

Compliance with Iron-Folic Acid Supplementation Among Pregnant Women in the Bekwai Municipality, Ghana

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Abstract: Globally, 40% of pregnant women are affected by anaemia. Anaemia, low haemoglobin level in the bloodstream, has many negative effects on pregnancy. The World Health Organisation recommends supplementation with iron and folic acid to prevent the incidence of anaemia in pregnancy. In Ghana, iron and folic acid supplementation has been through Ante Natal Clinics. Despite this intervention, Anaemia in Pregnancy prevalence in Bekwai has been above 37% for three years, higher than the national average of 25%. This study found out the compliance level and determining factors among ANC clients. This facility-based quantitative descriptive cross-sectional study was carried out in two sub-districts using multistage sampling. Data was collected using structured questionnaire. Data entered into SPSS was exported to Stata version for analysis. Demographic and obstetric data were analysed into frequencies and percentages. Bivariate and multivariate analyses were conducted to identify factors affecting compliance. Compliance was low (38.8%), despite high knowledge (90.3%). Gravidity (p-value 0.025 AOR= 5.88, 95% CI= 2.214-15.542) and level of knowledge (P-Value 0.01, AOR 2.89, 95%CI= 0.592-12.10) positively affected compliance. It was recommended that health education at ANC be improved, and adherence partners introduced to help prevent forgetfulness.

Keywords: Compliance, Iron-Folic, Supplementation, Pregnant Women, Bekwai, Ghana

1. Introduction

1.1. Background of the Study

Anaemia in pregnancy is a global public Health problem. It is defined as the low concentration of haemoglobin in one's blood stream. Iron (and folic acid) contribute greatly to haemoglobin concentration in blood. Among pregnant women, anaemia is defined as haemoglobin concentration of less than 11g/dl of blood [1].

Pregnant women require extra iron and folic acid to enable them meet their nutritional needs as well as the needs of their unborn children (World Health Organisation, 2019). WHO recommends routine daily oral supplementation with 30 to 60 mg of elemental iron and 400 µg (0.4 mg) folic acid for pregnant women to prevent anaemia in pregnancy, puerperal sepsis, low birth weight (below 2.5kg), and preterm birth

delivery [2].

The impact of anaemia on socio economic wellbeing and health is very adverse. Among the pregnant women, iron deficiency is associated with low birth weight (below 2.5kg), maternal and perinatal deaths [3].

Additionally, iron deficiency adversely affects the utilisation of energy sources by muscles, impacting negatively on physical capacity, work performance, immune status and morbidity from infections. Folic acid deficiency is also known to cause foetal neural tube defects [4]. Evidence exist to suggest that preventive iron supplementation can reduce maternal anaemia at term by up to 70%. Low Birth weight and neural tube defects can be significantly reduced with IFA supplementation. [5] Iron-folic acid

supplementation among pregnant women is known to increase haemoglobin by 1.17 g/dL in developed countries and 1.13 g/dL in developing countries [6]. Iron and folic acid deficiency during pregnancy can have negative impact on the health of the mother, her pregnancy, as well as foetal development [2]. Even mild and moderate anaemia has the adverse outcomes, including death among pregnant women. In Asia, the second highest cause of maternal mortality in 2010 was anaemia in pregnancy [6].

Evidence has shown that the use of iron and folic acid supplements is associated with a reduced risk of iron deficiency [2]. It has been reported that a focused national IFA supplementation programme can reduce pregnancy related anaemia by up to half [6]. In a control trial, Haemoglobin among study group taking IFA supplements increased from 7.97gm% to 8.99gm%, against increase from 7.98 to 8.42 among the control group [7]. In India, it was found out that anaemia severity was significantly higher among pregnant women who did not take enough IFA supplements [8]. Hence the importance attached to the programme.

The World Health Organisation (WHO) estimates that globally, over 40% of pregnant women are anaemic. Up to half of this anaemia burden is assumed to be due to iron deficiency [2].

The Anaemia burden in Africa is above the global average of 40%. It is estimated to be about 61.3% among pregnant women in Africa [9]. The WHO global prevalence of anaemia report supports the findings above. In their report, anaemia among pregnant women 15-49 years was estimated at 63% in Benin and 47% in Angola. In Cameroun, it was estimated at 49%, while Cote D'ivoire had 57%. Guinea Bissau and Nigeria had 49% and 58% respectively [3].

Anaemia among pregnant women is estimated to be about 36% in Ghana [10]. The Ministry of Health and the Ghana Health Service uses the Antenatal Clinics (ANC) to supply recommended doses of Iron and Folic acid tablets (IFA) to pregnant women for free. This has been the strategy to reduce and or prevent anaemia in pregnant mothers. These IFA supplements are given to ANC attendants on monthly basis. They are expected to take these medications on their own at home on daily basis [10].

Despite the intervention of this free monthly supply of IFAs, anaemia among pregnant women at term has not seen any significant improvement in Ghana, especially in the Bekwai Municipality. According to GHS Annual report 2016, anaemia at 36 weeks-plus continue to hover around 25% from 2015 to 2016. [11].

In the Bekwai Municipality, anaemia among pregnant women at 36 weeks has remained above the national average for 3 consecutive years. In 2016 and 2017, it stagnated around 37.5%, and then increased to 38% in 2018, despite supplying ANC clients IFA supplements [12].

The 2016 annual report of the Ghana Health Service cited "issues of lack of compliance to IFA and appropriate dosing regimens as well as inadequate counselling (also linked to lack of compliance)" as likely factors responsible for high

anaemia among ANC clients. According to the report, "empirical data" was not available in this area [10].

It is therefore imperative to find out the pregnant women's compliance with the IFA supplementations, and to also ascertain the factors that contribute to the compliance or otherwise. This study seeks to find out the situation in the Bekwai Municipality with the view to addressing this challenge.

1.2. Objectives of the Study

1.2.1. General Objective

The general objective of this study was to assess the factors that affect the compliance of the Iron Folic acid supplementation programme among pregnant women in the Bekwai Municipality.

1.2.2. Specific Objectives

- 1) To assess the knowledge of pregnant women on IFA supplementation in Bekwai Municipality.
- 2) To determine the level of compliance with IFA supplementation among pregnant women in Bekwai Municipality.
- 3) To identify the factors influencing compliance with IFA among pregnant women in Bekwai Municipality.

2. Methodology

2.1. Demographic Background to the Study Area

Bekwai municipality, formerly known as Amansie East District, is an old district which attained Municipality status in the year 2008. The land size of the municipality is about 633km².

The municipality has a 2020 population of 124,338 estimated from the 2010 population and housing census. The total population of expected pregnant women is estimated to be 4% (4974) of the total population according to the Municipal Health Directorate.

The Municipality which has its capital as Bekwai shares boundary with the Bosomtwe District in the North East, the Adansi South District in the South, the Bosome Freho District in the East, the Amansie Central District in the West and the Amansie West District in the North West.

