DISCUSSION
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Pregnancy is a physiological process which imposes increased demands of haemopoietic substances to fulfil the needs of growing foetus and for increasing red cell mass in the mother. During pregnancy, in view of high demands of haemopoietic substances, daily dietary intakes usually do not suffice and the needs are fulfilled mainly by a transfer of haemopoietic substances from body stores (Menon, 1967). In case, body stores do not satisfactorily fulfil the demands, a reduction in the haemoglobin level takes place, resulting in anaemia (Sood, 1967).

In India, anaemia is the commonest complication of pregnancy (Menon, 1967). Its high magnitude and widespread ill-effects, on mother as well as on foetus, have attracted the medical researchers and health professionals alike. It is known to be an important factor for high maternal mortality (Menon, 1967; Khana
\[ st \text{ et al.}, 1979\]) and neonatal and perinatal loss. Various workers have shown a positive correlation between maternal haemoglobin level and foetal birth weight (Rasufji et al., 1973).

Although a good amount of work has been done on anaemia in pregnant women, in recent years, majority of
workers have studied 'anaemia in pregnancy', a concept which significantly differs from 'anaemia of pregnancy'. As 'anaemia in pregnancy' takes into consideration all types of anaemias encountered during pregnancy, irrespective of it's etiology, it becomes difficult to ascertain the proportion of women in whom anaemia is directly caused or precipitated by pregnancy. Further, mostly the available studies are hospital based which fail to provide real picture of the problem in the community. Field based studies are very few and those controlled ones are negligible. In fact the problem of anaemia of pregnancy can not be studied in absence of suitable control. Workers who took studies on the subject have considered varied definitions for the diagnosis of anaemia; many of them used considerably low cut-off points for the purpose, thus, underestimating load of anaemia in the population. Further, in view of variability in definition considered, their results cannot be successfully compared. The present literature on the subject also lacks longitudinal studies to enable one to recognize the problem in terms of fresh development of the condition.

The present study is a controlled, community based and longitudinal study undertaken in a rural population under innate settings. All 246 available relevant pregnant woman of the considered area were
studied and equal number of non-pregnant women from the same area served as control. A random sample from a larger population could not be considered in view of paucity of time and lack of facilities. An universally acceptable definition of anaemia for pregnant women and for non-pregnant controls (W.H.O., 1966) was utilized for the process. Our results can, thus, easily be compared with other studies, within and between countries, undertaken in similar population. Further, since the entire investigation was carried out by author only, the results of the present study have relatively lesser observational error.

EXTENT OF THE PROBLEM OF ANAEMIA.

The overall prevalence of anaemia, in pregnant women, based on initial survey was 68 percent; it was 69 percent, based on total observations - initial as well as those of follow-up. As prevalence of anaemia often increases with gestational age (Shankar, 1962; Solomons et al., 1962; Mehrotra et al., 1965; Chopra et al., 1967), the higher rate in latter case is obvious because it had relatively higher proportion of women with advanced pregnancy.

Our results on prevalence rates in pregnant women are similar to many other workers (Subramanian and Fernandes, 1970; Gupta et al., 1973; Laxmi and Gupta, 1979).
Such results give an idea on load of anaemia in pregnant women; they themselves, however, do not indicate the extent of anaemia directly caused by pregnancy. Such an observation can be made only when the rates are compared with those observed for corresponding controls. The prevalence of anaemia in the non-pregnant women was 25 percent only, indicating that in about 43 percent of women, anaemia was either directly caused or precipitated by pregnancy.

Prevalence of anaemia increased significantly with the advancement of pregnancy, being 26 percent in first trimester, 67 percent in second and 76 percent in third trimester. This indicates that considerably different prevalence rate would be observed for women belonging to different trimesters of pregnancy. It is, thus, important to emphasize that extent of problem of anaemia, in the two groups of pregnant women, cannot be compared unless they are homogeneous in respect of at least gestational age. Our findings, on prevalence of anaemia by trimesters, are in agreement with those observed by Shanker (1962); Paintin (1962) and Mehrotra et al (1965) who also observed an increase in the prevalence of anaemia with the advancing pregnancy.

