ORIGINAL ARTICLE

EFFECT OF MATERNAL FOLIC ACID/IRON INTAKE ON THE WEIGHT OF NEWBORNS IN OBSTETRIC WARD OF TERTIARY CARE HOSPITALS OF PUNJAB

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ABSTRACT

A cross-sectional study has been designed to determine the influence of maternal folic acid and iron intake during pregnancy on newborns birth weight. The study was conducted from April–May 2014 at CMH Lahore Medical College and Institute of Dentistry, Services Hospital, Sir Ganga Ram, Lady Willingdon, Akhtar Saeed Trust and Mansoorah Hospitals in Lahore while Nishtar Hospital in Multan and Amina Hospital in Sialkot. About 300 females from the hospitals were selected by convenience sampling technique. A verbal consent was obtained before collecting data and the questionnaires were filled by the students. Majority of the 300 females (68.1%) who have been questioned during the study were between 22–30 years of age (selected range was 17–44 years) while the mean age was 28.5 years. Of the total studied population, 72% of the females took folic acid, 79.7% took iron and other multivitamins and 87% consumed leafy vegetables as a part of the routine diet. It was also noted that the average age at first pregnancy was between 20–24 years for 49% of the studied females. However, a gap of two years between successive pregnancies was found in only 33.3% cases. On the other hand, only 19.7% were graduates while 21.3% were illiterate. The study also included the correlation of household income with folic acid and iron intake. About 53.3% of the females with an income of 16,000 PKR or higher, reported better intake (folic acid 81.8%; iron 87.5%) than those with income of 15000 PKR or lower (46.7%) (folic acid ~61%; iron ~71 %). The normal birth weight (2.6–3.4 kg) babies were born to 79.4% of women who consumed folic acid and iron, while low birth weight newborns were 10% higher in mothers who have not taken folic acid or iron in pregnancy.

Keywords: Birth weight, folic acid, iron, maternal education, pregnancy.

1. INTRODUCTION

During pregnancy, the maternal physiology changes in order to accommodate the increased demands of the fetus. There is an increased metabolic load on the maternal body which needs to be catered in order to ensure the healthy development and eventual birth of the baby.

The extra dietary needs are met by exogenous sources such as multivitamins, folic acid, and iron, which are usually prescribed during pregnancy. Folate is a naturally occurring form of the vitamin, found in food, while folic acid is synthetically produced, and is used in fortified foods and supplements[1]. It itself is not active but its conversion to tetrahydrofolate and dihydrofolate in the liver makes it vital to the biosynthetic system of the body. Folate naturally occurs in a wide variety of food, particularly dark green leafy vegetables, fruits and fruit juices, nuts, beans, dairy products, meat, eggs, seafood, and grains. The daily requirement of folic acid is about 400 mg which may increase to 600 mg in pregnancy depending on patient's requirement/condition. Folic acid intake is of paramount importance in order to

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prevent congenital malformations like neural tube defects. The neural tube forms in the third and fourth weeks of pregnancy and grows into the brain and spinal cord. When the tube does not close properly, this is called a neural tube defect (NTD)[2]. NTDs include conditions like encephalocele, anencephaly, and encephalopathy. It has also been noted that the use of folic acid reduces the risk of fetal cardiac defects, maternal placental abruption, and preeclampsia. The deficiency of folic acid and iron would result in Iron Deficiency Anemia (IDA). It is estimated that 4% of non-pregnant women aged 20–49 years in the United States have IDA[3]. The prevalence of IDA among pregnant women has been shown to be highly correlated with gestational age[4,5]. Rates of IDA among low-income and minority women – a population at increased risk of IDA – were 1.8%, 8.2% and 27.4% in the first, second and third trimester, respectively. It is estimated that more than 40% of pregnant women worldwide are anemic[6]. At least half of this anemia burden is assumed to be due to iron deficiency. According to the study conducted by WHO in 2001, 39.1% of pregnant woman in Pakistan had a hemoglobin level below 11.0 g/dl. In fact, the numbers are staggering (2 billion people), over 30% of the world's population is anemic[6]. In developing countries, every second pregnant woman and about 40% of preschool children are estimated to be anemic. To support countries in combating anemia, WHO has developed guidelines on prevention and control of iron deficiency and anemia together with a manual for assessing the magnitude of the problem and monitoring interventions[6].