The main occupation of the citizens is farming. The major crops grown in the area due to the fertile nature of the land are vegetables, staples like cassava and plantain and cash crop like cocoa. However, a lot of trading also go on in the Municipality. The people trade mostly in farm produce and clothing materials with some provision stores available in the municipal capital-Bekwai. Pockets of communities in the Municipality also engage in small scale mining.

The municipality has 105 outreach points for Child Welfare Clinic (CWC) services spread in 136 communities. In these outreach points, services such as immunization for children under 5 years, growth monitoring, reproductive health services are offered as part of the CHPS concept.

To ease service delivery, the municipality is divided into

four Sub-Municipalities namely; Bekwai, Dominase, Kortwia and Kokofu with each of them having a Sub District Health Team (SDHT). In line with the electoral areas, the municipality has 34 CHPS Zones to which outreach staffs (CHNs and FTs) are assigned to carry out their duties with four CHPS Compounds.

The municipality has fifteen health facilities of which Six (6) are hospitals, Four (4) Clinics, One (1) Health Centre and Four (4) CHPS Compound. All fifteen health facilities provide ante natal services to the people, including free iron folic acid supplements [12].

2.2. Study Design and Type

A facility-based quantitative descriptive cross-sectional study was carried out at the ANC sections of selected facilities in two out of four sub municipalities. This design is used to collect data only at a particular point in time. The design is non-interventional, descriptive and provides no comparison group, but sought for prevalence in the study population. This design was chosen in order to find out the prevalence of compliance and knowledge existing at a point in time. Results could form the basis for further analytic or interventional study. Facility based was chosen because ANC clients are given IFA supplements during attendance. Also, assessing the respondents would be faster, compared to community based.

Respondents were assessed one time and were not needed for further follow-up, hence the choice of cross-sectional study.

This design was suited to the study since the objective was to find out existing practice from pregnant women who attended ANC once a month.

2.3. Study Population

Pregnant women attending ANC in health facilities in the Bekwai Municipality were studied. All pregnant women registered for and attending ANC were eligible for the study.

$$\text{Corresponding Number of Respondents} = \frac{\text{Number of ANC registrants for 2019 per facility}}{\text{Total Number of ANC clients for Municipality}} \times 258$$

At the facility level, systematic sampling was used. The quota of each facility was divided by 10 days (two weeks).

The figure obtained per day was used to divide the average ANC attendants for each facility per day. The value obtained was the *kth* respondent for the systematic sampling. In other words, every *kth* ANC attendant was interviewed for the period until the quota was obtained.

2.5. Study Variables

2.5.1. Dependent Variables

The dependent variable under this study was the compliance of IFA supplementation among pregnant women.

2.5.2. Independent Variables

- 1) Knowledge of pregnant women on IFA supplementation.

This was because registration for ANC was sufficient proof of pregnancy. Also, ANC serves as the channel for free distribution of Iron and Folic acid supplements. To this end, respondents were sampled only from ANC clinics. Any ANC client who was severely ill, or in labour was however excluded. These two conditions were thought to be able to affect the responses of the women since they could cause more pain and discomfort. In addition, recall could be negatively affected.

2.4. Sampling Technique and Sample Size

The sample size of 258 was used. This was based on assumption that the prevalence of IFA compliance was 20%. The Cochran formula

$$n = Z^2 pq / e^2$$

for a cross sectional study was applied where

n was the minimum sample score for a normal distribution,

z = 1.96, *z*-score for 95% confidence interval,

p was the presumed prevalence of IFA compliance (20%),

q (1-*p*) was the proportion of non-compliance and

e represented the margin of error (*e* = 0.05) [13].

The minimum sample size was therefore 246. In addition, non-response rate of 5% (12) was added to cater for a possible non-compliance data.

Multi-stage sampling was employed. First, 2 out of the 4 sub municipalities were selected by a simple random sampling technique. All four sub municipalities were assigned codes on small pieces of paper. Bekwai and Kokofu were picked at random and used. All facilities in these two sub municipalities were used.

Number of respondents per sub municipality and facility were determined by proportional quota, based on the proportionate percentage of ANC clients registered in 2019. Thus, for each facility, the corresponding number of respondents was calculated as follows:

- 2) Sociodemographic characteristics such as age, educational status, marital status.

- 3) Obstetric characteristics such as gravidity, gestational age of pregnancy at time of data collection, gestational age at registration for ANC.

2.6. Data Collection Tool and Techniques

A structured questionnaire with close ended questions was used to collect data from the respondents. The questionnaire had 3 parts. The first part was constructed by the researcher. This part captured the sociodemographic and obstetric information of respondents. The second part was constructed by the researcher and it captured responses relating to the knowledge of respondents on IFA supplementations. The final part measured compliance of medication. Pilot Testing was carried out in the Kortwia

Sub district, specifically Kensere CHPS compound, using 25 ANC attendants. This was to test the items for validity and reliability. After the pilot testing, grammatical errors were corrected as well as sequencing in the first two parts to ensure reliability. The tool was then finalized and used for the actual study.

The questionnaire was administered in Asante Twi language or English, and responses captured by trained data collectors, including midwives and disease control officers.

2.7. Data Analysis

Data collected on paper was coded and entered manually into Statistical Package for Social Sciences (SPSS) version 21 software. Data was then cleaned to identify outliers and errors for remedy. The data in SPSS was then exported electronically to Stata software version 15, which was used for the analysis.

Univariate analysis was done for the demographic and obstetric data and the results were presented in a table form using proportions to describe same.

On knowledge, each correct answer given for the questions on knowledge was scored one, while any wrong answer was scored zero. All scores were summed up. The score was classified as high if it was above the 75% of total possible score, and average if it was between 50 and 75% value and low if it fell under 50%.

Eight items were used to measure compliance. Each desirable response scored a one-point mark while a non-desirable response scored zero. The maximum score possible was 8. Each respondent's score was put together and a score above 6 was deemed to be compliant while a score of 0 to 5 was deemed non-compliant.

Bivariate analysis was conducted to identify factors that are significantly associated with IFA compliance, with their *p-value* set at 0.05. Significant variables were then incorporated into multivariate logistic regression analysis to identify independent factors that affected adherence of IFA, with odds ratio adjusted and unadjusted, at 95% confidence interval.

2.8. Limitations of the Study

This study relied on the subjective responses of ANC attendants. The Researcher did not verify the claims of the respondents beyond the one on one interviews, despite efforts made to elicit trustworthy responses. To this end, the results is subject to the claims of the respondents. Recall bias could be a possibility.

Compliance and related factors were measured simultaneously. It is therefore difficult to conclude that these factors caused changes in the compliance.

Also, data collection took place within a period of 2 weeks, even though ANC attendance is spread over a month. This potentially excluded some ANC attendants who attended clinics outside the chosen period since they attend clinic only once in a month, spanning 4 weeks. Thus, mothers attend their clinic anytime within the months. Selection bias could

therefore be possible.

