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# Predictors of optimum antenatal iron-folate supplementation in a low resource rural set-up in Eastern Kenya

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**There is depressed prevalence of the optimum iron-folate supplementation in Kenya and in other sub-Saharan Africa countries. The study was motivated by the paucity of area-specific data on predictors of optimum iron-folate supplementation. The aim of the study was to assess the maternal, knowledge and institutional factors that predict 90+ days (optimum) iron-folate supplementation among pregnant women in a rural set-up in Eastern Kenya. A descriptive cross-sectional study to collect quantitative data from 352 mothers of under-five years old children attending 7 health facilities in Kalama Division of Machakos constituency within Machakos County in lower Eastern Kenya. Using a standard questionnaire, mothers recalled the number of days they had ingested iron-folate supplements in their latest pregnancies. The overall prevalence of optimum supplementation (90+ days) during latest pregnancies was 18.3% and on average the study mothers were supplemented for ~38 days during the antenatal period. Mothers who visited antenatal care (ANC) for ≥4days (odd ratio [OR]: 2.756, 95% confidence interval [CI]: 1.396-5.445) were more likely to take iron-folate supplements for 90+ days and be supplemented for more days (45.8) than <4 days visitors (26.2 days), p=0.017. Earlier ANC visit was associated with the mean days of supplementation (p=0.006), but not with optimum supplementation (OR: 0.412, 95% CI: 0.236-0.719). Knowledge on supplementation for a minimum of 90 days predicted optimum supplementation (OR: 5.872, 95% CI: 2.945 -11.709). Knowledge on when to start supplementation and importance of supplementation only predicted higher days of supplementation (p<0.05), but not the optimum supplementation. Pregnant women who used tablet form were more likely to be supplemented optimally (OR: 1.007, 95% CI: 1.004-1.116). Those who were supplemented with a combined form of supplement were more likely to have more days of supplementation (p=0.004), but not optimum (OR: 1.125, 95% CI: 0.419-3.021) compared to those who used single iron and folate supplement. To increase the proportion of pregnant mothers taking iron-folate supplements for 90+ days in low resource rural set-ups, there should be intensified counselling/education on ANC attendance ≥ 4 times and on minimum number of days for optimum iron-folate supplementation. Use of tablets as opposed to syrup increases the likelihood for antenatal ingestion of iron-folate supplements for 90+ days in rural low-resource set-up.**

**Key words:** Predictors, optimum supplementation, iron-folate supplements, pregnant women.

## INTRODUCTION

Iron and folate supplementation during pregnancy is important for sound maternal health and favourable perinatal outcomes. As pregnancy commences and proceeds, most pregnancy cases show haematological changes suggesting iron and folate deficiency; the haemoglobin and serum iron, serum folate and red cell folate concentrations fall and the total iron binding capacity rises (Mahomed, 2000). The dietary intake of the two elements cannot meet the increased need during pregnancy and this justifies supplementation. At pregnancy, women meet foetal requirements only by drawing upon maternal iron stores (Abu-Saad and Fraser, 2010). The need for folic acid increases during times of rapid tissue growth which during pregnancy includes an increase in red blood cell mass, enlargement of the uterus, and the growth of the placenta and foetus (Bailey, 2000). World Health Organisation (WHO) currently recommends 30 to 60 mg of elemental iron and 400 µg (0.4 mg) of folic acid taken by all pregnant adolescents and adult women, that started as early as possible and taken throughout pregnancy, one supplement a day (WHO, 2012). Kenya is one of the countries that register very low proportions of pregnant women supplemented for at least 90 days during pregnancy. Currently (pending the release of the Kenyan DHS 2014 results), only 2.5% of pregnant women are supplemented for 90+ days (GOK, 2008). In Ethiopia (a neighbouring country to Kenya) this figure stands at 0.4% (Gebremedhin et al., 2014). These are very low coverage figures given that almost half of the women of reproductive age in Kenya for instance, are anaemic (GOK and UNICEF, 1999).

