Five hundred pregnant women were examined for assessing the occurrence of iron and vitamin A deficiency. By using self structured and pre-testing questionnaire, general information regarding economic status, age as well as educational status of the subjects were recorded. In addition reproductive history including age at marriage, age at first child birth, duration of menstrual cycle, bleeding during conception as well as miscarriage, number of infant death, term of previous delivery including birth weight of previous babies was also recorded. Clinical symptoms were recorded with the help of medical officer. Out of 500 pregnant women, 100 Iron and Vitamin A deficient subjects were selected for supplement feeding trials. These 100 iron and Vitamin A deficient pregnant women were classified into four groups each having 25 subjects i.e Iron tablet group (Group I), Iron tablet + β-carotene rich food supplement (Group II), Iron tablet + Iron rich food supplement (Group III) and Control (Group IV) to whom no supplementation has been given. Iron was supplemented in form of ferrous sulfate (100 mg elemental iron) to Group I, to Group II (100mg elemental iron and β-carotene rich food) was fed in the form of amaranthus biscuits in salty and sweet forms which contained 1200μg of β-carotene. To Group III, (100mg elemental iron and iron rich food in the form of rice flakes namkeen and ladoo which contained 35 mg of iron each). To the Group IV (control) no supplementation
was given. These supplements were fed for the period of around six months (from second trimester till delivery).

Weight gain, nutrient intake, haemoglobin and serum retinol was measured before and after the end of supplementation trial (within 3 days after delivery). In addition type of delivery (normal or caesarian), term of delivery as well as new born gestational age was recorded. In addition to this, their birth weight, chest circumference, head circumference and length of new born were recorded with the help of medical officers.

Among 500 pregnant women, 103 (20.6%) subjects were deficient in both the nutrients (iron and vitamin A). These subjects were further selected for experimental trial. Forty per cent of the subjects were between the age group of 20-25 years. The subjects 18-20 and 25-30 years of age group were 32 per cent and 26 per cent respectively. There were only 2 subjects between 30-35 years of age. Thirty six per cent were illiterate. There were 18 per cent subjects who had primary education followed by 26 per cent subjects who had secondary education. There were 6 per cent subjects who had bachelor degree also.

Majority of the subjects 72 per cent were housewives and 28 per cent subjects were working. Maximum subjects (45%) had monthly income within range of Rs 3000-7000 while minimum 15 per cent subjects had monthly income above Rs 12000.

In the selected subjects the most prevalent symptoms were mental lethargy, anorexia and behavioural disturbances respectively were 85 per cent, 84 per cent and 82 per cent. Most of the subjects (82%) were vegetarian followed by 18 percent
ovarian and 2 per cent non vegetarian. Maximum subjects (45%) had height between 151-155 cm and weight (38%) between 35-40 kg. Out of total subjects maximum subjects (54%) were having BMI < 18.5 i.e. underweight category and minimum subjects were having BMI between the ranges of 18.5-22.9 i.e. normal category. Among all the selected subjects, no one was found in obese category.

Thirty eight per cent of subjects got married at less than twenty years of age. Maximum (50%) got married at the age of 20-25 years and only 2 per cent subjects were between the age group of 30-35 years. Thirty six percent of the subjects were in the group of 19-20 years when became mother first time. About fifty four per cent respondents were at the age of 20-25 years whereas; only 1 per cent of subjects had first delivery at 30-35 years of age. Majority (70%) of the subjects were having normal menstrual duration i.e 3-4 days. Whereas, 25 per cent subjects were having duration menstration for 5-6 days and 10 per cent of subjects had this duration for seven or more than seven days. At the starting of pregnancy 95 per cent of the subjects did not have any kind of bleeding. Only 5 per cent of the respondents had complication for bleeding during conception. The subjects conceiving second time were 42 per cent. Whereas, thirty four per cent subjects were conceiving first time. Only 1 per cent subject was having infant death.