2.9. Ethical Consideration

Ethical clearance was sought and obtained from the Ghana Health Service Ethical Review Committee (protocol ID GHS-ERC 040/06/20). In addition, permission was sought from the Bekwai Municipal Health Directorate to enable access to the selected health facilities. Facility heads in sampled sub-municipalities were also notified for permission before the respondents were accessed.

At the facility, heads of the maternity wings, where the respondents access services were consulted for permission, while prospective respondents were given information on the rationale for the study, the benefits for the health system, and time to be spent. They were informed that the study was for academic purposes but could inure to the benefits of the iron folic acid supplementation programme.

They were assured of privacy and confidentiality and same was complied with during the data collection. Interactions were done in a manner that no third party could hear what went on data collector and respondent. No information that could reveal their identity was collected. Results are presented on mass basis to conceal any identity of the respondent.

Respondents were given the opportunity to ask questions for clarification and assured that they could withdraw from the process anytime they so wished, without any negative effect on them. All questions and concerns were clarified and respondents willingly consented to be part of the study.

Written informed consent of respondents was obtained prior to data collection for each respondent. Respondents either signed or thumb-printed after they were satisfied and willing to take part. Copies of the signed consent form were given to the respondents after they consented.

Protocols for prevention of COVID-19 was fully adhered to: social distancing and wearing of face mask during interview by the interviewer and the respondents. Respondents who did not have approved face masks were supplied with FDA approved face mask in order to protect both respondent and interviewer from the risks of COVID-19. Clients and data collectors ensured the use of masks throughout the data collection period.

In addition, respondents were educated on prevention of COVID-19, including the need to avoid crowds and observe all WHO approved protocols. This was so due to the increased risk due to their pregnant states.

3. Results

3.1. Sociodemographic and Obstetric Characteristics

From Table 1, 52.7% of the respondents were aged 20-30 years. The mean age was $27.84 \pm 6.52SD$. Ages ranged from 15- 46 years. Most of the ANC clients interviewed started ANC at first trimester (58.1%). Up to 15.5% of the mothers had tertiary education at the time of the study.

Table 1. Demographic and obstetric characteristics of respondents.

Demographic and Obstetric Characteristics	Sub Group	Proportion (N=258)	Percentage (%)
Age Group	UP to 19 years	32	12.4
	20-30 years	136	52.7
	31-40 Years	85	32.9
	41 and above	5	1.9
Gravida	1 (Primigravida)	79	30.6
	2-3 (Multigravida)	136	52.7
	Four and above (Grand Multigravida)	43	16.7
Age at ANC Registration	First Trimester	150	58.1
	Second trimester	87	33.7
	Third Trimester	21	8.1
Occupation	Artisan	30	11.6
	Trader	105	40.7
	Public Servant	45	17.4
	Housewife	20	7.8
	Unemployed	41	15.9
	Farmer	14	5.4
	Other	3	1.2
	Trader	98	38.0
	Artisan	50	19.4
	Public Servant	56	21.7
Partner occupation	Farmer	45	17.4
	Others	8	3.1
	Missing	1	0.4
	None	19	7.4
Educational Level	Basic	116	45.0
	Secondary	83	32.2
	Tertiary	40	15.5
	Rural	128	49.6
Residence of respondent	Urban	71	27.5
	Peri-Urban	59	22.9
	Christianity	196	76.0
Religious Affiliation	Muslim	48	18.6
	Tradition	13	5.0
	Others	1	0.4
	None	20	7.8
Educational Level of Partner	Basic	98	38.0
	Secondary	81	31.4
	Tertiary	59	22.9

Source: Field Data, 2020

3.2. Knowledge on IFA Supplementation

From Table 2, 10.5% of respondents had high level knowledge on IFA supplementation, while 9.7% had low level of knowledge.

Table 2. Level of ANC client's knowledge on IFA supplementation.

Knowledge Level	Proportion	Percentage
Low Knowledge	25	9.7
Satisfactory Knowledge	206	79.8
High Knowledge	27	10.5
Total	258	100.0

Source: Field Data, 2020

3.3. Compliance with IFA Supplementation

From the table 3, majority (67.1%) of respondents missed their IFA at least once in the two weeks prior to the data

collection. Fifty-Seven per cent (57%) of the respondents said they sometimes forget to take their drugs along when they travelled. Sixty-four percent (64%) of the respondents forget to take their IFA tablets the day before data collection.

Based on the scale used, where a score of less than 5 was complying with IFA supplementation. deemed non-compliant, 61.6% of respondents were not

Table 3. Compliance on IFA supplements.

Question on Compliance	Response	Proportion	Percentage
Do you sometimes forget to take your IFA tablets?	Yes	111	43.0
	No	147	57.0
In the past 2 weeks, were there times you did not take your IFA?	Yes	85	32.9
	No	173	67.1
Did you stop taking IFA due to adverse events or side effects	Yes	75	29.1
	No	183	70.9
	Yes	114	43.0
When you travel, do you sometimes forget to take your IFA with you?	No	144	55.8
	Yes	165	64.0
Did you take your IFA tablets yesterday or the day before	No	93	36
	Yes	102	39.5
When you don't feel sick, do you stop taking your IFA?	No	156	60.5
	Yes	85	32.9
Do you feel fed-up about sticking to taking same medicines everyday	No	173	67.1
	Sometimes or All the times	145	56.2
How often do you have difficulty remembering to take your IFA?	Never/Rarely	113	43.8
	Compliant	99	38.4
Over all Compliance	Non-compliant	159	61.6

Source: Field Data, 2020

3.4. Factors Influencing Compliance

Chi square test of association analysis was carried out and the results showed that only Knowledge (p-value 0.010) and Gravida (p-value 0.025) had statistically significant influence on compliance, from Table 4. Compliance was highest among those with satisfactory knowledge on IFA and lowest among those with low knowledge.

Table 4. Factors affecting Compliance of IFA supplementation.