It is apparent that factors that influence or predict optimum supplementation may differ from setting to setting. The understanding of the way these factors influence the days of supplementation as well as optimum supplementation in the different locations is important in informing context specific policy and programming. This understanding will allow for customised iron-folate supplementation strategies to contribute more to improved perinatal outcomes, maternal health, maternal survival, and child health and nutrition. This study assessed the optimum supplementation of iron and folate supplementation and the attendant influencing factors in the low resource rural set-up of Eastern Kenya.

## METHODOLOGY

### Study design and setting

The study employed a descriptive cross-sectional study, utilizing quantitative data collection methods from mothers of under-five years old children attending health facilities for post-natal care. It was conducted in Kalama Division of Machakos constituency that is within Machakos County in lower Eastern part in Kenya. The key variables collected were the number of days of supplementation during the last pregnancy, socio-demographic data, nutrition literacy, antenatal clinic attendance and information on the supplements provided.

### Sample size

A fairly equal representation of mothers with children of different age groups within the under-five's bracket was aimed at. Five groups of mothers were considered: mothers with 0-11 months old children, those with 12-23 months olds, 24-35 months olds, 36-47 months olds and 48-60 months olds. The sample size n, was computed as per the formula by Gibson and Ferguson (1999) to have a representative number from each group. The group representation was to adjust for any change (with time) of government policy or programs related to iron-folate supplementation (Gibson and Ferguson, 1999).

$$n = [(u+v)^2 \times (s_1^2+s_2^2)]/(m_1-m_2)$$

where n=sample size, u=0.64 which corresponds to β for the test of 95% confidence interval, v= 1.94, corresponds to an α of 5% two tailed test, $s_1$= the standard deviation of days of supplementation in one group (a hypothetical 15), $s_2$= the standard deviation of days of supplementation in other one group (a hypothetical 15), $m_1$ and $m_2$= corresponding means of days of iron-folate supplementation. Assuming that the maximum period of supplementation is 90 days and that the minimum is zero, it was assumed that the mean of one group ($m_1$) could be 0 (no supplementation) and other ($m_2$), at 45 days (halfway between 0 and 90 days). Using these assumptions, the sample size of 66 per each of the 5 age groups was arrived at. With a contingency consideration of 5%, a total minimum sample size of 346 mothers of under-five year old children was targeted.

### Sampling of the participants

Mothers were selected from the seven health facilities in the study area. A list of all the seven health facilities offering maternal and child health services in Kalama division was obtained from the district community health nurse. The mean number of mother-child pairs attending the child welfare clinic was obtained for each facility from the facility records. This was used to compute the number to be selected from each of the facility (proportionate-to-size). The proportionating was done per age group. For each day of assessment for each of the health facility, a count of mothers in the waiting bay with children under five years was done by about 9 am when most of the mothers attending post-natal clinic are expected to have arrived. The mothers were then assigned numbers per the age groups of their children which were confirmed from the child clinic cards before assigning the random numbers. Using random tables, mothers corresponding to the randomly selected number per age group were considered for the study. This was done until the target for each of the age group was reached. When the target number per age group was reached in a facility, the selection for the respective group was stopped. If the target per age was not

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reached on the first day, the selection continued for the proceeding days until the target numbers per facility were reached.

### Exclusion criteria

Underage mothers (<18 years of age) were excluded since they could not consent to the survey. Guardians (that is, those who were not mothers of children under five years old) accompanying the children to the health facilities were also excluded.

### Data collected and analysis

The data collection tools were developed in reference to the WHO (2001) safe motherhood assessments tools with some adjustments to suit the study objective. Key data collected included maternal socio-demographic characteristics, maternal knowledge on iron-folate supplementation, and access and use of the iron-folate supplements. The coded data was entered into a Statistical Package for Social Sciences (SPSS) for windows version 17. Student's t-test for independent samples was used to assess the means of supplementation among various groups, while the odds ratio (OR) was used to assess if the exposure (the various factors) was associated with higher odd of the outcome (90+ days of supplementation). Linear regression analysis indicated the correlation between the days of supplementation and some numerical variables.

### Ethical considerations

The research was approved by Great Lakes University ethical research committee. Additional approval was obtained from the National Commission of Science, Technology and Innovation (NACOSTI), Kenya. Anonymity of the study participants was ensured throughout the data collection period. Privacy was also ensured by conducting the interviews in enclosed and sound proof rooms. Only mothers who consented to the study were interviewed.

