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# Iron Supplementation During Pregnancy and Birth Weight in Iran: A Retrospective Study

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**Abstract:** This study was designed to determine the relationship between Maternal Iron Supplement (MIS) and Birth Weight (BW) in a rural area in North of Iran. A sample size of 2881 children was chosen by cluster and random sampling from 20 villages. MIS status, BW and demographic characteristics were recorded. Data was analyzed by SPSS 15 software and statistical significance was defined as $p<0.05$. Mean and SD of BW is 3177.2±522.6 g. Taking iron supplement by mothers with low birth weight, normal birth weight and high birth weight were shown 96.1, 94.9 and 87.1%, respectively. MIS increased birth weight only in younger mother, <5 family number and <3rd birth order but there is no statistical significant. Logistic regression showed that younger mother ($p = 0.014$, OR = 2.181), Low income ($p = 0.001$, OR = 1.601) and primary birth order ($p = 0.001$, OR = 1.738) are risk factor for low birth weight. MIS only in younger mother, low economic status and primary birth order led to improve birth weight. Maternal age, economic status, birth order and ethnicity are risk factors for low birth weight.

**Key words:** Iron supplementation, birth weight, pregnancy

## INTRODUCTION

Iron deficiency were considered as the first nutritional disorder in the world (CDC, 1998). Veghari's (2007) study in North of Iran showed that the prevalence of anemia is high and iron deficiency is the most agent of anemia in this area and anemia were shown 24.2% among pregnant women. The prevalence of iron deficiency among three ethnic groups that living in North of Iran, the same as Fars-native, Turkman and Sistani was 33.6, 47.6 and 26.2%, respectively (Veghari *et al*., 2007). World Health Organization (2001) has been estimated that one third of the population of 5.5 billion people worldwide are anemic: including 40% of children between 0-12 years old, 51% of pregnant women, 35% of all women and 30% of men.

Iron deficiency anemia is influenced with low dietary iron, malabsorption of iron or excessive blood losses (Tapiero *et al*., 2001). In comparison with the other groups, iron deficiency anemia is more in childbearing age, pregnant women, teenage girls, low BW infants and toddlers (CDC, 1998).

The annually numbers of low BW babies in world are 250 millions that 90% of them are living in developing countries (Child Health Research Project, 1999).

High calorie diet lead to High Birth Weight (HBW) (Ceesay *et al*., 1997) but anemia is a risk factor for preterm delivery and can cause Low Birth Weight (LBW) (Scholl *et al*., 1992; Allen, 2000).

Despite, the role of high-quality diet on birth size have been known well, but the effects of trace elements supplementation on BW have not been studied as well. An overview of five controlled trials showed that the folic acid declined LBW rate up to 40%, although these trials were small and not well considered (De Onis *et al*., 1988). Trials in Bangladesh (Osenderp *et al*., 2000) and Peru (Caulfield *et al*., 1999) have an aversion to others studies about increasing effect of zinc supplementation during pregnancy on birth weight. A randomized placebo controlled trial in Niger (Preziosi *et al*., 1997) showed no perfection in after iron supplementation during pregnancy, although fetal stature was improved. The low benefits of iron supplementation in pregnant women have been studied in several trials (Rasmussen, 2001; Scholl, 2005).

Gorgan, is the capital city of Golestan Province in the North of Iran and according to the report of Statistical Center of Iran (2006), it has a population of more than 300,000 and is one of the agricultural region of the country and based on above report the villages population in this town is 56.1% as whole, which are mainly engaged in agricultural occupation. Different ethnic groups are living in this region. The main ethnic groups are: Fars (native), Turkman, Sistani and Bluch. Sistani and Turkman ethnic groups are mainly the residents of the villages. Due to the restriction in executing epidemiological projects, there has not been any study on the iron supplement intake in the villages of this area, up till now; therefore it was

necessary to design a research project about it. The aims of study were determine of iron supplementation status during pregnancy, the relationship between iron supplementation and BW and socio-economic factors effect on it. Based on Iranian Health Policy iron supplement were recommended during pregnancy after the first trimesters.

## MATERIALS AND METHODS

This is a cross-sectional and retrospective study that carried out on the 2881 cases from 20 villages in North of Iran. Subjects were chosen by component type sampling (cluster and simple sampling). The data were recorded by 20 trained interviewers using a questionnaire. We recorded BW, iron supplementation status during pregnancy, socio-economic status, maternal age, maternal BMI, family number, birth order and ethnicity. Data was analyzed by SPSS 15 software and statistical significance was defined as $p<0.05$. Analysis of variance (ANOVA) was used to compare group means. Logistic regression model was applied to evaluate variables that were associated with the likelihood of being LBW.

