Original Article

Prevalence and determinants of iron deficiency anemia among non-pregnant women of reproductive age in Pakistan

Muhammad Atif Habib MBBS, MPH[1,2], Camille Raynes-Greenow PhD[3], Sajid Bashir Soofi MBBS, FCPS[1], Noshad Ali MBBS, MPH[1], Sidrah Nausheen MBBS, FCPS[1], Imran Ahmed MSc[1], Zulfiqar Ahmed Bhutta PhD[1], Kirsten I Black PhD[2]

[1]*Women and Child Health Division, Aga Khan University, Stadium Road, Karachi, Pakistan*
[2]*Discipline of Obstetrics, Gynaecology and Neonatology, Central Clinical School, University of Sydney, Sydney NSW, Australia*
[3]*Sydney School of Public Health, University of Sydney, Sydney NSW, Australia*

Background and Objectives: Iron deficiency Anemia (IDA) in women of reproductive age is a recognized public health concern that impairs health and well-being in women and is associated with adverse reproductive outcomes. In Pakistan there is a dearth of up-to-date information on the prevalence and predictors of IDA. This study sought to investigate IDA in Pakistani women. **Methods and Study Design:** Secondary analysis was performed using the National Nutrition Survey in Pakistan 2011- 2012. We used a pre-structured instrument to collect socio demographic, reproductive and nutritional data on women. We also collected anthropometric measurements and blood samples for micronutrient deficiencies. Univariate and multivariate logistic regression were used to analyse the data. **Results:** A total of 7491 non-pregnant women aged between 15-49 years were included in the analysis. The prevalence of IDA was 18.1%. In the multivariate regression analysis; not using iron folic acid supplementation during the last pregnancy adjusted odds ratio (AOR) (95% CI) 1.31 (1.05, 1.64), a history of four or more pregnancies AOR (95% CI) 1.30 (1.04, 1.60), birth interval of <24 months AOR (95% CI) 1.27 (1.06, 1.71), household food insecurity AOR (95% CI) 1.42 (1.23, 1.63) and presence of clinical anemia AOR (95% CI) 5.82 (4.82, 7.02) were significantly associated with increased odds of IDA while with obesity AOR (95% CI) 0.60 (0.4, 0.88) showed a protective effect on IDA. **Conclusion:** To reduce IDA in Pakistani women, the country needs a multifaceted approach that incorporates iron supplementation, food fortification, improved family planning services and efforts to reduce food insecurity.

Key Words: iron deficiency anemia, non pregnant women, prevalence, predictors, nationally representative data

INTRODUCTION

Iron deficiency anemia (IDA) in women of reproductive age is a public health concern that globally affects 17% of women including 15% (248 million) of non-pregnant and 19% (16.2 million) of pregnant women.[1,2] Most of the burden occurs in the low-resource countries of South Asia and Africa largely because of a combination of poverty, poor dietary intake, and high burden of disease.[3,4] IDA impairs health and well-being in women and is associated with adverse reproductive outcomes.[5-7] Annually it is estimated that 22% of maternal deaths and 24% of perinatal deaths around the world are attributed to IDA.[8] Maternal IDA is also associated with congenital birth defects, small for gestational age births, low birth weight infants and growth impairment in infants, and is a major contributor to disability adjusted life years in women.[8-10]

The reported prevalence of IDA in Pakistani women is between 30-60%.[11-17] Pakistan has a high maternal (276 per 100,000 live births) and perinatal mortality (75 per 1000 pregnancies)[18] and both are associated with acute blood loss in situations of chronic IDA.[19] IDA also contributes to the high numbers of small for gestational age births (19.3%) and low birthweight babies (25%) in Pakistan.[18-20] The available data on IDA prevalence and its risk factors in Pakistani women is limited; either because the studies are old, in small non-representative samples, limited to sub-groups (e.g. only pregnant women) or based only on hemoglobin concentrations. The most recent available population based data from Pakistan is from the National Nutrition Survey conducted in 2001-2002 which is more than ten years old.[17]