Daily oral iron and folic acid supplementation are recommended as part of the antenatal care to reduce the risk of low birth weight, maternal anemia, and iron deficiency[7]. In a developing country, such as Pakistan, diet deficiencies like iron and vitamin D deficiency are prevalent due to cultural and dietary factors. Most of the population of Pakistan belongs to a low socioeconomic class that cannot afford to eat meat, fruit, and vegetables to meet their nutritional requirements. An average Pakistani staple diet contains rice, potatoes, wheat (chapatti), which are far from being the source of iron, contain inhibitors of iron absorption, such as calcium. As a result, most women have low iron levels to start with, which decrease even more during pregnancy. During pregnancy, blood volume and hemoglobin requirements increases and the growing fetus also need more nutrients. RDA (recommended daily allowance) increases substantially during pregnancy and lactation for several nutrients[8]. A non-pregnant woman needs 18 mg of iron per day, whereas in a pregnant woman the requirement increases to 30 mg per day. Iron is also absorbed more efficiently during pregnancy. Iron supplements are recommended if diet alone cannot meet this demand. Lack of iron in the diet leads to IDA, which during pregnancy is an important cause of restricted fetal growth leading to low birth weight and preterm delivery and may also cause maternal illness and death[9,10]. Postpartum depression is also more common in women with iron deficiency as it causes tiredness, weakness, and decreased working capacity in the mother. Infants born to mothers with IDA have even more long-term and serious complications; besides low birth weight, they have a higher rate of morbidity and mortality[10,11], extending to chronic disease of adulthood[12]. Even when they survive the first few months of life, they have slow cognitive and social development during childhood, poor academic performance, increased susceptibility to infections[13]. Iron from mother during pregnancy can improve the iron status of a newborn. This was shown recently in Peru in a placebo-controlled trial, in which the iron transfer to infants was significantly increased by intake of 60 mg iron supplements in pregnant women[9]. Use of iron/folate for postpartum women was reported by UNICEF for only four countries; Bangladesh, Pakistan, Oman, Bhutan[9].

Thus there is a great need to assess the effect of maternal folic acid and iron intake on the weight of the newborn, as a child born with low birth weight (<2.5 kg) can have serious health issues both long and short term. This study also assesses how husband's income and socioeconomic status of the mother affected the intake of folic acid and iron.

2. MATERIALS AND METHODS

2.1. Hospitals Involved and Duration of Study

A cross-sectional study was conducted over a period of two months from April–May, 2014 at various hospitals across Lahore, Multan and Sialkot including CMH Lahore Medical College and Institute of Dentistry, Services Hospital Lahore, Sir Ganga Ram Hospital Lahore, Lady Willingdon Hospital Lahore, Akhtar Saeed Trust Hospital Lahore, Mansoorah Hospital Lahore, Nishtar Hospital Multan, and Amina Hospital Sialkot.

2.2. Sample Collection, Size, and Technique

Patients were selected on the basis of inclusion criteria that included married pregnant females of 15–45 years of age coming to the outpatient department of hospitals. Data were prospectively recorded, informed verbal consent was taken from the respondents and confidentiality was assured. A total of 300 patients were selected via non-probability convenience sampling technique.

2.2.1. Inclusion criteria

- Pregnant women who underwent caesarian section or gave birth via spontaneous vaginal delivery at the hospitals of Punjab as mentioned above.
- Women who gave birth in the months of April and May only.