## RESULTS

### General characteristics of the study participants

The study participants represented a low resource rural population of reproductive age women in Eastern Kenya. The socio-demographic characteristics of study group are summarised in Table 1. Mothers of under-fives considered for the study had a mean age of 28 years old with most being <30 years old. They had a mean number of children of 2. Majority (%) were married Christians and had completed primary school education. Farming was the most common economic pre-occupation among them while engaging in merry-go-round groups as the most common group involvement among the various available options. Majority (~80%) had been supplemented with iron folate during their last pregnancies.

### Maternal factors predicting optimum iron-folate supplementation

Optimal iron-folate supplementation was defined as supplementation for a minimum of 90 days during the course of their last pregnancies as specified by the Demographic Health Survey (GOK, 2008). Table 2 depicts the likelihood of maternal factors influencing the mean days of supplementation and the proportion optimally supplemented. For the mean days of supplementation, the p-values were computed using the Student's t-statistics and p<0.05 indicated a statistical significant difference between the groups compared. The OR>1 (with the lower OR value also >1) indicated that exposure (respective factor) was associated with higher odds of outcome (supplementation for 90+ days). The opposites were true for p<0.05 and OR<1. Those not supplemented at all (20.1%) were not precluded from this analysis.

On average, mean supplementation days was 38 and only 18% were supplemented optimally during their last pregnancy period. Maternal age was neither a determinant for mean days of supplementation nor for the optimum supplementation. Same was true for the number of children (indicative of parity), religion, level of education and income. Those who were married had ingested the supplements for comparable days as the single mothers (p>0.277) and there were no odds for differing proportion of optimum supplementation between the two groups (OR: 1.402; 95% confidence interval [CI]: 0.673-2.922). There was no indication that mothers earning higher income had increased odds for optimum supplementation (OR: 1.402; 95% CI: 0.521-3.771), and the same case was when mothers were salaried (OR: 0.728; 95% CI: 0.404-1.310) as compared to those who were not salaried. Group engagement influenced the days of supplementation but not the odds for optimum supplementation. The gestational age at first antenatal care (ANC) significantly determined the number of days of supplementation (p=0.006), but did not increase the odds for optimum supplementation (OR: 0.412, 95% CI: 0.236-0.719). ANC visit of >4 was associated with both higher mean number of days of supplementation (p=0.000) and the odds for optimum supplementation (OR: 2.756, 95% CI: 1.396-5.445) (Table 2).

For the numerical variables, linear regressions were run with the days of supplementation as dependent variable. Only 1.1% of increase in the days of supplementation could be explained by the increase in number of visits ($r=0.104$, $r^2=0.011$) (Figure 1). About 4.1% of the gestational age at first ANC visit explained the days of supplementation ($r=-0.202$, $r^2=0.041$), while 1.4% of income (US$ per day) explained the days of supplementation ($r=0.118$, $r^2=0.014$). Only 0.1% of days of supplementation was explained by years spent in school by the mothers ($r=0.032$, $r^2=0.001$). There was no relationship between the age of mother days of supplementation ($r=0.04$, $r^2=0.000$) and this was same for the number of children ($r=0.04$, $r^2=0.000$). In all the test independent variables, there was positive correlation (+ve r) and gestational age at first visit at the health facility

