Original Article

The Association between Birth Weight and Height and Some Maternal Risk Factors

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Abstract

Background and purpose: Since a large proportion of fetal mortality is associated with low birth weight (LBW) and regarding that fetal development is a vulnerable process influenced by maternal risk factors, this study examined some maternal risk factors associated with LBW infants.

Materials and Methods: This cross-sectional study was conducted based on the medical files of 300 infants born in hemoglobin and hematocrit levels Sajjadieh Arjomand Health Care Center, Kerman County, Iran. The required data were registered in a predeveloped checklist. The data were analyzed by SPSS Software using descriptive and inferential statistics.

Results: The mean weight of the infants was 3.22 ± 0.36 kg, the mean height 48.4 ± 0.3 cm, and the mean head circumference 35.00 ± 1.74 cm. The results indicated a significant association of the parity, maternal weight gain, pregnancy-induced hypertension, type of pregnancy (planned or unplanned), and abortion history with the birth weight ($P < 0.050$).

Conclusion: Regarding the findings of this study, health centers should study the risk factors before and during pregnancy more seriously. Many risks for LBW can be identified before pregnancy occurs.

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***Key words*:** Risk factors, Weight, Height

1. Introduction

Weight, height, and head circumference are considered as the determinants of the infants' physical and intellectual development and reliable indices of the fetal development (1). The birth weight of < 2500 g is one of the serious health problems of the infants in the world today (2). Low birth weight (LBW) (neonate weighing < 2500 g) is a multifactorial phenomenon (3). Many maternal and fetal factors are found significantly to be associated with the LBW (4).

LBW, regardless of gestational age, is a multifaceted public health problem with significant individual and societal impact worldwide, especially in developing countries (5). Globally, an estimated 20 million LBW infants are born each year, with over 18 million of these in developing countries LBW infants are at a disproportionately higher risk of mortality, morbidity, poor growth, and impaired psychomotor and cognitive development (6,7). These LBW infants are also disadvantaged when they become adults as they are more susceptible to type 2 diabetes, hypertension, and coronary heart disease.

LBW is not only related to basic maternal characteristics during pre-pregnancy, but also related to potential risk factors during pregnancy including maternal age, educational attainment, lifestyle, health status and diseases (6), of which maternal age, educational attainment and marital status are more closely associated with LBW. In addition, most current studies of LBW risk factors have focused on environmental, psychosocial, behavioral, and medical factors (8-10). Many medical factors and basic diseases are also reported to be related to LBW, including diabetes, preeclampsia, and oligohydramnios (11).

Across the world, neonatal mortality is 20 times more likely for LBW babies compared to heavier babies (≤ 2.5 kg) (12).

In Iran, 289 children under 5 years of age die each day. 48% of these mortalities occur within the first month of life and the majority of the deceased infants have a birth weight of < 2500 g (13). Determining the indices of height, weight, and head circumference (anthropometric indices) is one of the most common and easiest methods of assessing development to examine the infants' health of a community (14). If the above indices are compared with benchmark indices, their measurement, in addition to determining the physical status, can be used in monitoring the infants' development (15).

Prenatal development is a part of an evolutionary, inherited process which is influenced by family, socioeconomic, racial, and environmental factors (16). The infant survival is directly correlated with gestational age, birth weight, and a series of risk factors. These risk factors include age, occupation, education, parity, duration of pregnancy, and maternal illnesses and complications during pregnancy (17).

The reduction in LBW of infants is also an important objective of millennium development goal 4, which seeks to reduce child mortality by two-thirds by 2015 (18).

To more precisely determine the maternal risk factors associated with LBW, we examined the relationship between birth weight and maternal characteristics such as age, occupation, education, parity, duration of pregnancy, maternal weight gain, pregnancy-induced hypertension, gestational diabetes, type of pregnancy (planned or unplanned), hemoglobin and hematocrit levels, history of abortion and stillbirth.

2. Materials and Methods

In this cross-sectional study 3000 infants was born from 1999 to 2009 who was covered by Sajjadieh Arjomand Health Care Center, Kerman County, Iran, were chosen via the census. This center covers a large population and is referred to from different parts of the city. In addition, this center has been selected as an exemplary center thanks to complete

registration of the data in the medical files. Since the data in the medical files of the infants born from 1999 to 2009 were required for this study, the work was conducted only in this center. The inclusion criterion was being born from 1999 to 2009 and the inclusion criteria were incomplete registration of the data in the infants' medical files and multiple birth.

The required data were gathered with using a predeveloped checklist comprising the items on maternal factors such as age, occupation, education, parity, duration of pregnancy, maternal weight gain, pregnancy-induced hypertension, gestational diabetes, type of pregnancy (planned or unplanned), hemoglobin and hematocrit levels, history of abortion and still birth and the factors relevant to the infants (birth height and birth height). This study was not an ethical consideration because not mentioned on the name of people. The data were analyzed by appropriate statistical tests such as Chi-square and Pearson correlation. The analysis was done using SPSS Software (version 19, SPSS Inc., Chicago, IL, USA). Significance level was defined as $P < 0.050$.

3. Results

Totally, 3000 infants were studied for birth weight. The mean weight was 3.22 ± 0.36 (1.5-4.7) kg. About 18% of the infants had a birth weight of 2500 g or less. The mean height was 48.4 ± 0.3 (40-51) cm. About 15% of the infants had a birth height less than the standard birth height. The mean head circumference of the infants was 35.00 ± 1.74 (28-39) cm.

About 15% of the infants had a head circumference of <33 cm. The most frequent educational level in the mothers was secondary (43.2%) and the least was illiteracy and elementary (8.4%). 18% of mothers had guidance education and 27.2% had an academic education.

