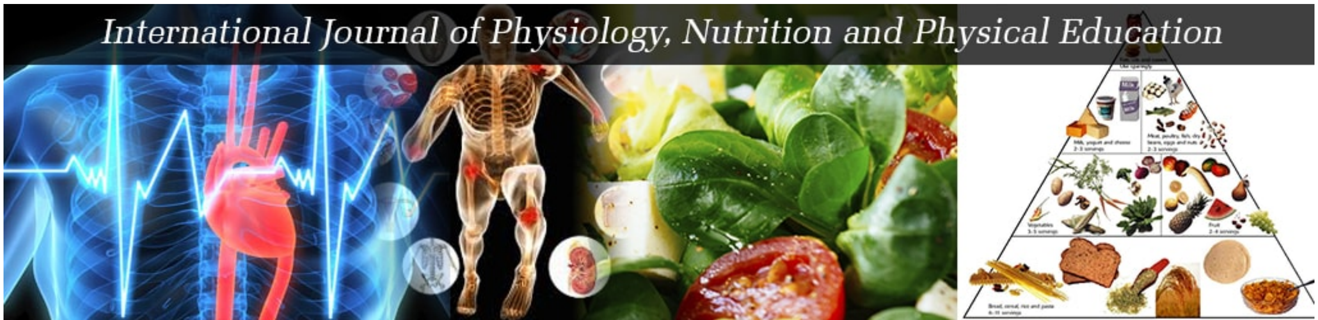

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A study of supplementary diet on iron deficiency anemia in pregnant women of Tamluk at Purba Midnapur district in West Bengal, India

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Abstract
Objective: The objective of the study was to study the effect of supplementary diet on Anemia in Pregnancy of different physiological status of three groups of Purba Midnapur District in West Bengal.
Design: Cross sectional study, using 7-day food record and blood hemoglobin, serum iron, concentrations with weight and BMI.
Setting: Different regions of Tamluk at Purba Midnapore district in West Bengal.
Subjects: A total of 75 women from low socio-economic group aged 16 -40 years participated in this study. The subjects divided in to three groups (control group.1, medicinal treted.2 and medicinal + dietary treted.3). On a selected subject of 25 control group, 25 Medicinal treated group and 25 medicinal + dietary treated group pregnant women.
Results: The weight (Kg) in medicinal treated group and medicinal + dietary treat group after 30 days ware (50.85 ± 1.61, 51.55 ± 1.53) and 60 days ware (52.4 ± 1.56, 53.15 ± 1.51) ware significantly increased (*P*<0.001) compeered with control group. The BMI (Kg/m^2) In medicinal treated group and medicinal + dietary treat group after 30 days ware (21.13 ± 0.55, 21.85 ± 0.53) and 60 days ware (21.32 ± 0.47, 21.92 ± 0.45) ware significantly increased (*P*<0.001) compeered with control group. The Hemoglobin (g/100ml) in medicinal treated group and medicinal + dietary treat group after 30 days ware (9.25 ± 0.222, 10.13 ± 0.217) significantly increased and 60 days ware (10.68 ± 0.218, 11.5 ± 0.214). In medicinal + dietary treated group after 30 days and 60 days ware significantly increased (*P*<0.01, *P*<0.001) respectively compeered with control group but in medicinal treated group the value was not significantly changed after 30 days, only increased significantly (*P*<0.001) after 60 days. The Serum Iron (µg/dl) In medicinal treated group and medicinal + dietary treat group after 30 days ware 106.00 ± 2.480, 107.70 ± 3.869 and 60 days ware 107.89 ± 2.579, 111.38 ± 3.931. After 60 days the value in medicinal + dietary treated group was significantly increased (*P*<0.01) compeered with control group.
Conclusions: The results of the present study show that anemia and iron deficiency are prevalent at Purba Midnapur District women of low socio-economic groups. It shows also the essentiality of combating iron deficiency among women of different physiological status, especially in low socio-economic group. Only medicinal treatment is not sufficient for prevention of iron deficiency anemia. As there is evidence to show that iron in medicinal form is better absorbed with dietary iron so dietary iron supplementation combined with medicine and other measures which increase the bioavailability iron intake for the whole population could be the suggested strategies to improve iron status.