Economic status was categorized based on possession of 10 consumer items considered necessary for modern-day life, such as telephone, running water, gas pipeline, personal house, color television, computer, video, private car, cooler, according to this list, the economic status of sample population in this study were as: low ≥3, moderate = 4-6 and good = 7-10. In this study, the ethnicity was defined as follows:

- **Fars ethnic group (native):** People resided in this region for long time and they are considered to be the native resident of this region
- **Sistani ethnic group:** People immigrated to this region from Sistan and Bluchestan Province during past decades
- **Turkman ethnic group:** This group do not have family relation with other ethnic group, therefore can be considered as an independent race and are residing in a particular rural area

BMI was calculated as weight (kg/height $m^2$). Birth weight classified as low birth weight (<2500 g), normal birth weight (2500 to 4000 g) and high birth weight (<4000 g). Educational level categorized three groups:

- Illiterate
- 1-12 years schooling
- Beyond high school (academic education)

Iron supplement has been used during pregnancy is defined as:

- **Non:** Lack of iron supplement intake
- **Routinely:** Iron supplement is used regularly
- **Sometimes:** Iron supplement is used time to time

## RESULTS

Mean and SD of BW is 3177.2±522.6 g and the prevalence of LBW, NBW and HBW is 9.8, 85.1 and 5.1%, respectively. Using of iron supplement among 68.7% of pregnant women is routine and 25.9% of them is irregular. Of 5.4% women didn't have iron supplement during pregnancy. Iron supplementary among pregnant mothers whose children are LBW is lower than pregnant mother with NBW and HBW children. Also, iron supplementary among illiterate women is less than educated women (Table 1).

Using iron supplementary by younger mothers (under 26 years old) uptakes BW (101.5 g). Iron supplementary among thinner mothers (BMI<18.5) were increased BW but it is not the same effect among overweight mothers. Iron supplementary were increased BW among under 5 family number, under third birth order, thin mothers and younger mother but in comparison with other groups the statistical differences is not significant.

BW is significantly differences among maternal BMI levels, three ethnic groups, three economic status, three maternal age groups, three family number groups, three levels of education and three birth order groups ($p = 0.001$) (Table 2).

Results of logistic regression analysis showed that the risk of LBW was higher in the younger mother (under 18 years old) ($p = 0.001$, 95% CI, OR = 2.750), Low economic status ($p = 0.001$, 95% CI, OR = 1.835), primary birth order <3 ($p = 0.001$, 95% CI, OR = 1.877) and Sistanish ethnic group ($p = 0.001$, 95% CI, OR = 1.691) (Table 3).

Table 1: Characteristic of subjects

| Criteria | N (%) | BW (g) (Mean±SD) | ANOVA test (p-value) |
|---|---|---|---|
| **Birth weight*** | | | |
| LBW | 281(9.8) | 2229.7±315.5 | 0.010 |
| NBW | 2453(85.1) | 3231.7±368.1 | |
| HBW | 147(5.1) | 4322.8±217.9 | |
| **Iron supplementation intake** | | | |
| No | 145(5.4) | 3246.2±519.5 | 0.264 |
| Routine | 1956(68.7) | 3173.3±515.2 | |
| Sometimes | 730(25.9) | 3173.9±542.2 | |

Miss: 18, BW: Birth Weight, LBW: Low Birth Weight, NBW: Normal Birth Weigh, HBW: High Birth Weight. *Mean of birth weight is statistical significant differences among three groups

