CHAPTER 6: SUMMARY AND CONCLUSION

Pregnant women are one of the most vulnerable groups from the nutritional point of view. The macro- and micro-nutrient requirement increases during pregnancy because in addition to meeting the needs of the mother, the nutritional needs of the growing foetus have to be met. The adverse impact of maternal undernutrition on the size of the offspring at birth, growth and development of the offspring during childhood and adolescence have been well documented.

Calcium and vitamin D are two nutrients whose metabolism changes significantly during pregnancy (Abrams.,2007). Calcium absorption in the intestine increases during pregnancy to meet the additional requirement of the foetus (Ritchie et al.,1998) and calcitriol concentration increases during pregnancy to facilitate calcium absorption (Hacker et al., 2012). Calcium and vitamin D deficiency has adverse impacts on the mother-child dyad. Vitamin D deficiency during pregnancy increases the risk of pre-eclampsia (Bener et al., 2013), insulin resistance (Asemi et al., 2013) and gestational diabetes mellitus (Zhang et al. 2018 and 2008), in the mother. Both short- and long-term adverse impacts like neonatal hypocalcaemia (Brooke et al., 1980), SGA infants (Leffelaar et al., 2010), impaired skeletal growth and development of rickets (Ingole et al., 2014), reduced bone mass density (Mahon et al., 2010), increased risk of metabolic and autoimmune disease (Mulligan et al., 2010) have been reported as some of the foetal consequences of intrauterine exposure to the vitamin D deficiency. Calcium deficiency during pregnancy has been recognized to increase pregnancy-induced hypertension and pre-eclampsia, toxaemia (Belizán & Villar, 1980, Villar et al.,2004 and 1983). Studies from UK reported a reduction in neonatal tetany following calcium and vitamin D supplementation during pregnancy (Brook et al., 1980). A supplementation study conducted by WHO on pregnant women with low calcium intake (<600mg/day) had reported that calcium supplementation reduced the relative risk of severe gestational hypertension and eclampsia (Villar et al., 2006).

The FAO/WHO Expert consultation has stated that in most locations of the world, the most physiologically relevant and efficient way to acquire the required amount of vitamin D is to synthesise it from 7-dehydrocholesterol present in the skin by adequate exposure

(30 minutes) to the sunlight (WHO/FAO Expert consultation, 2004). However, several factors like traditional Indian lifestyle, clothing, pollution, geographical location, seasons of the year, skin types (Indian skin type is V) etc. may interfere with skin exposure to sun's rays and can contribute to vitamin D deficiency.

Available epidemiological data indicates that biochemical deficiency of vitamin D is common in both south and north India (Harinarayan et al., 2008 and Goswami, Mishra and Kochupillai, 2008). Studies carried out in Lucknow (Sachan et al., 2005) have shown very high levels of vitamin D deficiency in pregnant women. Several studies have reported biochemical vitamin D deficiency in pregnancy from different parts of India (Goswami et al., 2000, Bhalala et al., 2007, Sahu et al.,2009, Marwaha et al.,2011, Dasgupta et al., 2012, Jani et al., 2014, Kumar et al., 2015, Ajmani et al.,2016, Kumari et al., 2017, Arora et al.,2018, Sharma, Nath & Mohammad, 2019, Sharma, Minhas & Shrama, 2021, Christy, Perumal & Sumathy, 2021 and Ravinder et al., 2022). There are several reports of vitamin D deficiency not only during infancy and childhood but also among adults living in different parts of India (Goswami, Mishra and Kochupillai, 2008). There are increasing numbers of reports from India on neonatal hypocalcaemia, hypocalcaemic symptoms in young infants, vitamin D deficiency in breastfed infants and clinical and radiological rickets in children of all ages (Balasubramanian & Ganesh, 2008 and Pettifor, 2008).

In view of the high prevalence of biochemical vitamin D deficiency, low calcium intake (Harinarayan, Akhila and Shanthisree, 2021), and known adverse consequences of poor vitamin D status on the mother-child dyad, calcium and vitamin D supplementation during pregnancy have been advocated. WHO 2013 guidelines recommended routine prenatal supplementation of calcium more than 1gm/day for prevention of pre-eclampsia.