The mean haemoglobin levels in study and control groups were 10.2 gm. percent and 12.3 gm. percent respectively, indicating that a reduction of about 2 gm.
percent in their haemoglobin level was because of their pregnancy. Yusufji et al (1973) also observed a mean haemoglobin level of 10.4 gm. percent and 12.2 gm. percent for study and control groups respectively. Similarly, Chopra et al (1967) observed a mean haemoglobin level of 10 gm. percent and 12 gm. percent for study and control groups respectively.

Mean haemoglobin level showed a consistent fall with enhancing duration of pregnancy being 11.4 gm. percent, 10.5 gm. percent and 9.7 gm. percent for first, second and third trimesters of pregnancy respectively. Our findings closely coincide with those of Shanker (1963), Solomon et al (1963), Mehrotra et al (1965) and Chopra et al (1967) also reported a significant fall in the mean haemoglobin level with the advancement of pregnancy.

Prevalence of microcytic hypochromic anaemia was highest in both the groups - study and control. The distribution of various types of anaemias in the two groups indicate a widely prevalent iron deficiency in them. Macrocytic hypochromic and macrocytic normochromic anaemias were found in study group only, indicating that the deficiency of Vit. B12 and folic acid play a significant role during pregnancy. A high prevalence of iron deficiency anaemias has been shown by many others (Sood, 1967; Apte, 1967; Mc.Fee, 1973 and Imang, 1977).
A high prevalence of megaloblastic anaemia has been reported by Kothari and Bhende (1952), Kurthogaonkar et al (1964) and Mehrotra et al (1965). However, these results cannot be strictly compared with our findings in view of differences in selection of women in the study sample and method adopted for determining the type of anaemia.

All the anaemic women were categorised into 3 groups, depending upon the severity of anaemia (Appendix III), viz. mild, moderate and severe. In the present study, 35 percent pregnant cases had mild anaemia, 54 percent had moderate and 11 percent had severe type of anaemia. In control group, 46 percent anaemic cases showed mild anaemia while 50 percent and 4 percent had moderate and severe anaemia respectively.

Since the definition for diagnosis of anaemia differs from one worker to the other, there is a wide variability in the criteria considered for categorisation of anaemic cases according to the severity. The comparisons of present findings with others is, therefore, not possible.

It was observed that normocytic normochromic pattern was present mainly in mildly anaemic cases whereas macrocytic anaemia was found in moderate and severely anaemic cases. Sood (1967) also opined that in
early iron deficiency, the changes in red cells, if any, are not usually marked, and by the result the blood picture seems to be normal.

Anaemia situations in a community are usually studied with the help of prevalence rates. Such a rate, though undoubtedly, very important, particularly in the studies like present one, fails to give an idea on number of anaemicics who turned to the anaemic state a few in a specified duration of time. With this in view, incidence rates for different trimesters were also worked-out for pregnant women. Such rates showed an increasing trend with the increase in duration of pregnancy. Overall gross and net incidence rates in the pregnant women were about 30 percent and 44 percent respectively.

Iyengar and Apte (1970) in a similar longitudinal study observed an incidence rate of 41 percent. However, the criteria for diagnosing anaemia was 10 gm. percent and not 11 gm. percent as in our study.

In study group 46 percent and in control group, 13 percent anaemic cases complained of some symptoms. Among non-anaemics, 20 percent had some symptoms in study group against 5 percent in control group. General weakness was found to be the most common symptom followed by giddiness in all the groups. Majority of women had
more than one symptoms. Chopra et al. (1967) reported 50 percent of the examined women to have one or the other symptoms. He found weakness and dizziness to be the most common. Vijayalakshmi et al. (1975) found about 51 percent pregnant women to complain general weakness, fatiguability and vague bodyaches. Mehta (1976) was of the opinion that symptoms like easy fatiguability and giddiness etc. are non-specific and have no relation with haemoglobin level.

On examination, positive signs were detected in 61 percent of anaemic women in study group against 67 percent in controls. Pallor was present in all the cases who showed positive signs. Koilonychia was found in 13 percent and 3 percent anaemic cases in study and control group respectively. In study group, oedema and congestive heart failure were detected in 10 and 5 percent anaemic cases respectively. In control group, none of the women showed the presence of these two signs.