**Table 1.** Socio-economic characteristics of the group.

| General characteristic | Proportion/Value (n=352) |
|---|---|
| Mean age in years (SD) | 28.0 (5.4) |
| **Age category (%)** | |
| <30 years | 64.5 |
| >30 years | 34.9 |
| Mean number of children (SD) | 2.2 (1.3) |
| **Marital status (%)** | |
| Single | 19.6 |
| Married (monogamous) | 72.7 |
| Married (polygamous) | 2.8 |
| Widowed | 1.1 |
| Cohabiting | 0.3 |
| Separated | 1.1 |
| **Religion (%)** | |
| None | 4.9 |
| None-Catholic Christian | 69.7 |
| Catholic Christian | 21.1 |
| Muslims | 2.0 |
| Indigenous religion | 2.3 |
| **Attainment of education level (%)** | |
| Primary education and below | 56.5 |
| Secondary education and above | 43.5 |
| **Source of income (%)** | |
| None | 25.0 |
| Farming | 33.5 |
| Self employed | 16.8 |
| Salaried | 9.9 |
| **Group belonging to (%)** | |
| Mother support groups | 17.1 |
| Merry-go-round group | 43.1 |
| Credit group | 6.3 |
| Church group | 24.9 |
| Self-help group | 3.7 |
| Supplemented with iron-folate (%) | 79.1 |

was the most correlated with the number of days of supplementation of all the variables tested (highest $r^2$).

## Maternal knowledge factors

As depicted in Table 3, all the knowledge factors did influence the mean days of supplementation ($p<0.05$). It was only for the knowledge on the minimum length of supplementation that was associated with higher odds for optimum supplementation (OR: 5.872, 95% CI: 2.945-11.709). It was also observed that all types of knowledge positively influenced the days of supplementation (Table 3).

## Institutional and supplements factors

Table 4 shows the association between the institutional factors and supplement factors as related to mean days of supplementation and optimum supplementation. Only those supplemented with iron folate were considered for this analysis. In this group, slightly more than a fifth were

**Table 2.** Maternal factors and supplementation.

| Factors | Mean days of supplementation (n=352) | | Proportion supplemented 90+ days (n=352) | |
|---|---|---|---|---|
| | **Mean days** | **p-value∞** | **Proportion (%)** | **OR (95% CI)[¥]** |
| Overall | 38.1 | - | 18.3 | - |
| **Age of the mother** | | | | |
| <30 years | 38.7 | 0.642 | 20.3 | 0.675 (0.372-1.224) |
| >30 years | 36.2 | | 14.6 | |
| **Number of children** | | | | |
| 1-3 (Primigravidae) | 39.2 | 0.460 | 19.4 | 0.722 (0.322-1.620) |
| >3 (Multigravidae) | 35.0 | | 14.8 | |
| **Marital status** | | | | |
| Single | 33.6 | 0.277 | 14.5 | 1.402 (0.673-2.922) |
| Married (or ever married) | 39.2 | | 19.2 | |
| **Religion (do if the data allows)** | | | | |
| Christian | 42.4 | 0.264 | 22.6 | - |
| Muslims | 25.7 | | 0.0 | - |
| **Education level** | | | | |
| Primary education and below | 11.1 | 0.091 | 24.0 | 0.402 (0.220-0.734) |
| Secondary education and above | 34.2 | | 11.3 | |
| **Employment status** | | | | |
| Salaried | 37.1 | 0.678 | 14.3 | 1.402 (0.521-3.771) |
| No-salaried | 38.9 | | 18.9 | |
| **Income** | | | | |
| <1 US$ a day | 37.1 | 0.509 | 19.9 | 0.728 (0.404-1.310 |
| >1US$ a day | 39.8 | | 15.3 | |
| **Belonging to a mother support group?** | | | | |
| Yes | 27.6 | 0.017 | 19.3 | 0.643 (0.289-1.430) |
| No | 40.2 | | 13.3 | |
| **Number of ANC visits** | | | | |
| ≥4 | 45.8 | 0.000 | 23.6 | 2.756 (1.396-5.445) |
| <4 | 26.2 | | 10.1 | |
| **Gestational age at first ANC visit** | | | | |
| 1st trimester | 45.4 | 0.006 | 26.2 | 0.412 (0.236-0.719) |
| 2nd, 3rd trimester and never attended | 34.0 | | 12.8 | |

∞P-values based on student t-test for independent samples at α=0.05. [¥]Risk values as generated by 2 by 2 cross-tabulations.

optimally supplemented. Cost prohibition, taboo prohibition and side effects experienced did not significantly influence the mean days of supplementation and the odds for optimum supplementation. Time taken to reach the health facility (indicative of the distance from the health facility) did influence the mean days of supplementation (p=0.026), but not the odds for optimumsupplementation (OR: 0.199; 95% CI: 0.044-0.889). The type of supplement (syrup verses tablets) did influence the odds for optimum supplementation (OR: 1.007 95% CI: 1.004-1.116), but not the days of supplementation (p=0.592). Source of supplements and