The results of the analysis are presented in table 1. As can be observed: there was no significant association between the mothers' education and birth weight and height ($P > 0.050$). On the association between the mothers' age and birth weight and height, 24- to 28-year-old mothers comprised the highest number of mothers (40%) and under 18-year-old mothers did the lowest (6%). Based on chi-square test, no significant association was observed between the mothers' age and birth weight. There was a significant association between the mothers' age and birth height ($P = 0.020$).

Table 1. The association between birth weight and height and some maternal risk factors

Variables	Birth weight	Birth height
	Results	Results
Age of mother	$\chi^2 = 2.68$ df = 1 P = 0.080	$\chi^2 = 4.48$ df = 1 P = 0.020
Occupation of mother	$\chi^2 = 0.005$ df = 1 P = 0.090	$\chi^2 = 0.008$ df = 1 P = 0.080
Mother's education	$\chi^2 = 0.001$ df = 1 P = 0.920	$\chi^2 = 0.005$ df = 1 P = 0.940
Parity	$\chi^2 = 3.78$ df = 1 P = 0.040	$\chi^2 = 3.88$ df = 1 P = 0.046
Duration of pregnancy	$\chi^2 = 10.4$ df = 1 P = 0.001	$\chi^2 = 8.18$ df = 1 P = 0.020
Maternal weight gain	$\chi^2 = 0.008$ df = 1 P = 0.001	$\chi^2 = 0.009$ df = 1 P = 0.002
Pregnancy induced hypertension	$\chi^2 = 3.28$ df = 1 P = 0.040	$\chi^2 = 4.18$ df = 1 P = 0.040
Gestational diabetes	$\chi^2 = 0.09$ df = 1 P = 0.800	$\chi^2 = 0.08$ df = 1 P = 0.900
Type of pregnancy	$\chi^2 = 3.08$ df = 1 P = 0.030	$\chi^2 = 4.08$ df = 1 P = 0.030
Hemoglobin and hematocrit levels	$\chi^2 = 2.08$ df = 1 P = 0.110	$\chi^2 = 3.08$ df = 1 P = 0.130
History of abortion	$\chi^2 = 2.08$ df = 1 P = 0.030	$\chi^2 = 3.08$ df = 1 P = 0.040
Still birth	$\chi^2 = 1.08$ df = 1 P = 0.060	$\chi^2 = 2.08$ df = 1 P = 0.070

On the parity and birth weight and height, 50% of the infants were the first child and 5% were the seventh child. chi-square indicated a significant association between the parity and birth weight (P = 0.040). As the parity increased, the birth weight and height decreased. Furthermore, a significant association was observed between the parity and birth height (P < 0.050).

No significant association was observed between hemoglobin and hematocrit levels at the onset of pregnancy and birth weight. The duration of pregnancy was 37-42 weeks in 95% of the studied mothers and no significant association was noted between the duration of pregnancy and birth weight and height. In this study, a significant association was observed between the history of abortion and birth weight and height (P < 0.050), meaning that have history of abortion caused decrease birth weight, but the history of stillbirth was not associated with birth weight and height (P > 0.050). A significant association was observed between preeclampsia and birth weight and height (P = 0.040), meaning that the preeclampsia caused decreased birth weight. However, no significant association was observed between the pregnant mother's diabetes and birth weight and height (P > 0.050). A significant association was noted between maternal weight gain and birth weight and height (P < 0.050) meaning that increased maternal weight gain increased birth weight.

4. Discussion

As observed in this study, there was a significant association between birth weight and height and some maternal risk factors. In this study, the association between the infants' height and mothers' age was significant. In other words, the likelihood of giving birth to the infants with the height of < 48 cm increased for the mothers under 18 years old and over 35 (P = 0.020). However, the association of another determinant of development, i.e., the infants' weight, with mothers' age was not significant by chi-square test. However, this association was reported significant in Gol Alipour et al. study (15).

In Tootoonchi's study in Tehran, the mothers' age of under 20 years old and over 35 years old was the risk factor for LBW (19). Based on Malik et al. findings, the rate of LBW infants was higher in the women over 35 years old than in those over 18 years (20). No significant association was observed between the mothers' occupation and education and birth weight and height, which has been confirmed by other studies (21,22). In the present study, it has been well demonstrated that if the parity increases, the likelihood of declined fetal development will increase (P = 0.030), confirmed by Aldous and Edmonson (21) and Klufio etal.(22). However, in Trotnow et al. study no significant association between the parity and decreased birth weight (23). Surprisingly, the association of hemoglobin and hematocrit with the fetal development was not significant in the present study despite a scientific relation between these two variables and fetal development. The reason for this finding could be controlling these variables during pregnancy as ferrous sulfate, and folic acid are regularly prescribed during pregnancy as a routine practice in health care centers. Several studies indicated that the satisfactory prenatal health care program could affect the fetal health remarkably (22,23). However, a significant association of hemoglobin and hematocrit with maternal blood pressure as well as that of smoking with birth weight was reported by some studies (22,24). In this study, no significant association was observed between the duration of pregnancy and birth weight (P = 0.200). However, this association was significant in Sam et al. (25). In this study, the history of abortion, pregnancy type (planned or unplanned), and the history of preeclampsia were significantly associated

with birth weight and height ($P < 0.050$), but diabetes and stillbirth were not significantly associated with birth weight and height ($P > 0.050$).

Regarding the present study's findings and other studies' (21,26), educational health care centers should study the risk factors during pregnancy more seriously. We hope that further attention be paid to general and regional risk factors that influence the fetal development by these centers.

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