In December 2014, the Maternal Health Division, Ministry of Health & Family Welfare, Government of India issued the National Guidelines for "Calcium Supplementation During Pregnancy and Lactation". The guidelines envisage calcium 500mg (as calcium carbonate salt) and 250 IU vitamin D are to be taken twice daily just after meal calcium and vitamin D supplementation starting from the second trimester of pregnancy till six months postpartum.

The supplementation is to be carried out in all settings – hospital antenatal clinics, antenatal clinics in MCH centres and primary health care institutions. In community settings, ANMs are to distribute these supplements to pregnant women attending Village Health and Nutrition Day (VHND). In case of pregnant women not coming to VHND, ASHA has the responsibility to deliver the supplements to the pregnant women. Government hospitals are supplied with different brands of calcium and vitamin D tablets; there are gaps in the supply of calcium and vitamin D supplements to the hospitals. The tablets are provided to all pregnant women attending the antenatal clinic when available.

The antenatal clinics do not document the regularity of supply or pregnant women's compliance with the calcium and vitamin D supplements. Regularity of supplementation intake is not monitored in these women. All women do not come for regular follow-up; it is not possible for the hospital to ensure that they do come back to the same hospital for follow up visits. Pregnant women who do not attend the antenatal clinic are to be provided with calcium and vitamin D supplementation in community settings by ASHA or ANM. There is no data on the coverage, compliance and continuation of use of calcium and vitamin D supplementation in community settings.

There is therefore a paucity of data on coverage, compliance (the number of supplements the pregnant women received and, consumed) or the impact of calcium and vitamin D supplements during pregnancy in hospitals or in community settings. It is essential to obtain data on coverage and compliance with calcium and vitamin D supplementation in in the hospital under research and service conditions and in the community settings, so that problems in the implementation of the supplementation programme can be identified and appropriate mid-course corrections can be done.

The current study was undertaken to assess the availability of supplements, coverage, acceptance, and compliance rates of ongoing Calcium and Vitamin D supplementation in three settings-

- Primary health care institution as part of the research study ensuring continuous supply and careful monitoring of the intake along with nutrition education
- Primary health care institution providing antenatal care under existing service conditions

- Urban community setting under existing conditions

Ethical clearance for the study in the three settings was obtained from the Institutional Ethics Committee of the Nutrition Foundation of India (NFI). Permission to conduct the study in the three settings was obtained from appropriate authorities.

The study design envisaged that apparently healthy pregnant women with no known systemic or obstetric problems would be enrolled for the study in three settings:

1. **Primary health care institution** (under SDMC) **as part of the research study ensuring continuous supply and careful monitoring of the intake along with nutrition education** (Group 1)
2. **Primary health care institution** (under SDMC) **providing antenatal care under existing service conditions (**Group 2**)**
3. **Urban community setting** (30 Anganwadis of 3 areas in South Delhi namely, Neb Sarai, Lado Sarai and Andheria Mod) **under existing conditions (**Group 3**)**

In all groups, apparently healthy pregnant women free from known systemic or obstetric problems who were willing to participate in the current study were enrolled in their second trimester. In Group 3, apparently healthy pregnant women with no known systemic or obstetric problems were identified in the community settings who were willing to participate in the study, were enrolled as and when they were identified.

In all three settings, information on SDP and obstetric profile was collected at the enrollment. Women were given the calcium and vitamin D tablets containing 500 mg calcium and 250 IU vitamin D, required for the month by the research team in Group 1 and by the existing service providers in Group 2 and Group 3.