Keywords: pregnant women; iron status; serum iron; Hemoglobin

Introduction

PREGNANCY represents a period of stress and demands increased nutrient intake not only for the mother but also for the offspring. Numerous observers have associated anemia in pregnancy with adverse effects both on the mother and fetus.

Iron deficiency is the most commonly recognized nutritional deficit in either the developed or developing world [1]. The increased risk sustained during childhood years, as well as during pregnancy, is associated with inadequate iron nutriture in face of rapid growth, which imposes increased demand for iron [2, 3]. Young woman have additional iron deficit because of blood loss with menstruation, as well as from the increased red blood cell mass and expansion of plasma volume during pregnancy [3]. Other factors being equal, dietary intake also plays an important role. Woman reproductive years are at risk of nutrient inadequacies because their energy intake is often restricted. As a result, dietary iron intake is often too low to offset losses from menstruation or the increased requirement associated with reproduction [4-6].

Anemia is one of the most common complications of pregnancy. A high proportion of women in both industrialized and developing countries become anemic during pregnancy. Estimates from the World Health Organization report that from 35% to 75% (56% on average) of pregnant women in developing countries, and 18% of women from industrialized countries are anemic [7] and all pregnant woman belonging to low income groups in India have levels of Hemoglobin below 10gm/100ml during the third trimester of pregnancy. In some parts of India as much as 10% of all maternal deaths are reported to be directly attributable to anemia whereas it is an important aggravating factor in an additional 10-20% [8]. The role of maternal anemia in the maturity and nutritional status are also considerable.

However, many of these women were already anemic at the time of conception, with an estimated prevalence of anemia of 43% in nonpregnant women in developing countries and of 12% in women in wealthier regions [9]. The prevalence of iron deficiency is far greater than the prevalence of anemia and iron deficiency (low serum ferritin and sparse or absent stainable iron in bone marrow) often develops during the later stages of pregnancy even in women who enter pregnancy with relatively adequate iron stores [10].

The several anemias of pregnancy are characterized by different morphological and clinical attributes and by different and necessarily interdependent etiologies. Most, if not all, of these are obviously not unique to pregnancy, but more probably precipitated by and exaggerated during gestation. They frequently coexist resulting in hemotological changes diagnosed only by extensive laboratory and/or theapeutic investigation. Prevalence of anemia in South Asia is among the highest in the world, mirroring overall high rates of malnutrition.

In India, recent nationally representative data from the National Family Health Survey 1998=1999(International Institute of Population Sciences and ORC Macro 2000) on anemia of women of reproductive age describe the magnitude of the problem. prevalence rates across the states are remarkably similar, reflecting underlying determinants that include diets low in heme-iron and high in phytates, high levels of malaria and other infectious diseases, and frequent reproductive cycling that decreases iron stores [11, 12, 13].

The occurrence of anemia in pregnancy has been reported in different parts of the world with an incidence up to 56 per cent [14]. The existence of a high percentage of anemia among pregnant and nursing mothers in Trinidad was revealed by the Interdepartmental Committee on Nutrition for National Defense (ICNND) survey conducted in 1961 [15] The worldwide anemia prevalence data suggest that normal dietary intakes of iron are insufficient to meet peak daily requirements for a significant proportion of pregnant women [16].

The present study was therefore designed to characterize this anemia and determine the various etiological factors that might be responsible for this deficiency. The dietary aspects of the study aim to determine what the role of nutrient intake is might play in the causation of anemia and to correlate clinical and biochemical findings with the nutrient intake.

Subjects and methods

Subjects

A total of 75 women from low socio-economic group aged 16 -40 years participated in this study. The subjects in the low socio-economic groups were selected from Dharinda, Pyrachali and Shalgechia, Rajabager, Chatimtala, Badamtala of Tamluk, respectively.

The socio-economic status of the subjects was based on family income level. Group consisted of women in the households of daily labourers, beggars, landless individuals, landless farmers and farmers with small holdings.

Considering poor socio-economic and unsanitary condition as well as inadequate health facilities, this is a typical area of Tamluk dominated by destitute people. The population of this area largely subsists on rice cultivation with some cash cropping and spring harvest. Two main crops (rice) are grown in this location, one harvested in December (Aman) and the other in June (Aush).