Considering how significant the problem of IDA is, it is important that Pakistan has nationally representative data to develop local strategies for treatment and preven-

Corresponding Author: Muhammad Atif Habib, Discipline of Obstetrics, Gynaecology and Neonatology, Central Clinical School, University of Sydney, Sydney NSW, Australia, 2006.
Tel: +61 2 9515 7696/+61404410786. Fax: +61 61 2 9036 3188
Email: atif.habib@aku.edu; mhab4985@uni.sydney.edu.au
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tion. This study aims to describe the prevalence and determinants of IDA among non-pregnant Pakistani women by conducting a secondary analysis of the Pakistan National Nutrition Survey undertaken in 2011-2012.

MATERIALS AND METHODS

Data source

We conducted secondary data analysis of the Pakistan National Nutrition Survey (NNS) 2011-2012. The NNS conducted at the national level by Aga Khan University in collaboration with the Federal Ministry of Health in Pakistan. The survey was funded by UNICEF and the sampling frame and design of 1500 enumeration blocks for data collection was provided by the Federal Bureau of Statistics. The data for NNS was collected using a two stage stratified survey technique. In the first stage the enumeration block was selected randomly assigned by the Federal Bureau of Statistics. Each enumeration block was mapped and listed before data collection and every household was assigned with a household number. The listing information was entered in a computer program in real time. In the second stage 20 households were selected randomly through a computer generated program from each enumeration block for data collection. A total of 30,000 households were included, 12,360 were urban households and 17,640 were rural. One married woman of reproductive age (15-49 years) was chosen from each selected household. If there were multiple eligible women in a household, one woman was randomly selected. The total number of respondents was 27,963.

Data was collected on socio-economic status, maternal reproductive history and food security using a pre-structured and pre-tested instrument. In addition, anthropometric, hematological and biochemical measurements of various micronutrients were undertaken. For anthropometric measurements women's height and weight were measured as per WHO guidelines[21] and the body mass index (BMI) was computed. Blood samples for hemoglobin measurement and micronutrient deficiencies were collected using standard venipuncture techniques. The blood samples were centrifuged within 30 minutes of sample collection at the field site and serum was separated.

Serum ferritin concentrations were measured to establish iron deficiency because it has the highest sensitivity and specificity for the detection of iron deficiency.[22] The ferritin levels were adjusted for C-reactive protein (CRP) to take into account that ferritin is an acute phase protein and is raised in inflammatory conditions.[23] Electrochemiluminescence immunoassay and ELISA immunoassay were used to measure ferritin levels and CRP levels in the serum respectively. The hemoglobin levels were measured by using a dual wave length HemoCue 201 photometer. Hemoglobin concentration was also adjusted for altitudes of more than 1000 meters using the CDC criteria.[24] All survey procedures and activities were monitored by internal and external monitors.

The ethical review committee of Aga Khan University and the National Bioethics committee granted ethical approval (1736-Ped-ERC-10). Written informed consent was obtained from all participants. In cases where the mother was illiterate, consent was documented by a thumbprint on the consent form and confirmed by a signature from a literate witness. All the names and personal information regarding the participants were kept confidential and data all identifying information was removed for analysis.

Description of variables

IDA status for non-pregnant women of reproductive age was the main outcome variable and was defined as having the combination of haemoglobin levels of <120 g/L and ferritin levels of < 12 μg/L for non-pregnant women.[25] The explanatory variables for analysis were informed by the literature and their availability in the dataset and are described in Table 1. Variables were grouped into three categories; sociodemographic factors, women related factors and biochemical factors. Under the household category; area of residence which was categorized into rural and urban, socioeconomic status which was ascertained by computing the wealth quintiles (from being poorest to wealthiest) using the standard demographic and health survey tool, and food security status using the standard household food insecurity access scale developed by Food and Nutrition Technical Assistance (FANTA) project[26] and categorized as (Food Secure and Food insecure) were considered.