The majority of pregnant women attending the antenatal clinics were anaemic (more than 80%). The National Iron Plus Initiative (NIPI) envisages that anaemic pregnant women should receive 2 tablets of IFA (100mg of elemental iron and 500 µg of folic acid daily. The majority of families have three-meal patterns and it will not be possible for pregnant women to take 2 tablets each of IFA and calcium and vitamin D separately after meal. In view of the well-documented adverse consequences of anaemia on the mother-child dyad many physicians prioritized supplementation with 2 IFA tablets to pregnant women; they

advised pregnant women to take two IFA tablets after two meals and take one tablet of calcium and vitamin D after the third meal. The research staff followed the same protocol and provided the pregnant women of Group 1 with the supply of calcium and vitamin D supplementation for a month from which one tablet was to be taken daily after the third meal leaving the remaining two for IFA supplementation.

In Group 1 and 2 i.e. in PHCIs when they came to collect the tablets for the next month the compliance was checked and recorded by the research team. The pregnant women were requested to bring the completed tablet strips; using this compliance was checked and recorded. In all women the address and mobile phone numbers of the husbands/ neighbours of the woman were collected; the mobile phones were used to contact them as and when necessary especially when they did not come for follow-up to the centre on the expected date. In the community setting (Group 3), home visits were undertaken by the research staff to enroll the willing subjects and collect information on whether they were attending any ANC clinic or private clinic, they were getting the required supplements from the ANM/ ASHA workers. The compositions of the supplements provided/purchased by the woman and the compliance and continuation of the supplementation were recorded.

In all three Groups, efforts were made to follow-up the enrolled women through pregnancy and delivery, to document the course (weight and BP) and outcome (birth weight) of pregnancy. Weight and BP in Group 1 were measured by the ANM from the antenatal clinic, and in Group 2 and 3 it was measured by the research team.

In Group 1, Group 2 and Group 3 a total of 387, 400 and 448 pregnant women who were willing to participate in the study were enrolled.

***Sociodemographic profile*:** The majority of the pregnant women were from low/ low-middle-income group families with 2 to 8 members. About 60% of the women had schooling and more than 90% were homemaker. About 2/3rd of the husband had a school education and were involved in the semiskilled or unskilled jobs. More than 50% of the women were living in rented houses, about 40% were sharing their toilets with other tenants and below 1% had no facilities. More than half of the households were dependent on public transport. More than 80% of the households had colour television as a means of entertainment. There was no statistically significant difference between the three groups.

In Group 1, the enrolled pregnant women were from a central urban area and attended a PHCI which had a better infrastructure and facilities available for antenatal care and a better supply of supplements and drugs than the PHCI where Group 2 was undertaken. Though it is not obvious from the data of SDP, it is possible that the clientele of Group 1 was from a slightly better-off population as compared to the pregnant women of Group 2. Among pregnant women of Group 3, not all the women availed health services and the remaining of them sought a variety of antenatal care facilities. There was no statistically significant difference in the sociodemographic profile of the three groups.

***Obstetric profile*:** The majority of the pregnant women were in their twenties and having their first or second pregnancies. The mean gestational age at enrollment was 19.2±2.62 weeks, 18.8±2.90 weeks and 17.3±7.82 weeks in Group 1, Group 2 and Group 3 respectively. There was a statistically significant difference in gestational age at enrollment of Group 3 women with the other two groups.

***Food frequency, food security and dietary intake in pregnant women*:** Information on food frequency, household food security and dietary intake of the pregnant women were assessed using food frequency, food purchase questionnaire and 24-hour dietary recall questionnaire in 205 pregnant women from all three settings. Dietary data were available from 34, 71 and 100 pregnant women in Group 1, 2 and 3 respectively.

The food frequency and food purchase questionnaires when undertaken together, it give a detailed idea of the food consumption pattern and food security status of the family. Twenty-four (24) hour dietary recall provides information about the food security status of the family and dietary intake of the individuals i.e. non pregnant and pregnant in the previous 24-hour. However, these questionnaires are time-consuming to administer and check. The majority of the pregnant women in any of the three settings were unable to spend 30-45 minutes with the research team; hence, in none of the three settings data on dietary intake was available from a substantial number of pregnant women. In view of the fact that there was no statistically significant difference amongst the three groups in SDP and obstetric profile, all the dietary data available were put together.