**Table 3.** Maternal knowledge factors and supplementation.

| Knowledge factors- Knowledge on: | Mean days of supplementation (=241) | | Proportion supplemented 90+ days (n=241) | |
|---|---|---|---|---|
| | Mean days | P-value∞ | Proportion (%) | OR (95% CI) ¥ |
| When expected to start supplementation | | | | |
| First trimester | 46.1 | 0.03 | 30.8 | 0.300 (0.172-0.524) |
| Other trimesters | 33.7 | | 11.8 | |
| Minimum length of supplementation | | | | |
| 90+ days | 50.2 | 0.00 | 29.3 | 5.872 (2.945 -11.709) |
| <90 days | 25.4 | | 6.6 | |
| Importance of supplementation (prevents anaemia?) | | | | |
| Yes | 44.6 | 0.00 | 22.9 | 0.251 (0.110-0.571) |
| No | 21.9 | | 6.9 | |
| Importance of supplementation (reduces chances for birth child complications?) | | | | |
| Yes | 59.2 | 0.00 | 36.3 | 0.262 (0.147-0.467) |
| No | 31.8 | | 13.0 | |
| Importance of supplementation (reduces chances for maternal mortality?) | | | | |
| Yes | 57.6 | 0.00 | 34.2 | 0.305 (0.171-0.544) |
| No | 32.4 | | 13.7 | |
| Importance of supplementation (reduces chances for congenital malformation?) | | | | |
| Yes | 55.2 | 0.00 | 30.1 | 0.414 (0.228-0.754) |
| No | 33.5 | | 15.2 | |

∞P-values based on student t-test for independent samples at α=0.05

¥ Risk values as generated by 2 by 2 cross-tabulations

tablet form (single or double form) did influence both supplementation days (p=0.004), but not the odds for optimum supplementation (OR: 1.125, 95% CI: 0.419-3.021).

## DISCUSSION

This study reports the days of antenatal iron-folate supplementation, proportion optimally supplementation and factors that predict supplementation. Compared to the national prevalence of supplementation of 90+ days of 2.5% and that of Eastern province of ~2.0% (GOK, 2008), the population under study was far much better optimally supplemented (~18%). The study participants were drawn from the health facilities and thus were not representative of the population of all women of reproductive age. It is known that majority (about 60%) of the pregnant mothers do not seek antenatal services and do not give birth at the health facilities (GOK, 2008). In a non-health facility survey (household survey), lower prevalence of optimum supplementation could be expected. Mothers, who visit ANC for ≥4 days are more likely to take iron-folate supplements for 90+ days. Earlier initial ANC visit rather than later is related to the days of supplementation, and this compares favourably with observed association between the the