Table 2: Comparison of measured variables, adjusted for iron supplement intake

| Criteria | Iron intake | No. (%) | Birth weight (g) (Mean±SD) | t-test (p-value) | Total (Mean±SD) | ANOVA test (p-value) |
|---|---|---|---|---|---|---|
| **Ethnic groups** | | | | | | |
| Fars (native) | No | 27(4.4) | 3250.7±417.6 | 0.231 | 3199.9±487.0 | 0.001 |
| | Yes | 587(95.6)** | 3197.5±490.1 | | | |
| Turkman | No | 68(6.6) | 3388.2±461.1 | 0.317 | 3324.4±543.2 | |
| | Yes | 968(95.4)** | 3319.9±548.4** | | | |
| Sistani | No | 4(0.4) | 3038.1±593.6 | 0.947 | 3033.6±482.0 | |
| | Yes | 1098(99.6) | 3033.4±476.9 | | | |
| Others | No | 2(5.7) | 3350.0±212.1 | 0.528 | 3118.9±522.8 | |
| | Yes | 33(94.3)** | 3104.9±534.2** | | | |
| **Economic status** | | | | | | |
| Good | No | 11(6.4) | 3372.7±568.0 | 0.439 | 3322.7±496.5 | 0.001 |
| | Yes | 161(95.6) | 3319.3±493.1 | | | |
| Moderate | No | 78(4.8) | 3287.6±501.5 | 0.273 | 3225.7±512.3 | |
| | Yes | 1564(95.2) | 3222.4±512.7 | | | |
| Poor | No | 54(5.1) | 3147.4±534.8 | 0.731 | 3093.2±526.6 | |
| | Yes | 1016(94.9) | 3090.4±526.3 | | | |
| **Maternal age (year)** | | | | | | |
| ≤25 | No | 24(2.2) | 2980.8±635.5 | 0.334 | 3079.8±518.4 | 0.001 |
| | Yes* | 1068(97.8) | 3082.3±516.8 | | | |
| 26-35 | No | 70(5.1) | 3255.1±482.9 | 0.580 | 3222.9±507.0 | |
| | Yes | 1313(94.9) | 3220.5±508.4 | | | |
| 36-60 | No | 48(13.6) | 3363.5±480.3 | 0.369 | 3301.5±543.5 | |
| | Yes | 304(86.4) | 3291.7±552.9 | | | |
| **Family No.** | | | | | | |
| 4≥ | No | 55(3.6) | 3032.3±500.6 | 0.307 | 3101.3±510.0 | 0.001 |
| | Yes* | 1489(97.4) | 3103.9±510.4 | | | |
| 5-8 | No | 78(6.7) | 3373.9±480.4 | 0.059 | 3268.2±512.4 | |
| | Yes | 1048(93.3) | 3260.4±514.1 | | | |
| 9≤ | No | 11(7.1) | 3318.1±519.7 | 0.782 | 3270.7±587.6 | |
| | Yes | 145(92.9) | 3267.2±593.9 | | | |
| **Maternal education** | | | | | | |
| Illiterate | No | 59(8.9) | 3370.3±469.8 | 0.017 | 3219.43±508.51 | 0.04 |
| | Yes | 606(91.1) | 3204.7±510.1 | | | |
| 1-12 schooling | No | 75(3.8) | 3138.0±520.7 | 0.699 | 3161.20±529.21 | |
| | Yes* | 1899(96.2) | 3162.1±529.7 | | | |
| Academic educated | No | 9(4.9) | 3216.7±666.2 | 0.837 | 3184.81±474.29 | |
| | Yes | 176(95.1) | 3183.2±464.9 | | | |
| **Parity** | | | | | | |
| ≤2 | No | 68(3.4) | 3061.0±505.9 | 0.342 | 3119.3±515.4 | 0.001 |
| | Yes* | 1823(96.6) | 3121.4±515.7 | | | |
| 3-5 | No | 54(6.9) | 3443.5±472.6 | 0.028 | 3298.7±502.3 | |
| | Yes | 725(93.1) | 3287.9±503.1 | | | |
| ≥6 | No | 21(14.1) | 3342.8±461.6 | 0.682 | 3294.6±579.7 | |
| | Yes | 128(85.9) | 3286.7±598.1 | | | |

*Iron supplementation lead to intrauterine weight growth increasing but there is not statistical signification. **Statistical significant differentiation exists among underlying variables

Table 3: Crude and adjusted odds ratios of LBW among neonatal children (CI 95%)

| | Crude | | Adjusted | |
|---|---|---|---|---|
| Criteria | Odds ratio | p-value | Odds ratio | p-value |
| Ethnic group (Sistani)* | 1.691(1.321-.164) | 0.001 | 1.484(1.123-1.961) | 0.006 |
| Economic status (Low)* | 1.835(1.427-2.359) | 0.001 | 1.601(1.210-2.118) | 0.001 |
| Maternal age (<18 year)*,** | 2.750(1.555-4.862) | 0.001 | 2.181(1.174-4.051) | 0.014 |
| Family No. <5 | 0.889(0.529-1.494) | 0.657 | 0.806(0.452-1.437) | 0.465 |
| Maternal education (Illiteracy) | 0.849(0.629-1.145) | 0.283 | 0.941(0.673-1.315) | 0.720 |
| Birth order <3* | 1.877(1.397-2.522) | 0.001 | 1.738(1.254-2.410) | 0.001 |
| Iron supplementation (No) | 0.693(0.370-1.295) | 0.250 | 0.947(0.680-1.320) | 0.748 |

CI: Confidential Interval. *There is statistical signification, **Odds ratio is higher than other factors

The adjusted odds ratios showed that maternal age >18 years (p = 0.014, 95% CI, OR = 2.181), low economic status (p = 0.001, 95% CI, OR = 1.601) and primary birth order <3 (p = 0.001, 95% CI, OR = 1.738) are significantly related to LBW (Table 3).