Factor	Compliance				p value
	No.	(%)	Yes	(%)	
Age Group					
UP to 19 years	18	(56.25)	14	(43.75)	0.414
20-30 years	89	(65.44)	47	(34.56)	
31-40 Years	48	(56.47)	37	(43.53)	
More Than 40 Years	4	(80.00)	1	(20.00)	
Gestational Age					
1st Trimester	42	(63.64)	24	(36.36)	0.743
2nd Trimester	65	(63.11)	38	(36.89)	
3rd Trimester	52	(58.43)	37	(41.57)	
Gravida					
1 (Primagravida)	58	(73.42)	21	(26.58)	0.025
2-3 (Multigravida)	81	(59.56)	55	(40.44)	
4+ (grand Multigravida)	20	(46.51)	23	(53.49)	
Educational Level					
None	11	(57.89)	8	(42.11)	0.762
Basic	68	(58.62)	48	(41.38)	
Secondary	54	(65.06)	29	(34.94)	
Tertiary	26	(65.00)	14	(35.00)	
Marital Status					
Married	121	(59.31)	83	(40.69)	0.298
Single	34	(69.39)	15	(30.61)	
Divorced/Widow	4	(100.00)	1	(25.00)	
Occupation					
Trader	62	(59.05)	43	(40.95)	0.29
Artisan	15	(50.00)	15	(50.00)	
Public Servant	28	(62.22)	17	(37.78)	
Unemployed	46	(71.88)	18	(28.13)	
Farmer	8	(57.14)	6	(42.86)	
Partner Educational Level					

Factor	Compliance				p value
	No.	(%)	Yes	(%)	
None	14	(70.00)	6	(30.00)	0.729
Basic	59	(60.20)	39	(39.80)	
Secondary	52	(64.20)	29	(35.80)	
Tertiary	34	(57.63)	25	(42.37)	
Level of Knowledge					0.01
Low	22	(88.00)	3	(12.00)	
Satisfactory	119	(57.77)	87	(42.23)	
High	18	(66.67)	9	(33.33)	
ANC Registration Age					0.084
1st	101	(67.33)	49	(32.67)	
2nd Trimester	47	(54.02)	40	(45.98)	
3rd Trimester	11	(52.38)	10	(47.62)	

Dependent variable: Compliance with IFA, criterion level =.05

From Table 5, it can be seen that pregnant women who had more than 3 previous pregnancies were more than 5 times likely to comply with IFA supplementation compared to primigravida (first time pregnant) (AOR-5.88, 95% CI 2.214-15.642).

Table 5. Logistic Regression analysis to identify independent factors affecting compliance.

Variable	UAO	95%CI	AO	95%CI
Gravida				
1 Primigravida	ref		ref	
2-3 Multigravida	2.15	1.007-4.584	3.49	1.425-8.572
4+ Grand Multigravida	3.18	0.004-1.456	5.88	2.214-15.642
Level of Knowledge				
Low	ref		ref	
Satisfactory	5.36	1.555-18.481	5.79	1.549-21.650
High	3.26	0.753-14.116	2.89	0.592-14.100

Dependent variable: Compliance with IFA, criterion level =.05

4. Discussions

In this chapter, the results and findings of the study are discussed in the context of results from other similar studies elsewhere that were reviewed in chapter two of this work. Discussions have been done along the sociodemographic and obstetric characteristics, and the specific objectives of the study. Efforts were made to explain significance and implications of the results obtained.

4.1. Sociodemographic Characteristics of Respondents

Majority (52.7%) of the respondents were between the ages of 20 and 30 years, quite a youthful population, and same percentage were mothers who were multigravida (2-3 pregnancies) but only 1.9% were above 40 years. This conformed to the findings of Appiah et al., (2020) from Juaboso where the majority (44.3%) of respondents were 20-29 years.

The mean age in years was $27.84 \pm 6.52SD$, closer to what pertained in Ethiopia where the mean age was $27.85, \pm 5.1SD$ [15], in Nunumba North district of Ghana where the mean age was $27.89, \pm 7.17SD$ [16], Juaboso district in Ghana, where a mean age of $24.4, \pm 2.6SD$ was reported, South Ethiopia where $25.7 \pm 4.2SD$ was the mean age [17] and India with a mean age of 25.8 ± 4.1 [18] and 23.49 [19].

Interestingly only 5 (1.93%) of the respondents were above the age of 40, lower than what was reported from Nunumba North as 4.8% for mothers above 40 years [16],

and also lower than the findings in Juaboso where 11.2% were 40 years or older [14]. On the other hand, this finding was very high compared to that of West Bengal, India where the highest age was 35 years [19]. This is basically because most women above 40 years may be approaching menopausal age where fertility may be naturally reduced.

More than half of the respondents started ANC during first Trimester. This showed that among the study group, initiation of ANC visits was early enough among majority of them. This could be due to the youthful ages of majority of the respondents. The gestational age at initiation of ANC among respondents of this study comes closer to the Nunumba study where 51.4% of the respondents started ANC in the first trimester [16] and the Ethiopian study where 56% started during trimester one [15], but very far from the Indian district of West Bengal where 90% initiated ANC in their first trimester [19]. Early initiation of ANC among this study population was a very important situation in the Bekwai Municipality, towards achieving the minimum of 4 ANC visits during pregnancy.

Also, the fact that only 7.4% of the respondents had no form of education could also influence the early initiation of ANC visits. The level of illiteracy from this study (7.4%) was lower than what pertained in Juaboso where 18.2% did not have any form of education [14] and Southern Ethiopia where 89.3% of 317 pregnant women did not have any formal education [20].

This meant that the proportion of mothers with education was very high, an indication that they could read on their

own, materials supplied them during ANC sessions.

Majority (40%) of the respondents were traders, followed by Public Servants (17.4%). Also, 15.9% of the were unemployed. This reveals that majority of them had means of generating incomes for themselves and their family. It was therefore possible for majority of them to travel regularly to their preferred health facility on regular basis for antenatal services. It must be noted also that more than 15% of them who were unemployed would require some financial support from spouses and other family members to enable them to travel regularly for antenatal clinics. For this group of mothers, a government policy to cater for the cost would always be useful. Interestingly majority of their spouses (38%) were traders and public servants (21.7%). This gives some indication that spouses could support the partners. No spouse of the respondents was unemployed.

4.2. Knowledge of Pregnant Women on IFA Supplementation

Overall, 92.28% of the respondents had good knowledge (Satisfactory and High). This could be inferred from the fact that majority of respondents had some form of basic education. Also, during monthly sessions, pregnant women are educated on services. As much as 92.6% of the respondents had at least basic education. This knowledge level was a positive finding. It conforms to what pertained in Ethiopia which was reported as 94% [21], closer to that of Ablekuma which was 78% [22] and that of Juaboso district, Ghana which was 71.9% [14] and 78% in Ethiopia [15] but quiet higher than what was reported from Eritrea, 59.89% [23], Kenya, 67.3% [24] Ethiopia, 57.3% [25], 53.6% [20] and in Nanumba North 51.4% [16] and Tamale Ghana which was about half [26]. The difference and or similarity in knowledge levels could be related the educational levels in the various studies.

This knowledge level holds the prospect for improvement on the programme. It is therefore very essential that health workers and other household members continue to take advantage of ANC services to counsel and educate pregnant women on the importance of IFA supplementations and the dangers of non-compliance. Knowledge of IFA could be obtained through ANC attendants. Since this study sampled only ANC attendants, it was not surprising that knowledge was high. This is because regularly, health workers educated their clients either as a group or one on one through ANC sessions. The clinics had audio visuals for various forms of education which were encouraging. The combined maternal and child health booklets given to ANC registrants during registration had adequate information on pregnancy related factors, including anaemia and its prevention.