In the women related factors; age, education level ascertained as completed years of education, BMI calculated on the basis of height and weight of mother and categorized as <18.5 underweight, 18.5-24.99 normal weight, 25-34.99 overweight/obesity and ≥35 severe obesity. Presence of clinical anemia observed through physical examination of conjunctiva and palms, history of iron folic acid supplementation, consumption of meat and green leafy vegetables ascertained through standard food frequency questionnaire, antenatal care visits, number of previous pregnancies, number of previous deliveries, birth interval and current pregnancy status were considered. In the biochemical category zinc deficiency defined as serum zinc concentration of <60 μg/dL[27] and categorized as deficient and non-deficient and vitamin A deficiency defined as defined as serum vitamin A concentration of ≤0.70 μmol/L[28] and categorized as deficient and non-deficient were considered.

Statistical analysis

All data analyses were conducted in IBM SPSS version 19[29] using a complex sample procedure to allow for adjustments of the sampling design implemented in the survey. Since IDA was the main outcome measure therefore women with results available for both hemoglobin and ferritin were included in the analysis. The frequencies, along with weighted percentages, were reported for selected predictors and the mean with 95% confidence intervals (CIs) were calculated for the outcomes. The analysis started with simple univariate analysis followed by multivariate logistic regression. Unadjusted odds ratio with their 95% CIs were reported for the bivariate analysis. Variables significant at $p<0.25$ were considered for inclusion in the multivariate model. Covariates that were not significant at the multivariate level were dropped consecutively from the model after careful assessment of confounding. The final model was selected on the basis of

Table 1. Description of explanatory variables used in the analysis

Variables	Description
Sociodemographic factors	
Area of residence	Urban and rural
Socio economic status of the household	SES was measured as quintiles of a linear index derived from household assets and utilities score, the wealth quintiles were divided into five (poorest, poorer, middle, richer, richest)
Food security status	Food security status was measured by using the standard household food and hunger scale developed by Food and Nutrition Technical Assistance (FANTA) project and categorized as (Food secure and Food insecure)
Women related factors	
Age	Categorized as <25 years, 25-34 years and >34 years
Education	Years of education completed (illiterate/years of education) and categorized as illiterate, primary or less (1-5 years) middle (6-8 years), matric (9-10 years) and Intermediate and above (>10 years).
Clinical anemia	Presence of anemia on physical examination i-e conjunctival and palmar pallor (1=yes or 2=no)
BMI	Calculated on the basis of height and weight of mother and categorized as <18.5 underweight, 18.5-24.99 normal weight, 25-29.99 overweight and ≥30 obesity.
ANC services during last pregnancy	Use of ante natal care during last pregnancy (1=yes; 2=no)
Iron folic acid supplementation	Use of iron folic acid supplements during last pregnancy (1=yes; 2=no)
Number of previous pregnancies	Number of times women has been pregnant (≥4 and <4)
Number of previous deliveries	Number of previous births (≥4 and <4)
Birth interval	Interval from one child's birth date until the next child's birth date and categorized as <24 months and ≥24 months
Intake of iron rich food	The data for intake of iron rich food was extracted from the standard food frequency questionnaire which was a part of main instrument. The variable was characterized as (none, 1-2 times per month and ≥1 times per week/day)
Intake of meat	The data for intake of iron rich food was extracted from the standard food frequency questionnaire which was a part of main instrument. The variable was characterized as (none, 1-2 times per month and ≥1 times per week/day)
Biochemical factors	
Vitamin A deficiency	Serum vitamin A concentration of ≤0.70 µmol/L and categorized as deficient and non-deficient
Zinc deficiency	Serum zinc concentration of <60 µg/dL and categorized as deficient and non-deficient

ANC: antenatal care.

theoretical and statistical significance of predictors. The Type 1 error was set at 0.05. The model estimates are presented with the adjusted odds ratios (AOR) and 95% CI.