Before commencing the supplement feeding trial, mean values of haemoglobin in supplement fed groups of deficient subjects i.e Iron tablet supplement fed group (I). Iron tablet +\(\beta\)-
carotene rich food supplement fed group (II) and Iron tablet + Iron rich food (III) were 8.04 ± 0.40; 8.16 ± 0.28 and 7.9 ± 0.36 (g/dl), respectively. After feeding supplements haemoglobin content was increased in respective groups, to Group I (Iron Tablet), II (Iron Tablet + β-carotene rich food supplemented) and III (Iron tablet + Iron rich food supplemented), the mean haemoglobin levels improved to 9.0 ± 0.20, 10.07 ± 0.31cand 9.34 ± 0.37 respectively. On feeding different supplements from 2\textsuperscript{nd} trimester till delivery favored to enhance the haemoglobin level of selected pregnant subjects in different supplement fed groups (I, II and III). Whereas, in control group it lightly decreased to 7.8gm/dl. Increased in serum iron (µg/dl) was 97.77, 111.99 and 98.50, respectively in Group I, II and III and in control Group this level decreased to 6.38 per cent. The decreased value of TIBC (µg/dl) was 429.23, 418.53 and 426.51, respectively in Group I, II and III and in Group IV the value of TIBC was 450.93 (µg/dl).

The values of transferrin saturation was increased from 18.48 to 22.79 in Group I, 18.25 to 26.77 in Group II, and 17.79 to 23.10 in Group III. However, in control Group this change was 18.31 to 19.30.

The increased mean change in UIBC values were 36.55, 60.82 and 44.00 in Group I, II and III respectively.

Initial values of serum retinol (µg/dl) was 15.44, 15.12, 14.72 and 15.08 respectively, in Group I, II, III and IV. On supplementation these figures increased to 16.24, 17.40, 15.88 and 15.16 in respectively, Group I, II, III and IV.
The change in all the biochemical parameters in feeding trial in comparison to control Group was significant \((p=0.000)\) and within the same group before and after completion of supplementation.

Birth of the normal weight babies was given by 60.60 per cent of the subjects whereas, 39.39 per cent had delivered low weight babies.

Significant observation was found in gain in weight after completion of delivery among all the groups. Maximum gain in weight was found in Iron tablet + \(\beta\)-carotene supplemented Group III.

In Group I, Group II, Group III and Group IV, the mean gestational age of newborn was 38.20 ± 1.08, 39.56 ± 1.08, 38.64 ± 1.07 and 37.24 ± 1.20 weeks respectively. Significant \((p < 0.01)\) variations in gestational age of new born among mothers of different experimental group was found significant.

Mean birth weight (kg) of new born in group I, group II and group III and control group were 2.61 ± 0.03, 2.8 ± 0.11, 2.8 ± 0.04 and 2.4 ± 0.08 respectively. Significant \((p < 0.01)\) variation in the weight of new born was observed among all the groups. Maximum (68%) low birth weight babies (LBW) were found in control groups, to whom no supplementation was fed. The infants who had normal head circumference were 60 per cent found in Iron tablet + \(\beta\)-carotene supplemented Group II. The mothers of the control Group had given the birth to the babies who had slightly less head circumference than the normal.
Maximum (70 %) pre term deliveries were observed among the subjects of control Group, whom no supplementation was provided whereas minimum (5%) was found in Group II, which was Iron tablet and β-carotene supplement fed group. Statistically significant difference of term of delivery was observed among all the supplemented groups in comparison to control group (Group IV). Highest percentage (44%) of caesarian delivery was found in Group IV (control group).

None of the subjects of any group delivered post-term baby however, pre-term baby was delivered by 12, 4, and 56 per cent of subjects of group I, II, III and IV respectively. Rests of the mother of different groups have normal delivery.

The iron and β-carotene contents of commonly grown and consumed foods were also determined. These samples were taken from local market. The determination of iron and β-carotene was done separately from each food in triplicate.

The mean iron contents of different samples of commonly available cereals, pulses and consumed fresh vegetables and fruits. The average iron content (mg/100g) in Rice, Rice Flakes, Maize (dry), Wheat Flour (whole) and Wheat Bread (white) were 2.5±0.23, 21.7±1.45, 2.1±0.47, 5.6±1.53 and 1.84±0.12 respectively. The average iron content (mg/100g) in Bengal gram (roasted), Soybean, Black gram dhal, Green gram dhal and Horse gram (whole) were 10.4±0.74, 11.5±0.7, 3.7±0.59, 3.8±0.64 and 6.54±1.23 respectively. The mean iron content (mg/100g) in the samples of Amaranth, Coriander Leaves, Carrot leaves and Spinach was 5.4±0.84, 2.4±0.3, 8.41±1.34 and 2.4±0.54
respectively. The mean iron content in the samples of Onion small and Potato was 1.03±0.23 and 0.34±0.10 respectively.