Food frequency: Cereals and roots were consumed on a daily basis; wheat being the predominant cereals consumed. Approximately 3/4th of the households consumed tubers daily. The frequency of consumption of pulses and legumes were low, around 39% of the

households consumed pulses daily; around 50% of the households consumed legumes weekly. Around 98% of the households consumed other vegetable daily; this can be attributed to the fact that potatoes and tomatoes were used to prepare a variety of dishes in these families. The majority (39%) of the households were consuming GLV weekly and around 50% of the households consumed fruits (mostly bananas) daily. Animal food items like eggs, flesh food and fish were consumed once a week in many households. The major contributors of dietary calcium were milk and milk products; 89% of the subjects were consuming milk daily; curd, buttermilk and other milk products were consumed twice or thrice in a week. The data indicated the fact that the frequency of micronutrient-rich food was low.

Food security: Food security was assessed by comparing the calorie intake/day/CU with the EAR for energy (ICMR 2020). The energy intake/CU/day was calculated both from the food purchased and the actual food cooked and consumed on the previous day. The average energy intake/CU/day computed from the food purchased was 2040.9±468.52 Kcal (n=204) and from the food cooked on the previous day was 1807.0±544.33 Kcal (n=205). The energy consumption /CU/day was higher than the calculated EAR for Delhi adult man; therefore, it can be inferred that the households were food secured. However, the data from food frequency indicated inadequate consumption of micronutrient-rich vegetables and fruit consumption. The energy consumed as calculated from the food cooked on the previous day was lower than the energy calculated from food purchased as the food cooked on the previous day only reflects the foods cooked in the previous 24-hours while purchased food provides an idea of over all food consumption over a longer period.

24-Hour Dietary Recall: The majority of the pregnant women from the families were homemakers and consumed homecooked food. Food and nutrient intake of non-pregnant and pregnant women from the families were computed from the 24-hour diet recall and were compared to the EAR for pregnant women (ICMR-NIN-2020).

Data from dietary intake using 24-hour dietary recall showed that consumption of milk and milk products, pulses/ legumes, GLV and other vegetables were below the appropriate quantity of foodstuffs needed for the balanced diet.

Energy and fat intake of pregnant women were higher than the EAR for sedentary Delhi pregnant women with height 151.7cm and optimal bodyweight (BMI of 21 in the non-pregnant state) of 48kg and 8kg pregnancy weight gain. Fats contributed nearly 30% of the energy in the diets consumed by pregnant women. Intake of roots and tuber and fat intake were higher than requirements. In pregnant women dietary intake of calcium and vitamin A met the EAR; whereas iron intakes were lower as compared to EAR.

***Nutritional profile at enrolment*:** The mean height of the pregnant women was 151.5±5.20 cm (387), 150.1±5.51cm (391) and 152.1±5.53 (448) in Group 1, 2 and 3 respectively; and the initial mean weights were 50.3±8.44 kg (373), 50.1±8.54kgs (400) and 53.9±10.08 (448) in Group 1, 2 and 3 respectively.

The mean height of women from Group 2 was lower than the mean height of women from the other two groups, and the difference was statistically significant. This might be because as they might have come from a slightly lower strata of the society and their access and utilization of the antenatal facilities were lower than the other two groups.

As enrolment continued across the second and third trimesters in Group 3; there was a statistically significant difference in the initial weight of women in Group 3 as compared to the mean weight of women in the other two groups who were enrolled in the second trimester.

***Haemoglobin at enrolment*:** At the time of their initial visit to the antenatal clinic, all pregnant women have the blood drawn from the blood Grouping and VDRL test. In those who agreed to participate in the study in Group 1 and 2 (in PHCIs), an additional 20 µl blood was pipetted and put on a filter paper for haemoglobin estimation by indirect cyanmethaemoglobin method. The data on the Haemoglobin status of the pregnant women showed that more than 80% of the pregnant women were anaemic at enrolment.