2.2.2. Exclusion criteria

- Women giving birth to a stillborn fetus.
- Women giving birth in months other than the months of April or May.
- Women giving birth at hospitals other than the ones listed.

2.3. Data Collection Procedure

A prior ethical consent was taken from the institutional review board and administrative authorities of the hospitals and also from the patients. A closed-ended questionnaire was developed (Table 1), which was filled out by the students while interviewing patients. Data was assembled and evaluated with SPSS (version 16).

Table 1. Questionnaire

1. Age _____

2. Educational status
   (a) Illiterate (b) Primary (c) Matric (d) Intermediate (e) Graduation or Above

3. Husband's job status
   (a) Government Job (b) Private Job (c) Own Business (d) Army Job

4. Household income
   (a) Less than 5000 (b) 6000–10000 (c) 11000–15000 (d) 16000 or above

5. Age at marriage
   (a) Up to 15 years (b) 16–20 years (c) 21–25 years (d) 26–30 years (e) 31 or above

6. Age at first pregnancy
   (a) 15–19 years (b) 20–24 years (c) 25–29years (d) 30 or above

7. Number of children
   (a) 1 (b) 2 (c) 3 (d) 4 (e) 5 or above

8. The gap between successive pregnancies
(a) 1 (b) 2 (c) 3 (d) 4 (e) 5 or above

9. Any complications during pregnancy
(a) Breathlessness (b) Lethargy (c) Fatigue (d) Postural Hypotension
(e) High Blood Pressure (f) Any other

10. Type of Health facility you visited throughout the pregnancy
(a) LHW House (b) BHU/ RHC/ DHQ (c) Teaching Hospital (d) Private Clinics

11. Routine of folic acid intake in first three months of pregnancy
(a) Yes (b) No

12. The routine of iron and multi-vitamin intake during pregnancy
(a) Yes (b) No

13. Number of times you used to take meal per day
(a) 3 times (b) 2 times (c) Any other routine

14. The routine of taking green leafy vegetables, beans, and fruits
(a) Yes (b) No

15. Duration of pregnancy in weeks
(a) ≤32 (b) 37 (c) ≥37 (d) 40

16. History of smoking, paan, hukka and any other addiction
(a) Yes (b) No

17. Weight of the newborn in kg
(a) ≤2.5 (b) 2.6–3.0 (c) 3.1–3.4 (d) 3.5 or above

18. APGAR score
(a) 0–3 (b) 4–7 (c) 8–10

19. Head circumference in cm
(a) ≤34 (b) ≥34

20. Was baby able to suckle
(a) Just after delivery (b) Within a few hours of delivery (c) Was not able

3. RESULTS

The results indicated that the age of the majority of the females was between 21–25 years when they got married. Only fourteen females were of 15 years and one of 31 years at the time of marriage. In this study, the most dominant age groups were between 20–24 years of age at the first pregnancy accumulating 49.0% of the total sample size and the lowest occurring age group was 30 or above with 3% of the total sample size. The youngest age reported was 17 years and the highest was 44 years. In 33.3% of the cases, there was a gap of two years between the successive pregnancies. In 25.7% of cases, it was their first pregnancy while 103 out of 300 women had two children, and 28 women had 5 and above children.

Education status of the mother was also found to be a vital variable (Table 2). About 21% of the total cases reported were illiterate. Majority of the females in the sample size (24.3%) had passed their matriculation and about 19.7% were graduates or above (Table 2). The use of folic acid and iron was more frequent in these groups along with 12.0% of secondary level educated women.

Table 2. Educational status of the mothers

Status	N (%)
Illiterate	64 (21.3)
Primary	68 (22.7)
Matriculation	73 (24.3)
Intermediate	36 (12.0)
Graduation or above	59 (19.7)
Total	**300 (100)**

A total of 216 (72%) females out of 300 have taken folic acid during the first trimester as directed to them. Whereas 239 (79.7%) females took iron and other multivitamins for the rest of the duration of their pregnancy. A vast majority of females, 261 (87.0%), had a routine of including green leafy vegetables into their diet. For 270 (90%) females there was no history of paan, hukka, smoking or any other addiction while 29 (9.7%) have a history of addiction.