Yasufji et al. (1973) reported glossitis in 19 percent stomatitis in 7 percent, koilonychia in 9 percent and oedema in 11 percent cases. In present study higher percentage of pregnant women were found to show positive signs as compared to non-pregnant women, probably because of higher nutritional demands during pregnancy.
Socio-economic factors and anaemia.

Socio-economic factors such as literacy status, occupation and monthly per-capita family income play a significant role in deciding the prevalence of anaemia in a community. Though, such factors have been studied by many workers (Vijayalakshmi et al., 1975; Sarma, 1976; Luwang, 1977) but results are divergent. Study of association of anaemia with socio-economic factors was, thus, thought to be essential.

No significant association could be observed between prevalence of anaemia and religion. This is, probably, because majority of women in both the groups were Hindu. No women came from other religions except Muslims, that too only a few.

Caste of the women also did not show any significant influence on the prevalence of anaemia. As the castes were divided into 2 broad groups - non-schedule (excluding backwards) and schedule castes including backwards, the association of individual castes with anaemia could not be studied. Luwang (1977) also did not find any significant difference in prevalence of anaemia in different caste groups. Chopra et al. (1967) observed in Trinidad that race of the pregnant women had no significant influence on the incidence of anaemia.
No significant association could be observed between prevalence of anaemia and main family occupation in either of the groups. It seems that the ratio of earning and dependant members in a family may be more important than family occupation in this regard. Moreover, the occupation studied here was family occupation and the occupations of individual women; the latter may show significant association with anaemia. In our study, the individual occupation were not considered for the purpose as majority of women in the two groups were housewife and representation of rest other occupation was very poor.

Literacy status is one of the important factors determining socio-economic status of the individuals. In the present study, illiterate pregnant women had significantly higher prevalence of anaemia in the two groups than those who had had some formal school education. Our findings are in conformity with those of Luwang (1977). Probably women with some formal education were more conscious of their health and were less biased towards harmful taboos and practices prevalent in the rural communities. The influence of other factors such as socio-economic status and income can not be ruled out in this regard.

The prevalence of anaemia showed a significant fall with the increasing literacy status of the husband.
in the study group. However, in control group, no such significant association could be observed. It could have been probably because the literate husbands took a better care of their wives during pregnancy than illiterates and were more receptive and cooperative for health care programmes, organised by the government and other social welfare agencies.

In order to study the socio-economic status of women, families of respondents were divided into 5 social classes as suggested by Prasad (1970). Criterion on social classification of Indian families by Prasad is based on per-capita income. Thus, the considered criterion would in fact, reveal the association of two factors jointly - family income and family size, with anaemia. Socio-economic status of an individual is the most important factor affecting the diet as well as health care in all the individuals in a community.

Prevalence rate of anaemia decreased significantly with enhancing socio-economic status; it was highest in social class V, in both the groups. Many other workers (Kothari and Shande, 1949; Das Gupta and Chatterjee 1953; Raut and Panda, 1972) have also observed considerably higher prevalence of anaemia in lower socio-economic groups.
DEMOGRAPHIC FACTORS AND ANAEMIA.

Demographic factors like age of the women, age at marriage, age at consummation and at first child birth, parity and spacing are important correlative factors of anaemia in a community. Many of them are inter-related and are governed by the local customs, traditions and culture of the society. The study of effect of these factors on prevalence of anaemia, if any, is extremely important for planning preventive measures in the community.

Our study showed a significant increase in the prevalence of anaemia with the increase in age of the women, so far so, that all the pregnant women belonging to the age group of 35 years and above were anaemic. A similar trend was observed in control group as well. This could have been, perhaps, due to the increasing hardships of life with advancing age. It might have also been due to effect of parity, which also increases with age. Findings of the present study are in agreement with Ganguli (1954) and Miller et al (1959).

Early marriages and their consummation make the women more liable to become pregnant at an early age. Such women, later on often have a higher parity than those in whom ages at marriage and/or consummation have been delayed. This adversely affects physical growth and development of a woman and renders her more prone for anaemia.
In the present study, prevalence of anaemia decreased significantly with increase in age at marriage in study group; but in control group, no significant association could be observed. However, when age at consumption was taken into account such an association became significant in both the groups; control group also showed a decrease in prevalence rate with increasing age at consumption. Comparison of our findings with other workers and further discussion does not seem possible as literature on it is very scanty.