***Current regimen of calcium and vitamin D supplementation in Delhi Hospitals*:** In Delhi, both IFA and calcium and vitamin D supplementation are being provided to pregnant women both in hospital and community settings. Data from the present study showed more than 80% of the pregnant women were anaemic and required 2 tablets of IFA. Taking into consideration the adverse effect of anaemia on the mother-child dyad, obstetricians complied with NIPI guidelines for IFA supplementation. It was not possible to fit both IFA and calcium and vitamin D supplements (4 tablets each to be taken after

one meal) in the habitual three-meal-a-day pattern. Clinicians therefore advised pregnant women to take one tablet of calcium and vitamin D after the third meal in both hospital and community settings.

***Exploring feasibility of providing two tablets of calcium and vitamin D as supplement*:** In 2018, the guidelines for IFA supplementation were revised Intensified National Iron Plus Initiative (I-NIPI). Under the revised recommendations anaemic pregnant women were to receive two tablets of IFA containing (containing 60 mg elemental iron and 500 µg folic acid) after a meal. Because of the modifications, it became possible to provide two tablets of calcium and vitamin D after the remaining two meals Nutrition Foundation of India, carried out a short-term research study on the side effects of IFA and calcium and vitamin D supplementation to fit two tablets of IFA (containing 60 mg elemental iron and 500 µg folic acid) and two tablets of calcium and vitamin D (containing 500 mg elemental calcium and 250 IU vitamin D) within the usual three meal pattern and found out that consuming two tablets of calcium and vitamin D together increases the side effects (Ramachandran, Pramanik and Kalaivani, 2019) which reduces the compliance with the calcium and vitamin D tablets. However, the Delhi government continued providing one tablet of calcium and vitamin D after lunch leaving the other two meals for consumption of IFA two tablets of IFA after two meals. In view of this, the study continued to use the same regimen.

Follow up during pregnancy: In Group 1, Group 2 and Group 3 a total of 387, 400 and 448 pregnant women were enrolled. Efforts were made to follow-up with the pregnant women till delivery. The follow-up rate of Group 1, 2 and 3 were 77.3%, 62% and 92.6% respectively. The follow-up rate was highest in Group 3 because the follow up was essentially by home visits of the pregnant women by the research team. The pregnant women of Group 1 and 2 with obstetric problems, anaemia, PIH / or oedema, were referred to tertiary care hospitals and they attended the hospital they were referred to, this led to some loss of follow-up. Referral to other PHCIs was common in Group 2 due to the poorer infrastructure and manpower of the PHCI where the study for Group 2 was undertaken. The other reason for the loss of follow-up was the shifting of the family from the location. In the community i.e. Group 3, much better follow-up of the women was possible; as the follow-up by the research team was done through home visits. In the

community setting women did not get antenatal check-ups done regularly so there was no data regarding PIH as they were not routinely checked for PIH in clinic settings and their attendance to the ANC was poor. Thus, in the community setting also, information on the course of pregnancy and PIH was not available.

Compliance with the supplementation: Calcium and vitamin D tablets containing 500 mg elemental calcium and 250 IU vitamin D were provided to the pregnant women in Group 1 along with nutrition education. From enrolment till delivery the pregnant women receive a mean of 134±26.2 tablets and consumed 124±25.9 out of the available tablets. This data indicated that if calcium and vitamin D tablets are made available regularly without interruption and the need for the supplements was explained during the nutrition and health education sessions pregnant women accepted the supplements and took them regularly.

In Group 2, the PHCI provided the pregnant women either the calcium and vitamin D tablets as and when available or provided a prescription for purchasing the tablets. Unlike IFA tablets calcium and vitamin D tablets are expensive; many women were unable to purchase the tablets due to economic constraints. Therefore, 12.9% of the women who were followed up in Group 2 did not consume calcium and vitamin D tablets at all. Single tablets of calcium and vitamin D were consumed daily by 199 pregnant women out of them 150 women had to purchase it from outside; a mean of 62±34.1 tablets were bought and 58±32.1 out of the available were consumed. The PHCI provided 82±30.7 calcium and vitamin D tablets to 33 pregnant women to be consumed as single tablets daily; out of the available tablets 74±27.8 were consumed by the pregnant women. Sixteen women sometimes received the supplement from the PHCI and sometimes bought it from outside; 84±29.2 tablets were consumed out of 92±30.9 tablets by these 16 women. Two tablets of calcium and vitamin D were consumed by 15 pregnant women. A mean of 156±70.3 tablets were available out of which the pregnant women consumed 147±71.1tablets. This data indicates that if calcium and vitamin D supplements were available to pregnant women and the intake was monitored the compliance rate was high.