More than 90% of the respondents had some form of education, compared to 90.3% who had adequate knowledge which is expected to impart on compliance positively. This meant that reading materials could be used for education among ANC clients with little or no difficulty. This if done regularly could improve the knowledge level of the mothers, with regards to iron and folic acid supplementations.

4.3. The Level of Compliance with IFA Supplementation Among Pregnant Women

From the results, Compliance was 38.8% among the respondents. This meant about 61% of them did not take their medications as expected. This also meant that the expected impact of the programme was not likely to be fully met among the population. This compliance level is lower than what was reported in India as 61.7% [27] and 47.1% reported in Ethiopia [28], 58% in Nepal [29], 43.1% [25] and 52.9% [30] in Ethiopia.

Also, this study results fell below other studies. For example, 71.4% in Ghana using the MMAS-8 [31], 68.9% in Niger among those receiving IFA tablets [32], 82% in Vietnam [33] and 64.% [34], 70% [23], and 81.74 [19] all in India. Also in South Africa, a very higher (93%) compliance was reported [35].

However, it was higher than 20.3% in North West Tanzania [36], This was also far better than the outcome of the hospital based study in Uganda where compliance was 11.6% [37]. It was also consistent with 38% [38].

Given that IFA supplements are free in the Bekwai Municipality, and this study sampled only ANC attendants, the compliance was seen to be low. This may account for the persistent non-achievement of the target of reducing anaemia prevalence to below 25% among the pregnant women. It can be inferred that some pregnant women just come for the tablets and fail to swallow them at home for various reasons.

From the results, 64% of the respondents did not take their IFA tablets the day before the data collection. This was better than what pertained in Ablekuma South, where 43.7% of respondents did not take the medication the day before meeting data collectors. This refers to the eve of attending ANC. The results showed that despite remembering to attend ANC, pregnant mothers still could not remember to take their IFA as required. Forgetfulness on the part of many pregnant women could account for this. This could be the reason for persistent high anaemia in pregnancy despite the continuous supply of IFA tablets. It is worthy to note that compliance was high among those with adequate knowledge on the supplementation and those who had previously delivered before this encounter.

The factors which mitigated against compliance among the study population included forgetfulness and feeling worse. A total of 57% of the respondents said they sometimes forgot to take their IFA tablets, while more 70% said they were feeling worse when IFA tablets are taken. This is similar to the findings of the Tamale study where forgetfulness and side effects were cited as barriers to compliance [26].

The level of compliance was expected to have been higher among ANC attendants, given that their supplements are distributed during ANC. It is therefore likely that a community-based study which may include non-attendants to ANC may be lower.

Again, the difference in compliance levels in different jurisdictions could be related to demographic differences, and how the supplementations is made available. Why some

jurisdictions like Ghana, supply ANC attendants with free IFA, others expect clients to buy either in the facility or from outside the facility- commercial outlets. In areas where payment were expected from some clients for ANC services or IFA tablets, compliance has been lower, example in Niger where compliance was estimated at 29.8% [32].

A possible explanation to the differences in compliance could also be related to the methods of assessing same. Pill count, interview using MMAS-8 [39] or other non-standardized tools could give different levels of compliance among similar study groups.

It was not clear if there were strategies by service providers to ascertain the compliance status of ANC attendants during visits. What was clear was that monthly re-supplies were made and no specific data was collected on compliance from the mothers. In some instances, mothers were just supplied the supplements without any key message.

4.4. Factors Influencing Compliance with IFA Among Pregnant Women

It could be seen that compliance was lowest among pregnant women above 40 years, but highest among women under 20 years. The proportion of complaint mothers increased as their aged increased from 20-30 years to above 30, but sharply decreases above 40. For the aged mothers, compliance was lowest. This could be attributed to stress associated to aging, including the raising up family at that age. The differences in compliance due to age was however not statistically significant as the *p-value* was 0.414. It did not also reveal an increasing or decreasing trend. This was in sharp contrast to what pertained in Eritrea and Nigeria where age was identified to significantly affect compliance in bivariate analysis [23, 40].

On gestational age at ANC registration, the results clearly showed an increasing trend of IFA compliance. Women who registered in the third trimester complied more (41.57%) compared to those who started at trimester 2 (36.89%) and trimester 1 (36.36%). This suggested that the earlier mothers registered for ANC, the lower the compliance of IFA compliance, contrary to other studies. This observed difference was however not statistically significant and was more likely due to chance. This was at variance with what pertained in Ethiopia where gestational age at ANC registration was a statistically significant factor [25]. In this study, early registration was seen to increase compliance significantly. This study also contradicted the work of [40, 15] which both identified one of the positive predictors of compliance as early initiation of ANC services.

From my point of view, early registration and initiation of ANC services even if not directly influencing compliance, should be encouraged as it can serve as a means to receive more counselling and other services before delivery. This can ensure that the minimum number of visits can be achieved before delivery.

The results showed a clear increasing trend in compliance as the number of pregnancies by the mother increased. Primigravid mothers had lower (26.58%) compliance rate

than multi-gravida mother (40.44%). Grand Multigravida mothers had the highest percentage of compliance (53.49%). Bivariate analysis also showed these observed differences was statistically significant. This can be linked to experience with previous pregnancy. Women had become pregnant previously probably understood the rationale for the programme better and as such had a better understanding of the risk factors. It could also be that they had experience previous challenges with their pregnancy and child birth which was linked to anaemia and IFA supplementation. This means that special attention must be given to primigravid mothers who register for ANC. Improved counselling should be targeted at them. The significant effect of gravida on IFA compliance is meaningful. This is because experience in previous pregnancies, coupled with the likelihood of more counselling sessions in previous encounters could be linked to high knowledge which is also significantly linked to compliance. In other words, the more one encounters the ANC services, the more likelihood of getting educated and consequently, comply more.

From the bivariate analysis, Gravida (*p-value* 0.02) was significantly associated with compliance of IFA among pregnant women. Gravida was seen to independently affect compliance. Women who had more than 3 pregnancies were about 6 times more likely to adhere to IFA than first time pregnant women (AOR= 5.88, 95% CI= 2.214-15.542).

Surprisingly, educational status did not show any significant influence on compliance. This is a deviation from several studies (*p-value* 0.729). Contrary to the findings in Southern Nigeria [39], Ethiopia [15] and Iran [42] where education was a significant factor, this study did not. Another contradictory report was from the study of 22 African States [43]. It reported that education could increase compliance by not less than 17%. Also in Kenya, a study of 384 women revealed a significant association of IFA compliance and level of education [44].

Education can however influence knowledge, which may have an influence on compliance. While education did not directly influence compliance from this study, knowledge did.

Knowledge about IFA was seen to be a significant positive predictor of IFA compliance among mothers. While only 12% of mothers with low knowledge complied, more than 33% of those with knowledge complied. With a *p-value* of 0.01, knowledge was identified as a significant statistical factor that can positively predict compliance. From the results, it could be seen that increasing knowledge could increase compliance by more than 5 times, compared to those without knowledge (AOR 5.79 95%CI: 0.592-14.100). This study conforms to the Ethiopian studies (meta-analysis) that revealed that knowledge could improve compliance by 2 fold [40]. Sendeku et al also found knowledge to be significant in determining compliance [45].