The normal period of gestation was variable due to many factors like maternal hypertension and anemia and was also influenced by age and previous conceptions hence for this study it was divided into four groups. Less than thirty-two weeks accumulated 23 cases, thirty-seven weeks consisted of 108 cases, more than thirty-seven weeks was in case of 134 females and more than forty-weeks was a case with 35 females.

A total of 70 babies (23.3%) had a birth weight of below 2.5 kg, 175 babies (58.3%) had a birth weight between 2.6 to 3 kg and 11 babies (3.7%) had a birth weight between 3.1 to 3.4 kg while 44 babies (14.7%) were reported to have a birth weight of greater than 3.5 kg (Table 3). Of all these cases, 114 infants were able to suckle just after the delivery, while 160 were able to feed within a few hours of delivery and 26 were not able to suckle.

Table 3. Weight of newborns

Weight (Kg)	N (%)
≤2.5	70 (23.3)
2.6–3.0	175 (58.3)
3.1–3.4	11 (3.7)
≥3.5	44 (14.7)
Total	**300 (100)**

Chi-square value (0.002) indicated a statistically significant association between folic acid intake and newborn's birth weight. Nearly three-quarters women (~80%) who had a regular folic acid intake gave birth to babies with normal birth weight (2.6 to 3.4 kg), while some (~20%) had low birth weight babies (Table 4). Those females who did not take folic acid regularly had a higher frequency (~31%) of low birth weight incidence (Table 4).

Table 4. Effect of maternal folic acid intake on birth weight

Birth Weight (Kg)	Folic Acid Taken (n)	Not Taken (n)
≤2.5	44	26
2.5–3.0	127	48
3.1–3.5	5	6
≥3.5	40	4
Total	**216**	**84**

For 131 out of 300 cases, the monthly income was Rs. 16,000 or above and for 5 cases it was Rs. 5,000 or below. This influenced their choice of healthcare and lifestyle since 68% of the females had access to three meals a day and 26.3% to twice a day and 5.7% followed some other routine. As most were housewives, so it was the husband's income which they informed us about. Chi-square value (0.001) indicated a statistically significant correlation between husband's incomes and both folic acid and iron intake (Table 5). The most frequent folic acid and iron intakes of ~61% and ~59%, respectively, was associated with husband's income equal to Rs. 16,000 or above (Table 5). For rest of the categories, it was approximately 39% and 41%, respectively for folic acid and iron (Table 5).

Table 5. Association of husband's income with folic acid and iron/multivitamin intake of the mother

Income Range (PKR/month)	Folic Acid (n)		Iron / Multivitamin (n)	
	Taken	Not Taken	Taken	Not Taken
<5000	5	3	6	2
5000–10000	26	16	25	17
11000–15000	54	36	68	22
≥16000	131	29	140	20
Total	**216**	**84**	**239**	**61**

4. DISCUSSION

It is crucial to supplement folic acid, iron, calcium and other multivitamins as a preconception, antenatal and postnatal care to ensure a healthy pregnancy to both mother and the baby. Iron-folic acid deficiency and their subsequent outcomes form the major preventable issue of pregnancy in our country. Most of the admitted pregnant ladies in the third trimester of pregnancy are diagnosed as 'anemic'. The main cause is being the dietary insufficiencies and noncompliance with the prescriptions of the doctor. The low birth weight of the newborns is also of paramount concern as it may lead to various physical and mental disabilities in later life, compromising the quality of life. For the mother; folic acid reduces the risk of anemia, placental rupture, and preeclampsia. Iron intake corrects anemia, therefore retains the working capacity, and if continued after the birth with multivitamins least deficiencies would occur. This prevent fetal neural tube and cardiac defects, and ensures optimal intrauterine growth and hence birth weight[10-13]. Therefore, it is important to maximize the awareness and promote the use of supplements through counseling in our hospitals to lead a healthy pregnancy.