Age at first child birth was found to be significantly related with anaemia in study group. The prevalence of anaemia decreased with increasing age at first child birth. However, in control group, no significant association could be observed between these two factors. The high prevalence of anaemia in pregnant women, who gave birth to their first child at an early age, might be due to the fact that in early age, nutritional demands are already high due to growth and development of body organs. In pregnancy, besides this, demands are further increased for the growth of foetus. This leads to significant exhaustion of haemopoietic stores rendering the women more prone for anaemia in successive pregnancies.

Parity of the women was found to be significantly associated with the prevalence of anaemia in both the groups. The prevalence rate showed a consistent increase
with increasing parity. Highest rate was observed in women who had parity 5 and above. Many other workers (Leon and Blazer, 1965; Todd and Han, 1965; Yusufi et al., 1973; I.C.I.I., 1974) have brought forth similar findings. It is due to the fact that depletion of haemopoietic substances in each pregnancy results in exhaustion of body stores; this is more so if these pregnancies are closely spaced.

Duration of menstrual phase was found to have no significant effect on the prevalence of anaemia in study as well as in control groups. These findings are in agreement with those of Luwang (1977). It may, therefore, be concluded that normal individual variations of menstrual cycles, in terms of days of bleeding, do not affect the haematological status of a woman.

The prevalence of anaemia of pregnancy showed a declining trend with the increase in space between last child birth and present conception. Similar observations have been made by Luwang (1977), who reported a significantly higher prevalence rate of anaemia in women with the space being less than 12 months, in between two pregnancies, than those who had relatively larger such space. This is because the woman who has a larger space, in between two pregnancies, yet better restoration of haemopoietic reserves than those with smaller space.
A study, carried out by I.C.M.R. (1975) has also shown that repeated closely spaced pregnancies led to a progressive depletion of iron stores.

LACTATION AND ANAEMIA.

The period of lactation is another period of nutritional strain, for a woman, after pregnancy. In India, prolonged lactation (in excess of one year) is quite common, especially in rural communities. One may therefore, expect some effect of lactation on health status of women, particularly anaemia.

Present study revealed that prolonged breast feeding to last child has no significant effect on the prevalence of anaemia, in study as well as control group. The findings contradict the results of Todd and Kan (1965) who observed that prolonged breast feeding plays a significant role in causation of anaemia. It may, however, be noted that the study conducted by Todd and Kan (1965) was a hospital-based study conducted in urbanites, while present study was conducted in ruralites where women giving prolonged breast feed were mostly those who had a sufficiently long space between two successive pregnancies. As the prolonged spacing has a proven favourable effect in reducing the prevalence of anaemia, it nullifies the deleterious effect of prolonged lactation if any.
The observed difference in two studies may, therefore, be because of varied breast feeding practices in them.

As some women continued breast feeding to the last child in initial months of their present pregnancy, its effect on prevalence of anaemia was also studied. A significantly higher prevalence rate of anaemia was observed in women who continued breast feeding during present pregnancy than those who did not. However, the duration of breast feeding, during present pregnancy was found to have no significant impact on the prevalence of anaemia. This supplements that our former observation, that breast feeding during the present pregnancy has a positive bearing, was perhaps because of the shorter space between the last child birth and present pregnancy and it was certainly not due to the duration of breast feeding.

Dietary Factors and Anaemia.

Diet is the only source of supply of most of the essential haemopoietic substances. It, thus plays a significant role in deciding the haematological status of an individual. The prevalence of anaemia may thus thought to be associated with dietary habits and quality of dietary intakes.

In the present study, it was observed that majority of women in the two groups were vegetarian and
amongst those who were non-vegetarian, number taking frequent non-vegetarian diets was almost negligible. No assessment could, thus, be made for the difference in the prevalence of anaemia in vegetarians and non-vegetarians.

In community studied the average dietary pattern indicated that the intakes of various food components, except cereals were considerably lower than that recommended by Indian Council of Medical Research (Singh et al., 1971).