In Group 3, 19.5% of pregnant women out of the continued cases did not consume any calcium and vitamin D tablets. Despite the national guidelines that calcium and vitamin D should be given as supplements, a substantial proportion of pregnant women attending

Government PHCIs and those who went to private practitioners were given/prescribed only calcium tablets. From the Government PHCIs 189 pregnant women received 138±82.7 only calcium tablets and 51 received 120±64.3 calcium and vitamin D tablets; out of which the women took 126±79.8 and 111±66.2 tablets respectively. Private practitioners provided prescriptions to pregnant women and they bought them from the pharmacy. Seventy-eight pregnant women bought 116±71.6 calcium and vitamin D tablets and 11 pregnant women bought 114±64.1 calcium-only tablets; out of which 114±70.3 and 112±63.3 tablets were consumed by them respectively. The majority of the pregnant women consumed most of the available tablets. This high consumption rate perhaps can be attributed to the fact that calcium and vitamin D supplements were not associated with any troublesome side effects.

Haemoglobin status during follow up: Accurate Hb estimation was not carried out in all women for diagnosis of anaemia. When Hb was not available the hospital provided 60mg elemental iron to all pregnant women; when women were anaemic two tablets of IFA were provided. The supply of iron tablets was sometimes erratic. Side effects with iron were common. There was a rise of 0.7 g/dL and 0.2 g/dL in the mean Hb levels of Group 1 and Group 2 respectively (comparing the paired samples). The increase in the haemoglobin is statistically significantly higher in Group 1 as compared to Group 2. This might be due to differences in screening for anaemia by Hb estimation, availability of IFA tablets and compliance between the two hospitals.

***Weight gain during pregnancy*:** The mean weight gain in the second trimester and third trimester was 11.8 kg in Group 1, 7.4 kg in the Group 2 and 7.6 kg in Group 3.

***Pregnancy outcome*:** The mean birthweight was 2.8±0.41, 2.6±0.51 and 2.8±0.49 in Group 1, 2 and 3 respectively. The birthweight of Group 2 is significantly different from the other two groups. Preterm birth rates were 16.4%, 21.4% & 18.1% and low birth weight rates were 13.0%, 31.8% & 21.4% in Group 1, 2 and 3 respectively. The differences in LBW rate were statistically significant but the differences in the pre-term rate were not statistically significant.

Maternal anthropometric indicators and Birth Weight: To assess the impact of maternal height and weight in the early second and late third trimester of pregnancy on birthweight, the mean height, weight at 16 weeks and 36 weeks and birthweight were

computed in three tertiles of maternal weight taking all the pregnant women from all three settings together. Data from the analysis indicated that maternal height is a major determinant of maternal weight during pregnancy and birth weight.

***Post-pregnancy weight retention*:** In the community setting there was excellent data on pregnancy weight gain and also some data on pre- and post-pregnancy weight and weight retention after pregnancy. In Group 3, records of prepregnant weight were available in 145 pregnant women. Efforts were made to collect weight in these women between three to six months after delivery. Even when weight gain during pregnancy was less than 8 kg, there was a significant residual weight gain of 1.9 kg in the post-pregnancy period. In these women the post-pregnancy weight and BMI were statistically significantly higher than pre-pregnancy weight and BMI respectively.