The main objective of the current study was to investigate the effect of folic acid and iron intake

on the weight of the newborns and to observe the association of other factors like household income with folic acid and iron intake. The study was designed as questionnaires to be filled up by the students after interrogating the pregnant females. The females may have understated or exaggerated their folic acid and iron intake related history and may have had to choose the single best answer in the questions where multiple choices could have been chosen. Several factors like hypertension affecting the quality of pregnancy and newborn weight were included but diabetes mellitus and/or gestational diabetes was not included which leads to macrosomia (large babies). Furthermore, the results obtained cannot be extrapolated to other population group levels that differ demographically from the subjects of this study.

According to some previous studies, iron and folic acid intake have shown a positive effect on birth outcomes[13-15]. Our study also shows that majority of the women (~80%) who took regular folic acid gave birth to babies with normal birth weight and those not taking folic acid regularly had a higher incidence (~31%) of low birth weight. In this study, the correlation between folic acid intake and weight of newborn has been calculated by applying the chi-square test and the results signify that there is a strong association of iron-folic acid intake with newborn's birth weight (Table 4). Supporting this fact are the studies conducted in 2003[14] and 2013[15], signifying that maternal iron and folic acid supplementation is associated with lower risk of low birth weight.

Iron and folic acid supplements intake were also affected by several variables including socioeconomic and educational status (Table 5). According to a study conducted in 2012[16], iron-folic acid intake and mean birth weight are positively correlated with socio-economic background, level of education, maternal age and parity. This study also signifies statistically the correlation between household income and iron-folic acid intake (Table 5).

Dose-response relationship in terms of folic acid intake and chances of low birth weight has previously been revealed in a systematic review[17]. Addition of micronutrients in pregnancy helps in limiting low birth weight[18]. This observation is in accordance with this study. In another study, it was observed that mean birth weight was higher in women who took iron and folic acid than those who did not[19]. In our setup mostly respondents took folic acid in the first trimester and turned up with better birth weight. This is in accordance with the results of some other studies that showed association of iron-folic acid supplementation[8,20-22]. Therefore, it is recommended that iron intake should be initiated early to avoid pre-maturity and low birth weight.

5. CONCLUSION

Outcomes of pregnancy in terms of newborn birth weights were found to be significantly associated ($p = 0.002$) with maternal intake of folic acid and iron supplements. Normal birth weight (2.6 to 3.4 kg) babies were born to ~80% of women who took folic acid, while newborns with low birth weight were ~10% higher in mothers' not taking folic acid or iron in pregnancy. In a nutshell, we need to implement the regular use of supplements during pregnancy and make people aware of its beneficial effects on the mother and infant. It is then that we can reduce the risk of low birth weights or other structural anomalies in newborns and nutritional deficiencies in mothers.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

ETHICAL APPROVAL

Ethical approval was obtained from the institutional review board as well as written consent was obtained from each participant.

REFERENCES

1. Weil A. Vitamin B9 – folate, folic acid, In: Vitamins, Supplements & Herbs, Healthy

Lifestyle Brands, LLC, USA, 2018. Available at: https://www.drweil.com/vitamins-supplements-herbs/vitamins/vitamin-b9-folate/ (Last accessed on March, 2017).

2. Wilson RD. Pre-conception folic acid and multivitamin supplementation for the primary and secondary prevention of neural tube defects and other folic acid-sensitive congenital anomalies. SOGC Clin Prac Guideline. 2015;324:534-549.

3. Morbidity and Mortality Weekly Report (MMWR). Recommendations to Prevent and Control Iron Deficiency in the United States. Centers for Disease Control and Prevention (CDC), Atlanta, USA. Available at: https://www.cdc.gov/mmwr/preview/mmwrhtml/00051880.htm (Last accessed on March 2017).

