education	1025 (15.9)
Mother's occupation	
Housewife	6028 (92.9)
Employed	463 (7.1)
Father's occupation	
Unemployed	188 (2.9)
Farmer	777 (12)
Worker	1359 (21)
Employee	997 (15.3)
Self-employed	3124 (48.2)
Retired	41 (0.6)
Birth order	
1st	3410 (52.7)
2nd	2106 (32.5)
3rd and higher	957 (14.8)
Family size	
1-4	4879 (75.2)
>4	1605 (24.8)
Family income	
<4000000 IRR	2230 (34.4)
4000000-6000000 IRR	2645 (40.8)
6000000-10000000 IRR	1240 (19.1)
>10000000 IRR	371 (5.7)
Ethnicity	
Fars	5348 (82.4)
Other	1145 (17.6)
Household furniture and facilities	
0-1 item	522 (8.1)
2-4 item	3999 (61.8)
5-7 item	1951 (30.1)

IRR: Iranian Rial

Table 2. Determinants of adverse birth outcome among children under 2 years of age

Variables	LBW N (%)	NBW N (%)	HBW N (%)	*P*
Sex				
Boy	283 (8.3)	3023 (88.7)	102 (3.0)	<0.001
Girl	353 (11.4)	2684 (86.9)	50 (1.6)	
Type of Settlement				
Urban	259 (9.8)	3204 (87.7)	90 (2.5)	0.74
Rural	277 (9.7)	2503 (88.1)	62 (2.2)	
Family Head				
Father	621 (9.7)	5657 (88.0)	149 (2.3)	
Mother	4 (13.3)	26 (86.7)	0 (0.0)	<0.001
Other	10 (31.3)	19 (59.4)	3 (9.4)	
Mother's Education				
Lower than diploma	316 (9.5)	2916 (87.5)	102 (3.1)	
Diploma	219 (10.8)	1766 (87.3)	37 (1.8)	<0.001
Academic education	101 (9.0)	1012 (89.9)	13 (1.2)	
Mother's Occupation				
Employed	39 (8.4)	413 (89.2)	11 (2.4)	0.58
Housewife	597 (9.9)	5290 (87.8)	141 (2.3)	
Father's Education				
Lower than diploma	355 (9.8)	3188 (87.6)	96 (2.6)	
Diploma	178 (9.9)	1580 (87.8)	41 (2.3)	0.22
Academic education	102 (10.0)	909 (88.7)	14 (1.4)	
Father's Occupation				
Unemployed	24 (12.8)	158 (84.0)	6 (3.2)	
Farmer	60 (7.7)	690 (88.8)	27 (3.5)	
Worker	151 (11.1)	1175 (86.5)	33 (2.4)	0.12
Employee	93 (9.3)	882 (88.5)	22 (2.2)	
Self-employed	305 (9.8)	2756 (88.2)	63 (2.0)	
Retired	3 (7.3)	37 (90.2)	1 (2.4)	
Family Size				
1-4	439 (9.0)	4348 (89.1)	92 (1.9)	<0.001
> 4	196 (12.2)	1349 (84.0)	60 (3.7)	
Ethnicity				
Fars	523 (9.8)	4704 (88.0)	121 (2.3)	0.65
Other	113 (9.9)	1001 (87.4)	31 (2.7)	
Family Income				
<4000000 IRR	243 (10.9)	1942 (87.1)	45 (2.0)	
4000000-6000000 IRR	263 (9.9)	2310 (87.3)	72 (2.7)	0.07
6000000-10000000 IRR	99 (8.0)	1114 (89.8)	27 (2.2)	
>10000000 IRR	31 (8.4)	332 (89.5)	8 (2.2)	
Birth Order				
1st	359 (10.5)	2983 (87.5)	68 (2.0)	
2nd	187(8.9)	1872 (88.9)	47 (2.2)	0.004
3rd or higher	90 (9.4)	830 (86.7)	37 (3.9)	