***Role of personalised nutrition education in the dual nutrition burden era*:**

In the last decade, residual post-pregnancy weight and its impact on the emerging problem of overnutrition in reproductive age group women has been a major concern in from the developed countries like USA. The focus in these countries had shifted to assessing pregnancy weight gain and optimal birth weight without significant residual pregnancy weight gain. India has also entered into the dual nutrition burden era. The present study was undertaken in pregnant women from urban low middle-income groups attending the antenatal clinic in government primary health care institution or community. The data on dietary intake by 24-hour dietary recall method showed that energy intake was either adequate or exceeded EAR in short-statured sedentary pregnant women; calcium intake of the pregnant women met the EAR recommended by the NIN-ICMR; however, iron intake was insufficient. Weight gain in the second and third trimesters in these women was 7.6kg (Group 3). The higher-than-required intake of energy during pregnancy appears to have resulted in post-pregnancy weight retention of 1.9 kg. Frequency distribution indicates that post-pregnancy weight across all the categories was to the right of pre-pregnancy weight.

Screening of the nutritional status of the women in pre-pregnancy and during pregnancy and providing personalized counselling regarding dietary intake and physical activity will enable them to attain optimal pregnancy weight gain, optimal birth weight and reduce post-pregnancy weight gain.

***Role of micronutrient supplementation in pregnancy*:**

For correcting the micro-nutrient deficiency in the short period during pregnancy, the IFA and calcium and vitamin D supplementation programme are very important.

In view of the high prevalence of anaemia the National Iron Plus Initiative (NIPI) recommended that all anaemic pregnant women take one tablet of IFA containing 100 mg of elemental iron and 500 µg of folic acid twice daily after meal making it impossible to fit both IFA and calcium and vitamin D supplements (4 tablets one each to be taken after one meal) in the habitual three meal a day pattern. A short-term study also reported that taking two tablets of calcium and vitamin D increases the side effects and therefore providing only a single tablet of calcium and vitamin D was essentially the protocol.

The Intensified National Iron Plus Initiative (I-NIPI, MOHFW, 2018) has revised and recommended that anaemic pregnant women should be provided with two tablets of IFA each containing 60 mg of elemental iron and 500 µg of folic acid after one meal. The IFA supplementation programme for pregnant women is currently getting reorganized and henceforth it will be possible to take two IFA tablets together after one meal and two tablets of calcium and vitamin D after the remaining two meals (Ramachandran, Pramanik & Kalaivani, 2019).

After reorganization of the supplementation programme for IFA and calcium and vitamin D supplementation to pregnant women, the impact of supplementing two tablets of IFA together after one meal and two tablets of calcium and vitamin D after two remaining meals on haemoglobin status along with biomarkers for assessing iron status and plasma vitamin D levels will have to be investigated and documented. However, as the biochemical assessment of vitamin D is expensive, it is not a part of routine antenatal check-ups and therefore, it is not possible to identify deficient pregnant women. On that account universalisation of the calcium and vitamin D supplementation is important.

***Calcium and vitamin D supplementation during pregnancy*:**

Data from the present study showed that when the calcium and vitamin D supplements were provided by the research staff free of cost without interruption in Group 1, most of the tablets provided were consumed by the majority of the pregnant women. Data from the present study indicate that if the supply of the calcium and vitamin D tablets are

regular, there is nutrition education and supportive supervision of the supplementation, it will be possible to improve coverage and achieve over 90% compliance of calcium and vitamin D supplementation. However, the supply of calcium and vitamin D in both, hospital (Group 2) and community (Group 3) were erratic but whenever the supplements were made available to the pregnant women or when they purchased the tablets, the majority of the pregnant women consumed most of it. The high continuation and compliance with calcium and vitamin D supplementation are perhaps due to the fact that the side effects of taking the same are minor and not troublesome. Calcium and Vitamin D tablets are expensive. When hospital supply is not there and women are requested to purchase and consume the tablets, they are unable to do so because of economic constraints. It is therefore important to ensure adequate availability of calcium and vitamin D tablets to pregnant women across the antenatal care system, from tertiary care hospitals to the community setting.

Optimisation of the supply of calcium and vitamin D supplements to pregnant women is likely to improve the coverage with the supplementation.