In agreement with this study, other studies also found out knowledge of pregnant women studied as a significant factors influencing compliance in Ethiopia [46, 28, 25], Eritrea [23] and in Kenya [24].

This study revealed an interesting trend of compliance

with regards to marital status. From Table 4, compliance among married women was more than 60%, followed by single mothers (30.61%). Divorced or widowed mothers had the lowest compliance level of 25%.

This could be explained in terms of the likelihood of spousal support during ANC. Married women could receive financial support to travel for ANC, and could be reminded frequently to take their medication if they stay with their spouses. Single mothers may not get this intimacy. However, the observed difference was not statistically significant.

Overall, two factors were found out to positively affect compliance with statistical significance. By this results, health education and counselling could help improve adherence and compliance of ANC attendants to IFA supplementations. Health educated individuals would know the essence of the supplementation programme, in addition to the effect of non-compliance. This would ensure that they take their medications regularly.

Factors that likely negatively affected compliance included forgetfulness and side effects. As much as 57% of respondents said they sometimes forgot to take their tablets, while 70.9% stopped taking their tablets when they began to feel worse. Staying alone could likely contribute to forgetfulness, as partners may not be available to remind them constantly. Compared to the study in West Bengal, where the proportion of respondents who reported forgetfulness was 73.3% [2], this figure looks lower.

This phenomenon could be linked to the occupation of respondents, stresses related to pregnancy and probably job schedules. Also taking the tablets at different times of the day could contribute to forgetfulness. This was likely to confuse the woman. These two factors were confirmed simultaneously in several studies. For example, the Ethiopian study among pregnant women. Women attributed their forgetfulness to their occupation. Mostly farmers (crops or livestock) attributed their compliance to their job, and the schedule with other medications, in this case calcium. Other factors cited included attending social events such as Churches and weddings [47]. Another Ethiopian study cited forgetfulness and side effects as causes of non-compliance [15].

Also in Yaoundé, Cameroun, these were included in the factors identified as working against compliance [48]. Other studies which identified these two factors simultaneously in their findings included Boti *et al* [20], Nasir *et al.*, [15] all in Ethiopia and Lyoba *et al.*, [36] in Tanzania. Others included Siabani *et al* [49] in Iran and Singh *et al.*, [50]. in India. It is therefore imperative that service providers adopt strategies to mitigate against forgetfulness and side effects in the program.

Forgetfulness could be addressed if adherence partners strategy could be adopted [51]. Chourasia *et al.*, [52]. reported in their study that if mothers were accompanied by their spouses to ANC, compliance to IFA could be doubled. It will not be out place to encourage partners to accompany their spouses to ANC so that they could be educated together on the benefits of IFA supplementation. Husbands could then easily serve as effective and informed adherence partners for their spouses throughout their pregnancy and even thereafter.

If pregnant women stop taking their tablets when they feel worse, then there was more to do with client counselling during ANC. In fact, if clients were educated on side effects and what to do when they experience same, they may not likely stop taking the tablets when they felt worse. They would rather appreciate that the side effects could be transient and manageable and that the benefits of the supplements could far out-weigh the effects of adverse reactions. Again, side effects could be coincidental and as such needed to be professionally managed. Not all observed effects could be the results of the IFA. Other underlying obstetric factors could be responsible for some observed adverse effects. Vomiting, is sometimes associated with pregnancy and could be wrongly attributed to IFA.

A surveillance system to identify, collate and report side effects for effective response could help in this regard since this problem is most widespread. On monthly basis, health care providers may have to find out from mothers if they experienced any side effects attributed to their medications. These should be routinely aggregated and reported for independent investigations to identify the magnitude, attribution and then find solutions to mitigate against this phenomenon. This way, they could be a holistic approach to addressing the issues of side effects which generally hinder the progress of the programme.

Another factor that could be the reason for lower adherence may be the perception that medications are for the treatment of the sick. This could be a very unfortunate perception. This would mean that healthy looking individuals had no business taking tablets on daily basis. This perception is very negative and may hinder on many preventive health interventions that require medication, if not addressed. This is expected to be addressed by regular counselling and health education during ANC sessions, where mothers would be made to appreciate the fact that IFA supplementation is a preventive therapy and that all pregnant women needed it.

5. Conclusion

The study sought to assess the factors influencing compliance with Iron Folic acid (IFA) supplementation among pregnant women in the Bekwai Municipality. Despite the high level of knowledge on IFA supplementation among pregnant women in the municipality, the level of compliance was low (38.8%). This implies that knowledge does not necessarily translate into practice. However, it is worth noting that majority of respondents (79.8%) had satisfactory knowledge whereas only (10.5%) had high level of knowledge.

Factors that contributed positively to compliance of IFA supplementation with statistical significance included Gravida and Knowledge on pregnant women on IFA. Therefore, the Municipal Health Directorate should take steps to educate pregnant women about the importance of IFA supplementation, especially primigravid women. This will play a significant role in scaling up the level of compliance with IFA among pregnant women in the municipality.