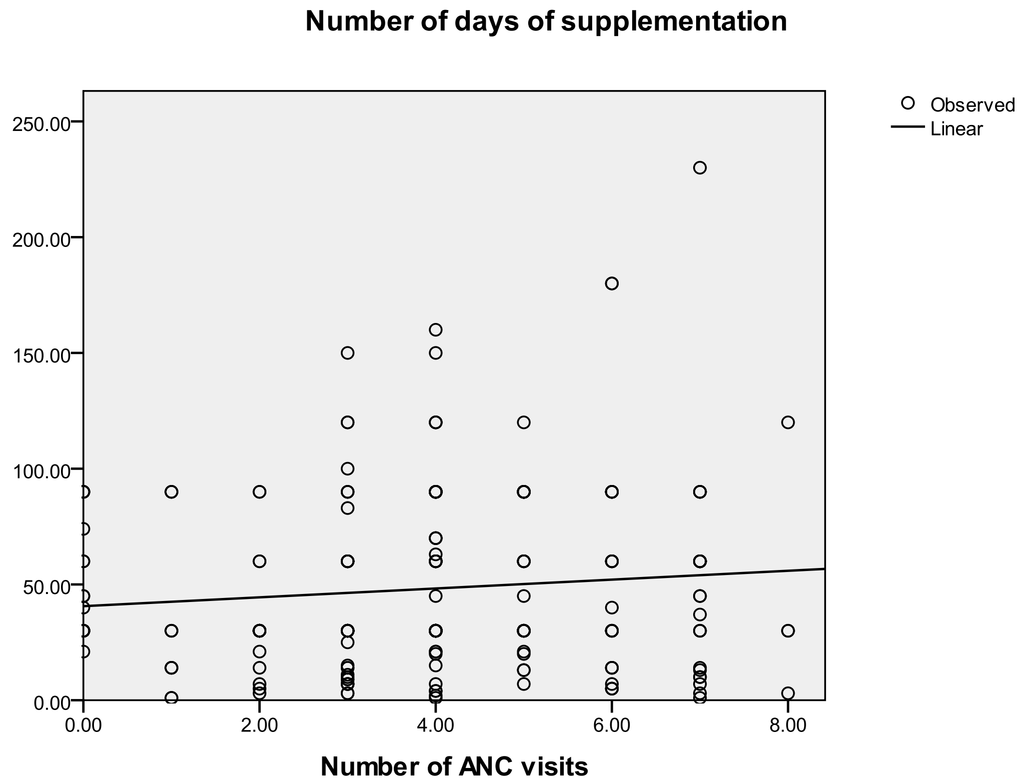


**Figure 1.** Curve fit for the number of ANC visits verses the days of supplementation.

hemoglobin (Hb) concentration and earlier prenatal visits (Lutsey et al., 2008). Women who come late to antenatal clinic miss opportunities to start supplementation early in pregnancy (Maina-Gathigi et al., 2013). Examining the marital status factor, there is no significant spouse involvement in promoting optimal supplementation. Although this study did not assess the level of spouse participation, it has been noted generally that in Kenya, there is increased male participation in the ANC in Kenya especially in the advent of Prevention of Mother to Child Transmission (PMTC) (Mangeni et al., 2013). This is however not the case for optimum iron folate supplementation. One of the pathways in which spouse influence can positively affect iron supplementation is through the spouses acting as active reminders (Seck and Jackson, 2008; Nisar et al., 2014), and it is thus evident that the spouses of the study mothers are not playing this role in a significant manner. There was no depiction that mothers who are salaried tend to be optimally supplemented as compared to those who were not, and this is explained by the reality that in this poor resource set-up, the supplements are mainly provided free of charge. This means that having disposable income does not guarantee access to the supplements and by extension optimum supplementation. This is consistent with findings that level of income (<1 US$ a day verses > 1US$ a day) did not predict neither the mean days of supplementation nor the proportion of mother who were supplemented 90+ days.

ANC visits ≥4 times is an important predictor of optimum supplementation and this is through the pathway of having increased contact with the health workers for counselling, initiation of supplementation, replenishment of the supplements and constant reminders for supplementation. This is consistent with some studies which have shown similar observations. In the Tanzania study, the OR for the proportion receiving iron supplementation increased with the number of visit, with OR reaching>1 with 4 to 8 visits (Ogundipe et al., 2012). Those women who visit perinatal health services are more familiar with supplement provided (Dusch and Elder, 2002). However, this present study showed that only a small proportion (1.1%) of the days of supplementation could be explained by the number of ANC visits ($r^2$=0.011) and shows that other factors are also important as well. Only 4.1% ($r^2$=0.041) and 1.4% ($r^2$=0.014) of days of supplementation could be explained by gestational age and income, respectively. The highest $r^2$ was observed for the gestational age of the first visit and this is indicative of the relative importance of start ANC visit as soon as the mother discovers that she is pregnant, but this is not associated with the optimum supplementation. In this study set-up, maternal age, number of children, religion, education level, and income