RESULTS

A total of 7491 non-pregnant women were included in the analysis and the descriptive findings are shown in Table 2. The overall prevalence of IDA was 18.1%. The prevalence for ferritin deficiency, vitamin A deficiency and zinc deficiency was 26.2%, 40.8% and 42.8% respectively. Among those who were ferritin deficient 1352 (68.9%) had low hemoglobin and 612 (31.1%) had normal hemoglobin. Among study participants 13.2% were less than 25 years old and 31.1% were older than 34 years. Clinical anemia was found in 20.5% and the BMI data showed that 16.5% of women were underweight, 20.8% were overweight and 10.5% were obese.

Table 2. Background characteristics of sampled women in National Nutrition Survey Pakistan (n=7491)

Variables	N	%
Sociodemographic factors		
Residence		
Rural	4485	69.3
Urban	3006	30.7
Wealth quintiles		
Poorest	1587	22.5
2	1452	20.1
3	1533	20.1
4	1547	20.0
5 wealthiest	1372	17.3
Food security		
Food insecure	4612	61.6
Food secure	2879	38.4

Table 2. Background characteristics of sampled women in National Nutrition Survey Pakistan (n=7491) (cont.)

Variables	N	%
Women related factors		
Age (years)		
<25	989	13.2
25-34	4190	55.7
>34	2312	31.1
Education		
Illiterate	4135	55.1
Primary or less (1-5 years of schooling)	1057	14.1
Middle(6-8 years of schooling)	683	9.1
Matric(9-10 years of schooling)	898	11.9
Intermidiate & above (>10 years of schooling)	711	9.4
BMI (kg/m^2)		
Underweight <18.5	1242	16.5
Normal 18.5-24.9	3890	51.9
Overweight 25-29.9	1565	20.8
Obese ≥30	794	10.5
Clinical anemia		
Yes	1532	20.5
No	5917	78.9
Iron folic acid supplementation during last pregnancy		
Not received	5319	71.5
Received	2172	28.5
Iron rich food (green vegetables) intake		
None	1416	18.9
1-2 times per months	2460	32.8
≥1 times per week/day	3534	47.2
Meat- frequency of intake		
None	919	12.2
1-2 times per months	1882	25.1
≥1 times per week/day	4609	61.5
Reproductive health variables		
ANC visit		
No	2167	28.9
Yes	5241	69.9
Number of pregnancies		
≥4	4049	54.1
<4	3434	45.8
Number of deliveries		
≥4	4044	53.9
<4	3440	46.0
Birth interval (months)		
<24m	2321	58.6
≥24m	1634	41.3
Biochemical factors		
Iron deficiency anemia (low Hb + low ferritin levels)		
Yes	1358	18.1
No	6133	81.9
Zinc		
Deficient (<60 µg/dL)	3210	42.8
Non-Deficient (60-150 µg/dL)	4202	56.1
Vitamin A		
Deficient (≤0.70 µmol/L)	3059	40.8
Normal (>0.70 µmol/L)	4394	58.6
Ferritin		
Deficient (<12 ng/dL)	1970	26.2
Normal (≥12 ng/dL)	5521	73.8
Ferritin Deficiency and Hb status		
Ferritin deficiency with low Hb	1358	68.9
Ferritin deficiency with normal Hb	612	31.1

ANC: antenatal care.

We found that 54.1% of women had four or more pregnancies, 53.9% had four or more deliveries and 58.7% reported a birth interval less than 2 years. The majority of women (69.9%) received antenatal care and only 28.5% received iron folic acid supplementation during their last pregnancy. The majority of women came from rural areas (69.3%) and 55.1% of them were illiterate. Among the study population the two lowest and two highest wealth quintiles accounted for 42.6% and 37.3% respectively. Of the sampled women 61.6% reported food insecurity, 47.2% and 65.1% reported intake of green leafy vegetables and meat for no less than once per week.