References

- [1] (United States Agency for International Development, "A rapid Initial Assessment of the Distribution and Consumption of Iron-Folic Acid Tablets Through Antenatal Care in Ghana," 2019, [Online]. Available: <https://www.spring-nutrition.org/publications/briefs/iron-folic-acid-ass..>
- [2] WHO, "e-Library of Evidence for Nutrition Actions (eLENA) Daily iron and folic acid supplementation during pregnancy," WHO Recommendation, 2019. https://www.who.int/elena/titles/daily_iron_pregnancy/en/.
- [3] World Health Organization, "The global prevalence of anaemia in 2011," WHO, 2015..
- [4] WHO, "WHO recommendations on antenatal care for a positive pregnancy experience." p. 14, 2016, doi: 10.1192/bjpp.111.479.1009-a.
- [5] J. P. Pena-Rosas, L. M. De-Regil, M. N. Garcia-Casal, and T. Dowswell, "Daily oral iron supplementation during pregnancy," *Cochrane Database Systematic Rev.*, no. 7, 2015, doi: 10.1002/14651858.CD0047...
- [6] T. G. Sanghvi, P. W. J. Harvey, and E. Wainwright, "Maternal iron-folic acid supplementation programs: evidence of impact and implementation," *Food Nutr. Bull.*, vol. 31, no. 2 Suppl, pp. S100-7, Jun. 2010, doi: 10.1177/15648265100312S202.
- [7] A. Bilimale, J. Anjum, H. N. Sangolli, and M. Mallapur, "Improving adherence to oral iron supplementation during pregnancy," *Australas. Med. J.*, vol. 1, no. 5, pp. 281-290, 2010, doi: 10.4066/AMJ.2010.291.
- [8] R. G. Viveki, A. B. Halappanavar, P. R. Viveki, S. B. Halki, V. S. Maled, and P. S. Deshpande, "Prevalence of Anaemia and Its Epidemiological Determinants in Pregnant Women," *Al Ameen J. Med. Sci.*, vol. 5, no. 3, pp. 216-223, 2012.
- [9] G. Abel and A. Mulugu, "Prevalence of Anemia and Associated Factors among Pregnant Women in North Western Zone of Tigray, Northern Ethiopia: A Cross-Sectoral Study," *J. Nutr. Metab.*, vol. 2015, pp. 1-12, 2015, [Online]. Available: <https://www.hindawi.com/journals/jnme/2015/165430/>.
- [10] Ghana Health Service, "2016 Annual Report," 2017. doi: 10.1136/bjo.2010.193169.
- [11] GHS, "Ghana Health Service Annual Report," 2017.
- [12] Bekwai Municipal Health Directorate, "2018 Annual Report," 2019.
- [13] W. G. Cochran, *Sampling Techniques*, 3rd ed. New York: John Wiley & Sons, 1977.
- [14] K. P. Appiah, D. Nkuah, and B. A. Duut, "Knowledge of and Adherence to Anaemia Prevention Strategies among Pregnant Women Attending Antenatal Care Facilities in Juaboso District in Western-North Region, Ghana," *J. Pregnancy*, vol. 2020, pp. 1-8, 2020, doi: 10.1155/2020/2139892.
- [15] B. B. Nasir, A. M. Fentie, and M. K. Adisu, "Adherence to iron and folic acid supplementation and prevalence of anaemia among pregnant women attending antenatal care clinic at Tikur Anbessa Specialized Hospital, Ethiopia," *PLoS One*, vol. 15, no. 5, 2020.
- [16] M. Atoobey, "Iron and Folic Acid Supplementation and Compliance Among Pregnant Women in Nanumba North District of Northern Region, Ghana," Kwame Nkrumah University of Science and Technology, 2019.
- [17] Z. Y. Kassa, T. Awraris, A. K. Daba, and Z. Tenaw, "Compliance with iron folic acid and associated factors among pregnant women through pill count in Hawassa city, South Ethiopia: A community based cross-sectional study," *Reprod. Health*, vol. 16, no. 1, Feb. 2019, doi: 10.1186/s12978-019-0679-8.
- [18] P. Mithra *et al.*, "Compliance with Iron-folic acid (IFA) therapy among pregnant women in an urban area of South India," *Afr. Health Sci.*, vol. 14, no. 1, p. 255, Mar. 2014, doi: 10.4314/ahs.v14i1.39.
- [19] S. Debi, G. Basu, R. Mondal, S. Chakrabarti, S. K. Roy, and S. Ghosh, "Compliance to iron-folic-acid supplementation and associated factors among pregnant women: A cross-sectional survey in a district of West Bengal, India with," *India. J Fam. Med Prim Care*, vol. 9, pp. 3632-8, 2020, doi: 10.4103/jfmprc.jfmprc.
- [20] N. Boti *et al.*, "Adherence to Iron-Folate Supplementation and Associated Factors among Pastoralist Pregnant Women in Burji Districts, Segen Area People's Zone, South Ethiopia: Community-Based Cross-Sectional Study," *International J. Reprod. Med.*, vol. 2018, pp. 1-8, 2018, doi: 10.1155/2018/2365362.
- [21] G. T. Gebrehiwot, H. Hansa, and T. G. Gereziher, "Time to start and adherence to iron-folate supplement for pregnant women in antenatal care follow up; Northern Ethiopia," *Patients Prefer Adherence*, vol. 13, pp. 1057-1063, 2019, doi: 10.2147/PPA.S184168.
- [22] D. Patience, "Knowledge and perception of risk of anaemia during pregnancy among pregnant women in Ablekuma South." University of Ghana, 2016.
- [23] M. Getachew, M. Abay, H. Zelalem, T. Gebremedhin, T. Grum, and A. Bayray, "Magnitude and factors associated with adherence to Iron-folic acid supplementation among pregnant women in Eritrean refugee camps, northern Ethiopia," *BMC Pregnancy Childbirth*, vol. 18, no. 1, Apr. 2018, doi: 10.1186/s12884-018-1716-2.
- [24] M. W. Kamau, W. Mirie, and S. T. Kimani, "Maternal knowledge on iron and folic acid supplementation and associated factors among pregnant women in a rural County in Kenya," *Int. J. Africa Nurs. Sci.*, vol. 10, pp. 74-80, Jan. 2019, doi: 10.1016/j.ijans.2019.01.005.
- [25] A. Demis, B. Geda, T. Alemayehu, and H. Abebe, "Iron and folic acid supplementation adherence among pregnant women attending antenatal care in North Wollo Zone northern Ethiopia: Institution based cross-sectional study 11 Medical and Health Sciences 1117 Public Health and Health Services," *BMC Res. Notes*, vol. 12, no. 1, Mar. 2019, doi: 10.1186/s13104-019-4142-2.
- [26] A. Wemakor, H. Garti, M. M. Akai, A. A. Napari, and J. Dankyi-Frimpomaa, "Prevalence and factors associated with compliance to iron and folic acid supplementation in pregnancy in Tamale Metropolis, Ghana," *Nutrire*, vol. 45, no. 2, pp. 1-10, 2020, doi: 10.1186/s41110-020-00120-6.
- [27] A. J. Dutta, P. Patel, and R. K. Bansal, "COMPLIANCE TO IRON SUPPLEMENTATION AMONG PREGNANT WOMEN: A CROSS SECTIONAL STUDY IN," *Natl. J. Community Med.*, vol. 5, no. 4, pp. 457-462, 2014.