## DISCUSSION

In this study, the prevalence of LBW is 9.8%. Prevalence of LBW was reported in whole of Iran 8% by Naghvi (2006). Prevalence of LBW was reported in

other studies 10.5% in Zimbabwe (Friis *et al*., 2004) 6.6% in Syria (Wannous and Arous, 2001) 6.2% in Taiwan (Wang and Chou, 2001) and 5.7% in Spain (Valero De Bernabe *et al*., 2004). In comparison with studies cited above, we can conclude that the prevalence of LBW in this area is higher than similar area.

In present study, 94.6% of pregnant women toke iron supplement. Based on Safavi's *et al*. (2006) study, 84.7% of Iranian women have taken iron supplement during pregnancy (70.4% routinely and 14.3% occasionally) and 15.3% of them did not take it. In comparison with mentioned study, iron supplementary in north of Iran is 10% more than whole of Iran. and lack of iron supplementary in this area is lower than other areas in Iran. Another study in Iran (National Nutrition and Food Technology Research Institute, 2003) reported that approximately 70% of Iranian families are at risk of iron deficiency.

Iranian health policy recommended all of pregnant women should intake iron supplement after the first trimester. This nutritional strategy is monitored in rural areas by governor health workers but it is not supervised in urban as well as in rural areas.

Birth Weight (BW) is influenced by several factors, including: maternal BMI (Nahar *et al*., 1998; Lawoyin, 1993; Ramakrishnan *et al*., 2005 ) socio-economic factors (Valero De Bernabe *et al*., 2004; Lawoyin, 1993; Starfield *et al*., 1991; Siega-Riz *et al*., 2006; Cogswell *et al*., 2003), maternal education level (Lawoyin, 1993; Karim and Mascie-Taylor, 1997), birth order (Feleke and Enquoselassie, 1999; Zahed Pasha *et al*., 2004). Maruoka *et al*. (1998) maternal age (Feleke and Enquoselassie, 1999), family number (Lawoyin, 1993) and ethnicity (Fang *et al*., 1999; Hessol and Fuentes-Afflick, 2000; Collins and Shay, 1994). In present study, these factors significantly change the mean of BW. Mentioned factors can influence in food intake, trace elements as well as iron in pregnant women. Therefore, besides iron, other nutritional factors improve BW in North of Iran.

There is a great need for trace elements in gestational period; therefore food supplementary is necessary for prevention of nutritional disorders in this period. In that way, iron, folic acid and zinc were recommended more than other trace elements.

In contrary to the other studies (Katz *et al*., 2006; Siega-Riz *et al*., 2006; Ceesay *et al*., 1997) present study did not show iron supplementation as a stimulator factor on birth weight. All factors that are related to BW were not considered in this study; therefore we can not exactly determine reasons of this matter in iron supplementation group. With regard to increasing of BW in high educated level group and overweight mothers that had taken more iron supplement, we can conclude that besides iron, intake of other nutrients in this group is high. Therefore, the high quality diet more than only iron supplementary improved birth weight.

The low benefits of iron supplementation in pregnant women have been studied in several trials (Preziosi *et al*., 1997; Rasmussen, 2001; Scholl, 2005; Casanueva and Viteri, 2003). Another trial (Friis *et al*., 2004) showed a slight beneficial effect of it. One trial in Mexico did not report a greater advantage over iron-only supplementation ( Ramakrishnan *et al*., 2003).

Two trials were carried out in developing countries and comparing multiple micronutrient supplementation with folic acid plus iron showed a decreased LBW in women with anemia only (Kaestel *et al*., 2005) and an improve in BW (Osrin *et al*., 2005). Haider and Bhutta (2006) reported that multiple micronutrient supplementary is not better than folic acid plus iron supplementary.

Vitamin A or α-carotene supplementary during pregnancy failed to influence either infant mortality rate (Katz *et al*., 2000) or neonatal weight (Dreyfuss *et al*., 2007) but it is associated with a 44% decline in maternal mortality related with pregnancy (West *et al*., 1999).

Summery, in this study iron supplementation during pregnancy does not lead to intrauterine growth increasing among all of mothers but among susceptible mothers have a protective roll for LBW incidence. This finding does not refuse of other beneficial roll of iron supplement during pregnancy. Although the present data does not allow us to examine the mechanisms underlying the above variations, our analysis suggests hypotheses for future research in relation to the role of other factors to BW besides iron supplementation.

We did not have any information about medical supervision status and dosing of iron supplement and we did not determine all of factors related to BW. They are the limitations of this study.

Briefly, present study showed that maternal age, economic status, birth order and ethnicity are risk factors for LBW and iron supplementary during pregnancy can not improve birth weight, alone. Needing of iron supplement during pregnancy for all of pregnant women in this area should evaluate in further studies.

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