Intake of cereals, roots and tubers was found to be higher in non-pregnant women while intake of milk and milk products were higher in pregnant women. The lower intake of food by pregnant women was, perhaps, due to the symptoms like nausea, vomiting, loss of appetite and dislike for food, which are quite common during pregnancy. Many workers (Chakravarti, 1962; Singh et al., 1971; Vijayalakshmi et al., 1975) have reported a poor dietary intake by pregnant women in different parts of India.

The intake of cereals was found to be significantly lower in anaemics than non-anaemics in both the groups, clearly indicating that the prevalence of anaemia is affected by the dietary intake of cereals.
Further analysis revealed that intake of all the haemopoietic nutrients was lower in study group than in control group; and in anaemics than in non-anaemics in both the groups. Average calorie intake was found to be 1,506 Kcal and 1,615 Kcal for pregnant and non-pregnant women respectively. Vijayalakshmi et al (1975) observed a mean energy intake of 1,503 Kcal in pregnant women belonging to lower socio-economic status. Shanker (1962) in such women reported that average Kcal consumption varied from 1,390 to 1,650 depending upon the duration of pregnancy.

Pasricha (1950) observed a considerably higher daily calorie intake (1,900 Kcal.). However, the composition of population studied in respect of gestational age was significantly different than ours; there were only 3 percent women belonging to first trimester when the food consumption is said to be low. Moreover, his subjects might be belonging to a comparatively better socio-economic status than those of present study.

The average daily protein intake in study group was found to be 55 gm. against 59 gm. in control group. The protein intake observed in present study are almost similar to that reported by Chopra et al (1967).
Other workers have shown a varied daily intake of protein from different parts of India (Shanker, 1962; 40 gm.; Copalan et al., 1969, 37 gm.; Vijayalakshmi et al., 1975, 36 gm.; Singh et al., 1971, 72 gm.). The intake of protein depends mainly on the type of cereal consumed in a community, and socio-economic status of the individuals and may, thus, differ from one population to the other. Although the protein consumption in present study seems to be approaching to that recommended by I.C.R.R. (Copalan et al., 1971), its large portion is wasted in calorie production, due to deficient calorie intake, and as such, can not be utilized as body building food. Moreover, being mainly derived from vegetable sources, the protein is of low biological value.

The prevalence of anaemia showed a considerable decline with increasing protein intake in both the groups. Our findings are in agreement with Barns (1976) and Luweng (1977).

The average intake of total iron was found to be 48 mg. in study group against 52 mg. in corresponding controls. Shankar (1962), Copalan (1967) and Sood (1967) have emphasized that the average Indian diet seemingly contains adequate amount of iron. However, almost whole of it was derived from vegetable sources, mainly cereals.
having high phytate contents which lowers the availability of iron for absorption. Moreover, the calcium content of the diet was also found to be very low; this again lowers the absorption of iron. Agte and Venkatachalam (1962, 1964, 1966) have also reported that the high phytate and low calcium contents in the Indian diet restrict the availability of iron and also inhibits its absorption.

The prevalence of anaemia showed a significant decline with increase in dietary intake of iron. Lawm (1973) also observed a similar significant association between daily iron intake and various grades of anaemia in pregnant women.

The role of deficiency of folic acid, as a definite entity in the causation of anaemia of pregnancy has been stressed by many workers during recent past (Copalan, 1967; Manon, 1967; Yusufi et al, 1973). However, the literature on the dietary intake of folic acid in the communities and that, showing its association with the prevalence of anaemia or otherwise is very scanty.

The average intake of free folic acid, in the present study, was found to be 57.6 μg. in study group and 64.7 μg. in control group; these value are very low in comparison to those recommended by I.C.M.R. (Copalan et al., 1971). The prevalence of anaemia showed a
significant decreasing trend with increasing intake of folic acid in both the groups. Lwam (1977) has also reported similar findings.

Our study, besides estimating load of anaemia in pregnant and non-pregnant women, indicates the proportion of pregnant women in which anaemia has been directly caused or precipitated by pregnancy. It also brings forth many factors as correlative factors of anaemia. The results of the present study are undoubtedly more precise than many other studies done on the subject in view of many reasons indicated earlier. Our conclusion, can taken to be true for all those populations commensurating in nature with present woman.