- [28] H. Assefa, S. M. Abebe, and M. Sisay, "Magnitude and factors associated with adherence to Iron and folic acid supplementation among pregnant women in Aykel town, Northwest Ethiopia," *BMC Pregnancy Childbirth*, vol. 19, no. 1, p. 296, 2019, doi: 10.1186/s12884-019-2422-4.
- [29] K. D. Yadav, U. N. Yadav, R. R. Wagle, D. N. Thakur, and S. Dhakal, "Compliance of iron and folic acid supplementation and status of anaemia during pregnancy in the Eastern Terai of Nepal: Findings from hospital based cross sectional study," *BMC Res. Notes*, vol. 12, no. 1, Mar. 2019, doi: 10.1186/s13104-019-4167-6.
- [30] T. Molla, T. Guadu, E. A. Muhammad, and M. T. Hunegnaw, "Factors associated with adherence to iron folate supplementation among pregnant women in West Dembia district, northwest Ethiopia: A cross sectional study," *BMC Res. Notes*, vol. 12, no. 1, 2019, doi: 10.1186/s13104-019-4045-2.
- [31] H. E. kofi Kordorwu, "Factors Associated with Anaemia in pregnancy among Antenatal Care Attendants in Keta Municipality," University Of Ghana, 2018.
- [32] K. Begum *et al.*, "Prevalence of and factors associated with antenatal care seeking and adherence to recommended iron-folic acid supplementation among pregnant women in Zinder, Niger," *Matern. Child Nutr.*, vol. 14, Feb. 2018, doi: 10.1111/mcn.12466.
- [33] I. Gonzalez-Casanova *et al.*, "Predictors of adherence to micronutrient supplementation before and during pregnancy in Vietnam," *BMC Public Health*, vol. 17, no. 1, May 2017, doi: 10.1186/s12889-017-4379-4.
- [34] P. Mithra *et al.*, "Compliance with iron-folic acid (IFA) therapy among pregnant women in an urban area of south India," *Afr. Health Sci.*, vol. 13, no. 4, pp. 880–885, 2013, doi: 10.4314/ahs.v13i4.3.
- [35] X. Mbhenyane, M. Cherane, and H. Nutrition, "Compliance with the consumption of iron and folate supplements by pregnant women in Mafikeng local municipality, North West province, South Africa," *Afr. Health Sci.*, vol. 17, no. 3, pp. 657–670, 2017, doi: 10.4314/ahs.v17i3.8.
- [36] W. Lyoba, J. Mwakatoga, C. Festo, ... J. M.-I. J. of, and U. 2020, "Adherence to Iron-Folic Acid Supplementation and Associated Factors among Pregnant Women in Kasulu Communities in North-Western Tanzania," *Int. J. Reprod. Med.*, vol. 2020, p. 11, 2020, doi: <https://doi.org/10.1155/2020/3127245> Research.
- [37] T. S. Kiwanuka, S. Ononge, P. Kiondo, and F. Namusoke, "Adherence to iron supplements among women receiving antenatal care at Mulago National Referral Hospital, Uganda-cross-sectional study," *BMC Res. Notes*, vol. 10, no. 1, 2017, doi: 10.1186/s13104-017-2834-z.
- [38] T. M. Birhanu, M. K. Birarra, and F. A. Mekonnen, "Compliance to iron and folic acid supplementation in pregnancy, Northwest Ethiopia," *BMC Res. Notes*, 2018, doi: 10.1186/s13104-018-3433-3.
- [39] D. Morisky, L. Green, & D. Levine, "Morisky Medication Adherence Scales: MMAS-8. www.the.nationalcouncil.org/wp-1986."
- [40] N. G. Onyeneho, N. I'Aronu, N. Chukwu, U. P. Agbawodikeizu, M. Chalupowski, and S. V. Subramanian, "Factors associated with compliance to recommended micronutrients uptake for prevention of anemia during pregnancy in urban, peri-urban, and rural communities in Southeast Nigeria," *J. Health. Popul. Nutr.*, vol. 35, no. 1, 2016, doi: 10.1186/s41043-016-0068-7.
- [41] M. Desta *et al.*, "Adherence of iron and folic acid supplementation and determinants among pregnant women in Ethiopia: A systematic review and meta-analysis," *Reproductive Health*, vol. 16, no. 1. BioMed Central Ltd., Dec. 21, 2019, doi: 10.1186/s12978-019-0848-9.
- [42] S. Soraya, S. Sina, S. Hossien, M. A. Marjan, R. Fateme, and B. Maryam, "Determinants of Compliance With Iron and Folate Supplementation Among Pregnant Women in West Iran: A Population Based Cross- Sectional Study," *J. Fam. Reprod. Heal.*, vol. 12, no. 4, pp. 197–203, 2018, [Online]. Available: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6581656/>.
- [43] D. M. Ba *et al.*, "Adherence to Iron Supplementation in 22 Sub-Saharan African Countries and Associated Factors among Pregnant Women: A Large Population-Based Study," *Curr. Dev. Nutr.*, vol. 3, no. 12, p. nzz120, Oct. 2019, doi: 10.1093/cdn/nzz120.
- [44] H. M. Nge'the and C. Muthui, "Effects on non-compliance to iron, folic acid supplementation during pregnancy," *J. Food, Nutr. Popul. Heal.*, vol. 2, 2018.
- [45] F. W. Sendeku, G. G. Azeze, and S. L. Fenta, "Adherence to iron-folic acid supplementation among pregnant women in Ethiopia: A systematic review and meta-analysis," *BMC Pregnancy Childbirth*, vol. 20, no. 1, Mar. 2020, doi: 10.1186/s12884-020-2835-0.
- [46] Z. Y. Kassa, T. Awaris, A. K. Daba, and Z. Tenaw, "Compliance with iron folic acid and associated factors among pregnant through pill count in Hawassa city, South Ethiopia: a community based cross-sectional study," *Reprod. Health*, vol. 16, no. 14, 2019, [Online]. Available: <https://reproductive-health-journal.biomedcentral.com/articles/10.1186...>
- [47] G. C. Klemm *et al.*, "Integrating Calcium Into Antenatal Iron-Folic Acid Supplementation in Ethiopia: Women's Experiences, Perceptions of Acceptability, and Strategies to Support Calcium Supplement Adherence," *Glob. Heal. Sci. Pract.*, vol. 8, no. 3, pp. 413–430, 2020, doi: 10.9745/GHSP-D-20-00008.
- [48] F. Y. Fouelifack, D. J. Sama, and C. E. Sone, "Assessment of Adherence to iron supplementation among pregnant women in the Yaounde gynaecolo-obstetric and paediatric Hospital," *Pan Afr. Med. J.*, vol. 34, no. 211, 2019, doi: 10.11604/pamj.2019.34.211.16446.
- [49] S. Siabani, M. M. Arya, F. Rezaei, and S. Siabani, "Determinants of Adherence to Iron and Folate Supplementation among Pregnant Women in West Iran: A Population Based Cross-Sectional Study," *Qual. Prim. Care*, vol. 25, no. 3, pp. 157–163, 2017.
- [50] G. Singh, M. Lal, and S. Singh, "Utilization of iron folic acid tablets among pregnant women in rural Punjab: an interventional study," *Int. J. community Med.*, vol. 7, no. 4, pp. 1307–1312, 2020, doi: <http://dx.doi.org/10.18203/2394-6040.ijcmph20201033>.
- [51] S. L. Martin *et al.*, "Adherence partners are an acceptable behaviour change strategy to support calcium and iron-folic acid supplementation among pregnant women in Ethiopia and Kenya," *Matern. Child Nutr.*, vol. 13, no. 3, Jul. 2017, doi: 10.1111/mcn.12331.
- [52] A. Chourasia, C. M. Pandey, and A. Awasthi, "Factors influencing the consumption of iron and folic acid supplementations in high focus states of India," *Clin. Epidemiol. Glob. Heal.*, vol. 5, no. 4, 2017, doi: 10.1016/j.cegh.2017.04.004.