The purpose of the present study was explained to the potential subjects through direct communications, family connections and a community network. They were asked to consent to participate in the study. In some cases the permission of husband and parents-in-law was sought for the subjects to participate. The response rate was about 90% in each location.

In fact, illiteracy made the field study difficult in the low income group. Women in this group are dependent on men for their economic livelihood. Considering this fact the first approach was to contact the community leaders, explain the purpose of the study and ask for co-operation. The community leaders were often uncooperative and they sometimes even misguided the illiterate husband of the subject with false information. We changed this strategy and went to motivate them as well as their husbands and mothers-in-law. We explained the objective of the study in an understandable way. A small monetary reward was given to the subjects in this group which greatly encouraged them to participate in the study. Using this approach the response rate was practically 100%.

As the subjects in the low income group were selected from an illiterate community in one location, the cultural features in this group were similar. In Tamluk, women, particularly in low income group, are very much afraid of giving blood samples. Therefore, first of all the blood sample was collected. The collection of socioeconomic information, dietary and anthropometric studies were carried out sequentially only from those who had given a blood sample. The subjects divided in to three groups (control group.1, medicinal treted.2and medicinal + dietary treted.3). On a selected subject of 25 control group, 25 Medicinal treated group and 25 medicinal + dietary treated group pregnant women, detailed clinical, biochemical, and dietary data were collected simultaneously.

At first; all information including blood samples was collected from the group 1. The field work was carried out on group 2 and group 3 subjects sequentially. The pregnant subjects of the present study were at late second trimester to beginning of third trimester of their pregnancy. None of the subjects of control group (group-1) was reported any iron, vitamin C and folic acid or any dilatory supplementation. Medicinal treated group (group-2) of the subjects reported with iron, vitamin C and folic acid supplementation.

Collection of data on dietary intake

The information regarding dietary intake was collected for seven-day in total including one Sunday, which was at that time a weekly holiday. The subjects were asked to maintain their normal dietary practice. Dietary information of the subjects in a given area and were present at their houses during their every meals. Recorded the dietary intake of each food item used by the study subjects by the food record method. Subjects were instructed to report the food and beverage taken between meals and to describe the portions in terms of measures provided which were recorded during following visits on the same day.

The recorded food were coded by food items and weight measured in grams using the Food Quantities Manual and Food Code by ICMR. The average daily energy and nutrient intakes were calculated using the computerized version of the food composition database promoted by the ICMR. The average intake over 7 days was calculated for each individual.

Supplementary diet

This diet is referred to in the project work as the supplementary diet. The composition of the diets is given bellow:

	Foodstuffs	Amount
Early morning 6:30 am	i. Bengal gram(whole)	30 gm
	ii. Jiggery	10 gm
Breakfast 8 am	i. Rice flakes with mixed veg	50 gm
	ii. Guava / banana	100 gm
Late morning 10 am	i. milk	50 ml
Lunch 12:30 pm	i. rice	100 gm
	ii. dhal (lentil)	50 gm
	iii. G.L. Veg (Amaranth)	100 gm
	iv. Mixed veg (cauliflower greens + potato + brinjal)	100 gm
	v. Fish / soyabin	50 gm
	vi. Amloki	1 piecs
2:00 pm	Orange, Dates	50 gm
6:00 pm	Channa,	50 gm
	Puffed rice,	50 gm
	Bengal green, Salad	25 gm
Dinner 9:00 pm	Chapati,	4 pics
	Liversheep,	100 gm
	Midveg (cauliflower green + cowpea + potato)	50 gm

Anthropometric measurement

Height: height was measured without shoes, by anthropometric rod

Weight: weight was measured fully clothed but without shoes by weight machine.

BMI: was calculated by weight (Kg)/ Height (m^2).

Sample collection and laboratory measurement

Blood samples were collected in the morning after an overnight fasting of the subjects by disposable syringe through vane puncture and a maximum of 5ml blood was taken. An aliquot of this blood (20 ml) was taken in a heparinized micro tube immediately after collection of the blood sample for the measurement of the blood hemoglobin concentration and Serum Iron concentration.

Blood hemoglobin concentrations

Measure by the cyanmethemoglobin method. Anemia was defined as hemoglobin levels for pregnant females <10g/100ml (DeMaeyer *et al.*, 1989). Iron deficiency anaemia was considered to be present when blood haemoglobin concentration fall below listed cut-off values (Cook *et al.*, 1992) [126].