The univariate analysis found that IDA in Pakistani women was significantly associated with not using iron folic acid supplementation during the last pregnancy OR (95% CI) 1.27 (1.10, 1.45), no antenatal care (ANC) during the last pregnancy OR (95% CI) 1.24 (1.1, 1.31), a history of four or more pregnancies OR (95% CI) 1.14 (1.1, 1.4), birth interval of <24 months OR (95% CI) 1.37 (1.20, 1.68), presence of clinical anemia OR (95% CI) 5.74 (4.94, 6.68), serum vitamin A deficiency OR (95% CI) 1.2 (1.05, 1.36), household food insecurity OR (95% CI) 1.27 (1.08, 1.47), living in a rural area OR (95% CI) 1.13 (1.05, 1.30) and being in the poorest quintile OR (95% CI) 1.42 (1.14, 1.76). In contrast being overweight OR (95% CI) 0.67 (0.6, 0.84) or obese OR (95% CI) 0.61 (0.48, 0.77) were associated with decreased risk of IDA (Table 3).

In the multivariate regression (Table 4) living in rural area, being in the poorest quintile, no ANC during the last pregnancy, serum vitamin A deficiency and being overweight and were no longer significantly associated with IDA. Of the variables that remained significantly associated with increased odds of IDA were not using iron folic acid supplementation during the last pregnancy adjusted AOR (95% CI) 1.31 (1.05, 1.64), a history of four or more pregnancies AOR (95% CI) 1.30 (1.04, 1.60), birth interval of <24 months AOR (95% CI) 1.27 (1.06, 1.71), presence of clinical anemia AOR (95% CI) 5.82 (4.82, 7.02) and household food insecurity AOR (95% CI) 1.42 (1.23-1.63), while obesity was found to be associated with decreased odds of IDA AOR (95% CI) 0.60 (0.41, 0.88).

DISCUSSION

In our study the estimated prevalence of IDA in women was 18.1%. This is slightly higher than the estimated global prevalence which sits around 17%[1] and is considerably lower than previous estimates reported from Pakistan between 30% and 60% that were derived from smaller, non-representative samples.[12-16] Given that the previous National Nutrition Survey conducted in 2001 reported a prevalence of IDA as 25.5%,[17] the current estimate represents a 29.0% reduction over the ten year period between NNS 2001 and 2012. Nevertheless, Pakistan still remains a country of moderate IDA burden according to WHO standards[30] which is based on the prevalence of anemia defined by hemoglobin alone. The prevalence of IDA in our study is consistent with a study from Ethiopia (18%)[31] but lower than that documented in studies from Afghanistan (48.4%),[32] Saudi Arabia (27%),[33] India (36.3%),[34] and Côte d 'Ivoire (20%).[35]

Our study found that the odds of IDA increased with not using iron folic acid during the last pregnancy. The literature suggests that iron folic acid supplementation during antenatal and post natal period reduces the risk of IDA in women and consequently improves birth outcomes.[36-39] Although endorsed by WHO,[40] and integrated into maternal and child health services through the lady health workers program in Pakistan, compliance with universal delivery of antenatal iron and folic acid remains low at 45%.[18] This is well below that of neighboring countries[41-43] and is indicative of program implementation issues and potential user associated barriers to uptake such as misconceptions and lack of knowledge of the importance of iron folic acid supplementation.[44]

Our study reported that woman having a history of four or more pregnancies and short birth interval of <24 months had increased odds of IDA. It is known that serum ferritin and iron stores are reduced in pregnancy due to the increased demands the developing fetus and placenta places on the mother,[38,45,46] and is particularly so in the latter stages of pregnancy.[47-49] It is difficult to achieve the high level of iron requirement with diet alone especially when women in low resource settings such as Pakistan commence pregnancy with insufficient iron stores, and are food insecure.[40,50] Previous research has also established that due to frequent pregnancies and short intervals women are unable to recover their iron stores [51,52] which are further depleted with lactation.[53] As a result of low use of contraception and high reliance on traditional methods, Pakistani women encounter multiple pregnancies and experience a high fertility rate of 3.8 births per woman[18] which contributes to IDA.