**P* values were resulted from chi square test to associate each variable with birth weight outcomes
LBW: low birth weight, NBW: normal birth weight, HBW: high birth weight, IRR: Iranian Rial

Table 3. Multinomial logistic regression analysis to relate significant determinants of LBW and HBW

Parameters	LBW		HBW	
	OR (95% CI)	*P*	OR (95% CI)	*P*
Child's sex				
Male (Ref)	1		1	
Female	1.38 (1.17 – 1.63)	<0.001	0.56 (0.39 – 0.79)	0.001
Family size				
1-4	0.54 (0.42 – 0.68)	<0.001	0.60 (0.37 – 0.96)	0.03
>4 (Ref)	1		1	
Family Head				
Father	0.31 (0.13 – 0.68)	0.004	0.19 (0.05 – 0.71)	0.01
Mother	0.43 (0.11 – 1.64)	0.22	*	
Other (Ref)	1		1	
Birth order				
1st	1.7 (1.25 – 2.31)	0.001		
2nd	1.4 (1.06 – 2.02)	0.02	*	
3rd and higher (Ref)	1			
Maternal Education				
Lower than diploma			2.52 (1.36 – 4.70)	0.003
Diploma	*		1.64 (0.85 – 3.14)	0.13
Academic education (Ref)			1	

Ref: Reference category, LBW: low birth weight, HBW: high birth weight

* Variable not determined as LBW or HBW in multinomial regression models

The current study demonstrated that female newborns had a higher LBW rate compared to males, as also reported in other studies (11, 15). However, Silva et al. could not find a significant association between birth weight and fetal sex (16). On the other hand, in our study the rate of HBW in male sex was found to be higher than in females.

The present study demonstrated that mothers who were less educated had more HBW infants. The protective effect of education was seen in academic level compared to diploma and lower levels. The same impact of maternal education on birth weight was reported by other researches, although they showed this relationship for LBW incidence (17-20). The socioeconomic status associated with educational level may affect health care knowledge (21).

We found that the first born children were significantly more LBW compared to the third ones and higher. Likewise, Acevedo-Garcia et al. and Golestan et al. reported the same results (10, 18). The younger maternal age may be the underlying cause of LBW in first born children. As it has recently been proposed, the maternal age lower than 18 years could be a risk factor of LBW (16, 22, 23). Higher maternal age and small birth interval trigger the risk of HBW. Besides, incremental maternal obesity and lower care services in the next pregnancies may enhance this phenomenon.

Another determinant of birth weight was found to be family size (>4 members). Families who were more crowded were more prone to have both LBW and HBW infants. Furthermore, the risks of LBW and HBW were lower in families whose head was father or mother. The crowded families and those who had an irresponsible head were at an inappropriate social status. The supportive role of family in the health care during pregnancy and psychological supports can positively affect the birth outcome. In this line, Rizvi et al. revealed that better housing condition can lower the risk of LBW (19). Moreover, the crowded families, as a psychosocial stress, increase the risk of LBW among live births (22).

In addition, other studies reported that the accessibility of public health services and care management programs can improve the birth outcomes (23, 24).

In the present study, family income, as another socioeconomic variable, was not found to be significantly associated with LBW (P=0.07); however, it was inversely associated with LBW in a remarkable level. Likewise, Morgen et al. reported lower impact of income and occupation relative to maternal education (20).

The limitation of the present study was lack of assessment of some maternal characteristics, their disease history, anthropometrical indices, and age. Also, we did not categorize LBW in preterm infants and infants in small gestational age group.

LBW was identified at a relatively high level. Some demographic and social factors determined birth weight outcomes. Children were more vulnerable to LBW and HBW in more crowded families and in families in which the head of family was not father or mother. Also, first born children and lower education level of mothers were determined as underlying factors of LBW and HBW, respectively. Thereby, improving the quality of life especially at lower social level may effectively prevent the adverse birth weight outcomes.

Conflict of interest

Authors declare no conflict of interests.

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