**Table 4.** Institutional and supplementation factors determining supplementation.

| Factor | Mean days of supplementation (=241) | | Proportion supplemented 90+ days (n=241) | |
|---|---|---|---|---|
| | Mean days | P-value[∞] | Proportion (%) | OR (95% CI) |
| Overall | 49.3 | - | 23.1 | - |
| **Source of supplement** | | | | |
| Government facility | 33.17 | 0.000 | 6.0 | 1.760 (0.621-4.986) |
| Non-government facility | 99.3 | | 10.2 | |
| **Form of supplement** | | | | |
| Syrup | 60.0 | 0.592 | 0.0 | 1.007 (1.004-1.116) |
| Tablet | 49.2 | | 7.1 | |
| **Tablet form** | | | | |
| Combined | 55.7 | 0.004 | 6.7 | 1.125 (0.419-3.021) |
| Single | 42.9 | | 7.4 | |
| **Side effects experienced?** | | | | |
| Yes | 46.1 | 0.145 | 8.3 | 0.675 (0.248-1.837) |
| No | 52.6 | | 5.8 | |
| **Taboo prohibitive?** | | | | |
| Yes | 35.8 | 0.836 | 37.5 | 0.107 (0.230-0.492) |
| No | 38.1 | | 6.0 | |
| **Time taken to reach health facility** | | | | |
| <30 minutes | 45.5 | 0.026 | 10.1 | 0.199 (0.044-0.889) |
| >30 minutes | 55.6 | | 2.2 | |
| **Cost is prohibitive?** | | | | |
| Yes | 32.3 | 0.018 | 37.1 | 0.327 (0.155-0.691) |
| No | 37.5 | | 16.2 | |

∞P-values based on student t-test for independent samples at α=0.05. [¥] Risk values as generated by 2 by 2 cross-tabulations.

did not determine either the days of supplementation or optimum supplementation. Many other studies have attempted to explain the other area-specific reasons for failures to adhere to the iron folate supplementation guidelines in different parts of the world (Dye et al., 2015; Galloway and McGuthrie, 1994; Bondarianzadeh et al., 1998; Taye et al., 2015; Wulff and Ekström, 2003).

Knowledge on minimum recommended days of supplementation (90+ days) predicts optimum supplementation. Knowledge on when expected to start supplementation and importance of supplementation only predict higher number of days of supplementation, but not the optimum supplementation. In general nutrition, literacy is correlated with nutrition outcomes and this is the same for the optimum supplementation. The specificity of the knowledge (knowledge on 90+ days) is thus more important since it is more direct. Those with this knowledge therefore stands a high chance for optimum supplementation (OR: 5.872, 95% CI: 2.945-11.709). In this particular study area, the knowledge on the importance of iron folate supplementation influences the mean days of supplementation. This is consistent with a number of findings. For instance, perceived health benefits of supplementation were found to be positively associated with supplements intake (number of pills) (Lutsey et al., 2008). Dusch and Elder (2002) found that inadequate counselling (which is strongly associated with knowledge), was a significant barrier to iron supplementation among pregnant women. In a study that defined compliance to iron supplementation as number of tablets ingested/tablets prescribed, compliance was associated with the perception of improved health upon taking the supplements. In a Kenyan study (Maina-Gathigi et al., 2013), the need for health workers to better explain the importance of supplements to pregnant women was underscored. However, the knowledge on the importance did not increase the likelihood for optimum supplementation.

Form of supplement (syrup verses tablet) is associated with optimum supplementation. Syrup seam not be preferred by antenatal mothers. There is no indication that side effects, taboo towards the supplements, distance away from the health facility and the cost of the supplements does influence optimum supplementation.

## Conclusions

Our findings point onto some programmatic implications for optimal iron folate supplementation in Eastern Kenya and potentially for other resource poor rural set-ups. While intensifying awareness, education and mobilisation for iron folate supplementation, there is need to emphasize more on the attendance of ANC more than 4 times and this includes commencing antenatal visit as soon as the mothers suspects that they are pregnant. While all forms of knowledge on iron folate supplementation are important, counselling and education on the minimum days of supplementation should be more emphasised to promote optimum supplementation. Using tablets as opposed to syrup increases the likelihood for antenatal ingestion of iron-folate supplements for 90+ days among pregnant mothers in low resource rural set-ups.

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## Conflicts of interest

Authors have none to declare

## REFERENCES

Abu-Saad K, Fraser D (2010).Maternal nutrition and birth outcomes. Epidemiol. Rev. 32(1):5-25.