Our study revealed that the food insecurity status of households is also associated with IDA in women. This finding is supported by previous population-based studies showing that women who were food insecure had higher odds of having anemia compared to those living in food-secure households.[54,55] Pakistan faces a huge burden of food insecurity with frequent periods of reduced access to food and nutrition across the country resulting in complications like IDA.[56]

In our study, the odds of IDA decreased with obesity. The finding is consistent with the results of a large multi country study conducted in Mexico, Egypt and Peru[57] and also with other studies conducted in Taiwan[58] Columbia[59] and China.[60] On the contrary, there is also evidence which is in favor of increased risk of IDA with obesity[61,62] but a recent systematic review revealed that obese women tend to have higher hemoglobin and ferritin concentrations.[63] The debate about whether obesity is associated with increased risk of IDA remains controversial and further research is required.[57,59]

The major strengths of this study are the use of ferritin for the detection of IDA and a large nationally representative sample. However there are some limitations. The cross-sectional nature of the study means the temporality between IDA and the associated factors cannot be established. The data were collected retrospectively which may have introduced some recall bias when answering the structured questionnaire, but this is unlikely to be differential. Our study did not measure AGP which is a more subtle marker of chronic inflammation and chronic inflammations results in high ferritin concentrations which might result in an under estimation of IDA especially for those who are obese and have low ferritin levels without anemia.

Iron supplementation and food fortification are considered the best strategies to reduce population level IDA[64] however their delivery and compliance remains a challenge.[65,66] Improving access to contraception offers a novel solution to indirectly improve IDA. Apart from the

Table 3. Univariate associations between iron deficiency anemia and covariates (N=1358)

Characteristics	IDA	Unadjusted OR (95% CI)	*p* value
Sociodemographic variables			
Residence			
Rural	945 (69.6)	1.13 (1.05, 1.3)	0.046
Urban	413 (30.1)	Ref.	
Wealth quintiles			
Poorest	339 (25.8)	1.42 (1.14, 1.76)	0.008
2	261 (19.4)	1.11 (0.87, 1.42)	0.071
3	270 (19.9)	1.14 (0.90, 1.45)	0.274
4	282 (19.5)	1.13 (0.88, 1.43)	0.330
5 wealthiest	206 (15.3)	Ref.	
Food security			
Food insecure	891 (65.6)	1.27 (1.08, 1.47)	0.001
Food secure	467 (34.3)	Ref.	
Women related variables			
Age (years)			
<25	174 (12.8)	0.98 (0.81, 1.21)	0.902
25-34	754 (55.5)	1.01 (0.89, 1.16)	0.920
>34	430 (31.6)	Ref.	
Education			
Illiterate	737 (54.2)	1.22 (0.94, 1.58)	0.135
Primary or less (1-5 years of schooling)	193 (14.2)	1.21 (0.89, 1.65)	0.223
Middle (6-8)	146 (10.7)	1.17 (0.85, 1.61)	0.334
Matric (9-10)	160 (11.7)	1.01 (0.74, 1.4)	0.930
Intermidiate & above (>10)	122 (8.9)	Ref.	
BMI (kg/m^2)			
Underweight (<18.5)	265 (19.8)	0.98 (0.83, 1.14)	0.758
Normal (18.5-24.9)	771 (56.9)	Ref.	
Overweight (25-29.9)	216 (16.1)	0.67 (0.60, 0.84)	0.001
Obese (≥30)	106 (7.2)	0.61 (0.48, 0.77)	0.003
Clinical anemia			
Yes	658 (49.1)	5.74 (4.94, 6.68)	0.000
No	695 (50.9)	Ref.	
Iron folic acid supplementation			
Not used	1018 (74.9)	1.27 (1.1, 1.45)	0.001
Used	340 (25.1)	Ref.	
Iron rich food intake			
None	287 (21.1)	1.13 (0.95, 1.34)	0.178
1-2 times per months	438 (32.2)	1.08 (0.93, 1.24)	0.317
≥1 times per week/day	628 (46.2)	Ref.	
Meat intake			
None	187 (13.7)	1.09 (0.91, 1.3)	0.366
1-2 times per months	325 (24.0)	0.92 (0.79, 1.06)	0.228
≥1 times per week/day	840 (61.8)	Ref.	
ANC visit			
No	460 (33.8)	1.24 (1.1, 1.31)	0.045
Yes	898 (66.1)	Ref.	
Number of pregnancies			
≥4	763 (55.6)	1.14 (1.0, 1.3)	0.023
<4	592 (44.3)	Ref.	
Number of deliveries			
≥4	761 (55.4)	1.11 (0.98, 1.26)	0.116
<4	595 (44.6)	Ref.	
Birth interval (months)			
<24 m	471 (60.9)	1.37 (1.10, 1.68)	0.010
≥24m	302 (39.1)	Ref.	
Biochemical variables			
Zinc			
Deficient (<60 µg/dL)	560 (41.8)	1.07 (0.94, 1.23)	0.316
Non-Deficient (60-150 µg/dL)	714 (58.2)	Ref.	
Retinol			
Deficient (≤0.70 µmol/L)	586 (43.1)	1.2 (1.05, 1.36)	0.007
Normal (>0.70 µmol/L)	748 (56.9)	Ref.	