4. Beard JL. Effectiveness and strategies of iron supplementation during pregnancy. Am J Clin Nutr. 2000;71:1288S-1294S.

5. Scholl TO. Iron status during pregnancy: setting the stage for mother and infant. Am J Clin Nutr. 2005;81:1218S-1222S.

6. World Health Organization (WHO). Daily Iron and Folic Acid Supplementation in Pregnant Women. WHO, Geneva, Switzerland, 2012.

7. Huffman SL, Baker J, Shumann J, Zehner ER. The Case for Promoting Multiple Vitamin/Mineral Supplements for Women of Reproductive Age in Developing Countries. The LINKAGES Project, Academy for Educational Development, Washington DC, USA, 1998.

8. Allen LH. Anemia and iron deficiency: effects on pregnancy outcome. Am J Clin Nutr. 2000;71:1280S-1284S.

9. World Health Organization (WHO). Iron Deficiency Anemia Assessment, Prevention and Control. A Guide for Program Managers, WHO, Geneva, Switzerland, 2001.

10. Baker DJ. Adult consequences of fetal growth restriction. Clin Obstet Gynecol. 2006;49: 270-283.

11. Mclntire DD, Bloom SL, Casey BM, Leveno KJ. Birth weight in relation to morbidity and mortality among newborn infants. N Engl J Med.1999;340:1234-1238.

12. National Institutes of Health (NIH). Iron – Fact Sheet for Consumers, US Department of Health and Human Services, 2016. Available at: https://ods.od.nih.gov/factsheets/Iron-Consumer/ (Last accessed on March 2017).

13. Abu-Saad K, Fraser D. Maternal nutrition and birth outcomes. Epidemiol Rev. 2010;32:5-25.

14. Cogswell ME, Parvanta I, Ickes L, Yip R, Brittenham GM. Iron supplementation during pregnancy, anemia, and birth weight: a randomized controlled trial. Am J Clin Nutr. 2003;78:773-781.

15. Balarajan Y, Subramanian SV, Fawzi WW. Maternal iron and folic acid supplementation is associated with lower risk of low birth weight in India. J Nutr. 2013;143:1309-1315.

16. Passerini L, Casey GJ, Biggs BA, Cong DT, Phu LB, Phuc TQ, Carone M, Montresor A. Increased birth weight associated with regular pre-pregnancy deworming and weekly iron-folic acid supplementation for Vietnamese women. PLoS Negl Trop Dis. 2012;6:e1608.

17. Fekete K, Berti C, Trovato M, Lohner S, Dullemeijer C, Souverein OW, Cetin I, Decsi T. Effect of folate intake on health outcomes in pregnancy: a systematic review and meta-analysis on birth weight, placental weight and length of gestation. Nutr J. 2012;11:75.

18. Zerfu TA, Ayele HT. Micronutrients and pregnancy; effect of supplementation on pregnancy and pregnancy outcomes: a systematic review. Nutr J. 2013;12:20.

19. Abdullahi H, Gasim GI, Saeed A, Imam AM, Adam I. Antenatal iron and folic acid supplementation use by pregnant women in Khartoum, Sudan. BMC Res Notes. 2014;7:498.

20. Hodgetts VA, Morris RK, Francis A, Gardosi J, Ismail KM. Effectiveness of folic acid supplementation in pregnancy on reducing the risk of small-for-gestational age neonates a population study, systematic review and meta-analysis. BJOG. 2015;122:478-490.

21. Abu-Ouf NM, Jan MM. The impact of maternal iron deficiency and iron deficiency anemia on child's health. Saudi Med J. 2015;36:146-149.

22. Gautam CS, Saha L, Sekhri K, Saha PK. Iron deficiency in pregnancy and the rationality of iron supplements prescribed during pregnancy. Medscape J Med. 2008;10:283.