Bailey LB (2000). New standard for dietary folate intake in pregnant women. Am. J. Clin. Nutr. 71:1304S-1307S.

Bondarianzadeh D, Siassi F, Omidvar N, Golestan B, Keighobadi K (1998). Low compliance with the iron supplementation program among pregnant women in the rural areas of Kerman District, IR Iran. Nutr. Res. 18(6):945-952.

Dusch GE, Elder L (2002). Women's perceptions of iron deficiency and anemia prevention and control in eight developing countries. Soc. Sci. Med. 55:529–544

Dye TDV, Pelto G, Kristensen S, Samen A, Dozier A (2015). Attitudes and practices towards micronutrient supplementation among pregnant women in rural Tibet. Glob. Public Health 10(1):119-128.

Galloway R, McGuire J (1994). Determinants of compliance with iron supplementation: Supplies, side effects, or psychology? Soc. Sci. Med. 39:381–390.

Gebremedhin S, Aregash S, Girma M, Tibebu M, Tsehai A (2014). Coverage, compliance and factors associated with utilization of iron supplementation during pregnancy in eight rural districts of Ethiopia: a cross-sectional study BMC Public Health 14:607.

Gibson RS, Ferguson EL (1999). An interactive 24-hour recall for assessing the adequacy of iron and zinc intakes in developing countries.ILSI Press, Washington D.C.

GOK and UNICEF (1999).National Micronutrient Survey.Anaemia and status of Iron, Vitamin A and Zinc in Kenya.A publication of Ministry of Health and UNICEF Kenya Country Office.

GOK.Kenya Demographic Health Survey (2008).Kenya National Bureau of Statistics.Government Printers.

Lutsey PL, Dawe D, Villate E, Valencia S, Lopez O (2008). Iron supplementation compliance among pregnant women in Bicol, Philippines. Public Health Nutr. 11:76-82.

Mahomed K (2000). Iron and folate supplementation in pregnancy. Cochrane Database Syst. Rev. (2):CD001135.

Maina-Gathigi L, Omolo J, Wanzala P, Lindan C, Makokha A (2013). Utilization of folic acid and iron supplementation services by pregnant women attending an antenatal clinic at a regional referral hospital in Kenya. Matern Child Health J. 17:1236-42.

Mangeni NJ, Mwangi A, Mbugua S, Mukthar VK (2013). Male Involvement in Maternal Health Care as a Determinant of Utilization of Skilled Birth Attendants in Kenya.ICF International Calverton, Maryland, USA. Available at: http://www.dhsprogram.com/pubs/pdf/WP93/WP93.pdf

Nisar YB, Dibley MJ, Mir AM (2104). Factors associated with non-use of antenatal iron and folic acid supplements among Pakistani women: a cross sectional household survey. BMC Pregnancy Childbirth 14:305

Ogundipe O, Hoyo C, Ostbye T, Oneko O, Manongi R, Lie RT, Daltveit AK (2012). Factors associated with prenatal folic acid and iron supplementation among 21,889 pregnant women in Northern Tanzania: A cross-sectional hospital-based study. BMC Public Health 12(1):481.

Seck BC, Jackson TR (2008). Determinants of compliance with iron supplementation among pregnant women in Senegal. Public Health Nutr. 11:596-605.

Taye B, Abeje G, Mekonen A (2015). Factors associated with compliance of prenatal iron folate supplementation among women in Mecha district, Western Amhara: a cross-sectional study. Pan Afr. Med. J. 2:20-43

WHO (2001). Safe motherhood needs assessment Version 1.1. World Health Organisation, Geneva Switzerland 2001. Available at: http://www.who.int/reproductivehealth/publications/maternal_perinatal_health/rht_msm_96_18/en/ [accessed 14th April 2015]

WHO (2012). Guideline: Daily iron and folic acid supplementation in pregnant women. Geneva, World Health Organization.

Wulff M, Ekström EC (2003). Iron supplementation during pregnancy in Sweden: to what extent is the national recommendation followed? Acta Obstet. Gynecol. Scand. 82:628-35.