The serum iron concentration

Routine laboratory method by cook *et al.*, 1992(-----) [126].

Statistical analyses

Data are expressed as mean ± SEM and Paired student t test were performed for comparisons between the values of control group, 30 days and 60 days after Medicinal treated group and Medicinal + dietary treated group. For each test $P<0.05$ was considered as significant.

Results

Weight (Kg)

Weight (Kg) in medicinal treated group, medicinal + dietary treat group and control group. Was measured 30 days and 60 days after medicine and dietary supplements and in control group none of the subjects (group-1) was reported any iron, vitamin C and folic acid or any dilatory supplementation. In medicinal treated group and medicinal + dietary treat group the weight (Kg) after 30 days ware 50.85 ± 1.61, 51.55 ± 1.53 and 60 days ware 52.4 ± 1.56, 53.15 ± 1.51 ware significantly increased ($P<0.0001$) compeered with control group.

BMI (Kg/m^2)

BMI (Kg/m^2) in medicinal treated group, medicinal + dietary treat group and control group was measured 30 days and 60 days after medicine and dietary supplements and in control group. None of the subjects control group (group-1) was reported any iron, vitamin C and folic acid or any dilatory supplementation. In medicinal treated group and medicinal + dietary treat group the BMI (Kg/m^2) after 30 days ware 21.13 ± 0.55, 21.85 ± 0.53 and 60 days ware 21.32 ± 0.47, 21.92 ± 0.45 ware significantly increased ($P<0.0001$) compeered with control group.

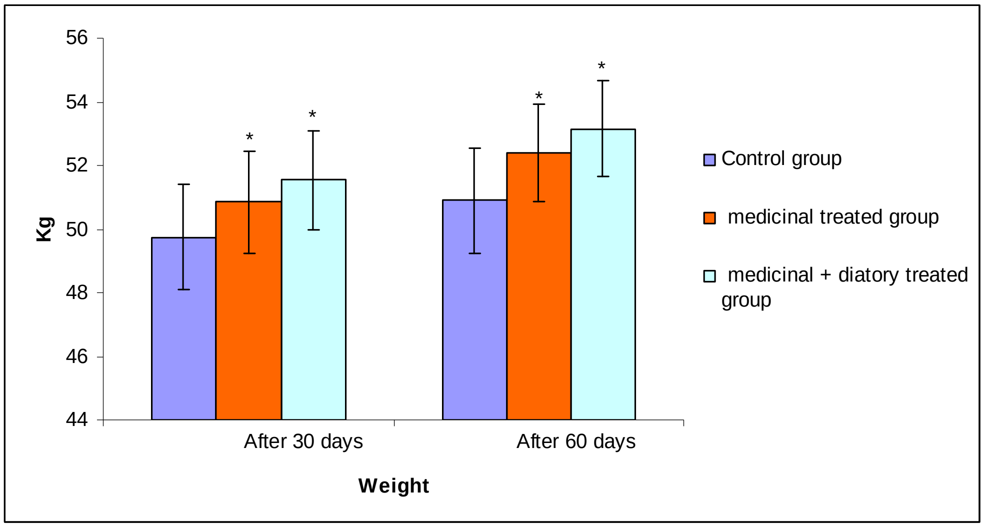
Hemoglobin (g/100ml)

Hemoglobin (g/100ml) in medicinal treated group, medicinal + dietary treat group and control group was measured 30 days and 60 days after medicine and dietary supplements and in control group. None of the subjects control group (group-1) was reported any iron, vitamin C and folic acid or any dilatory supplementation. In medicinal treated group and medicinal + dietary treat group the Hemoglobin (g/100ml) after 30 days ware 9.25 ± 0.222, 10.13 ± 0.217 and 60 days ware 10.68 ± 0.218, 11.5 ± 0.214. In medicinal + dietary treated group after 30 days and 60 days ware significantly increased ($P<0.01$, $P<0.0001$) compeered with control group but in medicinal treated group the value was not significantly changed after 30 days, only increased significantly ($P<0.0001$) after 60 days.