IDA: iron deficiency anemia; ANC: antenatal care.

strategies that replenish the iron stores; efforts are required to counter factors such as high pregnancy and Fertility which indirectly contribute to low iron and iron depletion. This could be achieved with routine use of modern family planning methods. Despite the evidence that long acting reversible contraceptive methods, such as

Table 4. Multivariate associations of predictor variables of iron deficiency anemia in women (N=1358)

Characteristics	IDA	Adjusted OR (95% CI)	*p* value
Sociodemographic factors			
Food security			
Food insecure	1026 (65.9)	1.42 (1.23, 1.63)	0.001
Food secure	532 (34.2)	Ref.	
Women related factors			
Number of pregnancies			
≥4	763 (55.6)	1.30 (1.04, 1.60)	0.015
<4	592 (44.3)	Ref.	
Birth interval (months)			
<24 m	471 (60.9)	1.27 (1.06, 1.71)	0.020
≥24m	302 (39.1)	Ref.	
Iron folic acid supplementation			
Not used	1210 (75.3)	1.31 (1.05, 1.64)	0.005
Used	398 (24.8)	Ref.	
Clinical anemia			
Yes	658 (49.1)	5.82 (4.87, 7.02)	0.001
No	695 (50.9)	Ref.	
BMI (kg/m^2)			
Underweight (<18.5)	265 (19.8)	0.91 (0.73, 1.13)	0.397
Normal (18.5-24.9)	771 (56.9)	Ref.	
Overweight (25-29.9)	216 (16.1)	0.8 (0.62, 1.03)	0.087
Obese (≥30)	106 (7.2)	0.6 (0.41, 0.88)	0.016

IDA: iron deficiency anemia.

intra uterine devices (IUDs) and implants, are effective in reducing the total fertility compared to traditional methods,[67] their utilization is uncommon in Pakistan. Results from a recent study in five low income countries including Pakistan showed that almost all women in their early postpartum period wish to delay a future pregnancy.[68] A national program that provides contraceptive services (IUDs and implants) to women immediately after a birth and before they leave hospital or birthing centers would be potentially beneficial.[69] Recognizing that Pakistan is a male dominated society in which the majority of the decisions including family planning are being taken by men, any successful family planning strategy will require the involvement of men. Indeed a recent large scale study of engaging men in family planning resulted in improvement in attitude and behaviors, a decrease in the fertility rate and an increase in the contraceptive prevalence rate.[70]

Addressing the iron deficiencies will require attention to both iron supplementation programs targeting women and adolescent girls as well as population based solutions such as fortification of flour. Other programs that can improve food security through food supplements and agricultural support that can have a greater impact with fewer side effects are also required.

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AUTHOR DISCLOSURES
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