Among other vegetables such as Cauliflower and Lady finger the mean iron content was 1.20±1.23 and 0.33±1.21 respectively. Among fruits maximum iron content was found in mango ripe (0.84±0.24) and minimum iron content was found in orange (0.12±0.04).

In spices and condiments, the iron content of Cloves dry, Cumin seeds, Coriander and Mango powder were 10.09±1.21, 10.06±1.34, 6.8±0.57 and 43.15±0.56 mg/100g respectively. Maximum iron content was found in Mango powder.

The mean β-carotene content in the samples of Wheat flour (refined), Maize and Rice were 24.23±1.05, 95.32±0.69 and 8.50±1.00 respectively. Among these samples highest concentration of β-carotene was present in Maize. Among pulses and legumes, the mean β-carotene content in the samples of Bengal gram (whole), Soybean, Black gram dhal, Green gram dhal and Horse gram (whole) were 187±1.25, 425.54±0.53, 38.55±0.67, 51.31±0.54 and 68.32±0.67 respectively.

Amongst leafy vegetables maximum and minimum β-carotene content was found in coriander leaves (6921±1.25µg/100g). The β-carotene content was found in Banana, Mango, Orange, Papaya and Tomato were 79.67±0.64, 2749.7±0.58, 1109.2±0.64, 670.2±1.42 and 350.34±0.57 respectively.

In Coriander (dry), Cloves, Cumin and Fenugreek seeds β-carotene content were 940.2±1.02, 254.7±0.58, 520±0.57 and
952.4±0.63 respectively. Maximum β-carotene value was found in coriander dry (940.2±1.02).

Figure 4 β-carotene in milk (buffalo) and milk (cow) respectively were 42.7±0.68 and 60±1.0.

Variations in the β-carotene content in foods of the present study in comparison to the values given by Gopalan et al., (2011) might have been attributed to the factors such as difference in variety of samples, climate conditions, fertility of soil and maturity of vegetables.

CONCLUSION

During pregnancy, 20.6(103) per cent women were found deficient in Iron as well as in Vitamin A. Among these subjects 100 were selected for the trial.

Increased in haemoglobin, serum iron and retinol values in all experimental group of iron and vitamin A deficient subject were measured after supplementing various supplements. Iront tablet, iron rich food and β-carotene rich food supplements. On feeding all the supplements separately favoured improvement in above blood parameters and overcoming iron and vitamin A deficiency during pregnancy but maximum increased in above parameters were found in the subjects, supplemented with β-carotene supplements along with iron when compared to iron tablet and iron rich food alone.

Beneficial effect of supplementation of iron and β-carotene was observed in all the pregnancy (term and type of delivery), new born (birth weight, head circumference, chest circumference,
length and gestational age) outcomes. Maximum positive effect was found in Iron, β-carotene supplementation with in combination in comparison to iron and iron rich food supplementation alone.

Iron and β-carotene contents in commonly consumed in locally available food were in variation with values given by NIN. Thus, this can be concluded that Vitamin A deficiency with a serum retinol <20 µg/dL and iron deficiency with haemoglobin <12 gm/dL appear to be an important problem in pregnancy, particularly in communities of low socio-economic status, significantly associated with pre-term and caesarean delivery, low birth weight, low head circumference, low chest circumference and low length of newborn. Their effect on length of the baby needs further study.

In the end, this is further concluded that to reduce iron and vitamin A deficiency during pregnancy, iron supplementation along with vitamin A in the form of β-carotene can be better approach due to the reason that vitamin A teratogenic in pregnancy. Effect of β-carotene supplementation on pregnancy outcomes is also wide area of research.

This study further suggests that iron and β-carotene supplements may improve pre-term and caesarean delivery, low birth weight, low head circumference, low chest circumference and low length. Although, these findings need to be confirmed in further studies with larger sample size and optimal micronutrient could be encourage.
Increased in Heamoglobin level, Serum Iron, Transferrin Saturation, UIBC, and Serum Retinol values in all the supplemented subgroups improved after supplementing various supplements i.e. iron tablet, iron tablet + iron rich food and iron tablet + beta carotene rich food. But the maximum increased in all the parameters was found in the subjects, supplemented with vitamin A (in the form of beta carotene) along with iron tablet as compared to iron rich food + iron tablet and iron tablet alone.

Thus this can be concluded that to reduce iron deficiency anaemia during pregnancy, vitamin A supplementation along with iron tablet can be a better approach. Further researches are still required to find out the mechanism by which vitamin A imporves the iron status. Effect of retinol supplementation on pregnancy outcome is also a wide area of research.