Serum Iron (µg/dl)

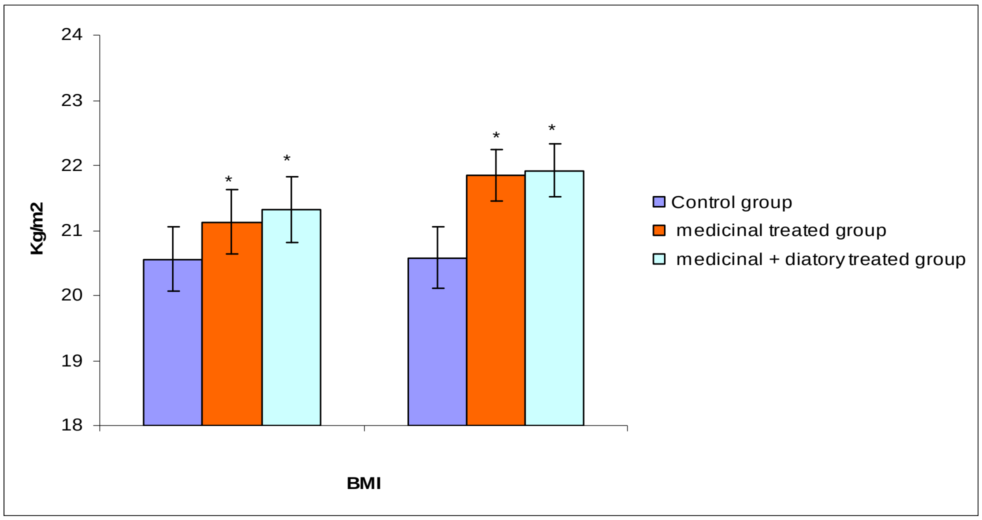
Serum Iron (µg/dl) in medicinal treated group, medicinal + dietary treat group and control group was measured 30 days and 60 days after medicine and dietary supplements and in control group. None of the subjects control group (group-1) was reported any iron, vitamin C and folic acid or any dilatory supplementation. In medicinal treated group and medicinal + dietary treat group the Serum Iron (µg/dl) after 30 days ware 106.00 ± 2.480, 107.70 ± 3.869 and 60 days ware 107.89 ± 2.579, 111.38 ± 3.931.The value was not significantly changed after 30 days both in medicinal treated group and medicinal + dietary treated group and after 60 days the value in medicinal treated group was not significantly changed but in medicinal + dietary treated group it was significantly increased ($P<0.01$) compeered with control group.

Results



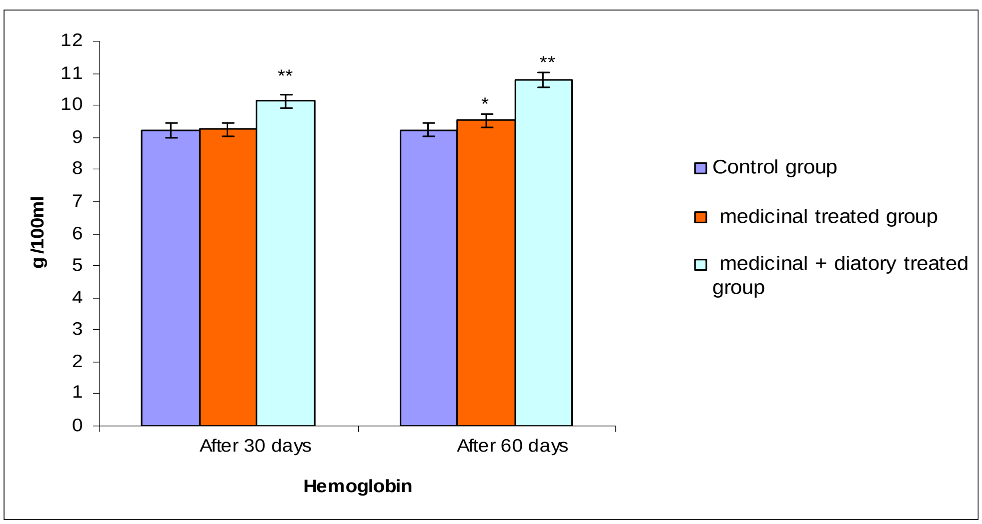
Value shows: Mean ± S.E *P<0.001

Fig 1: Weight (Kg) of medicinal treated group, medicinal + dietary treated group after 30 and 60 days with control group.



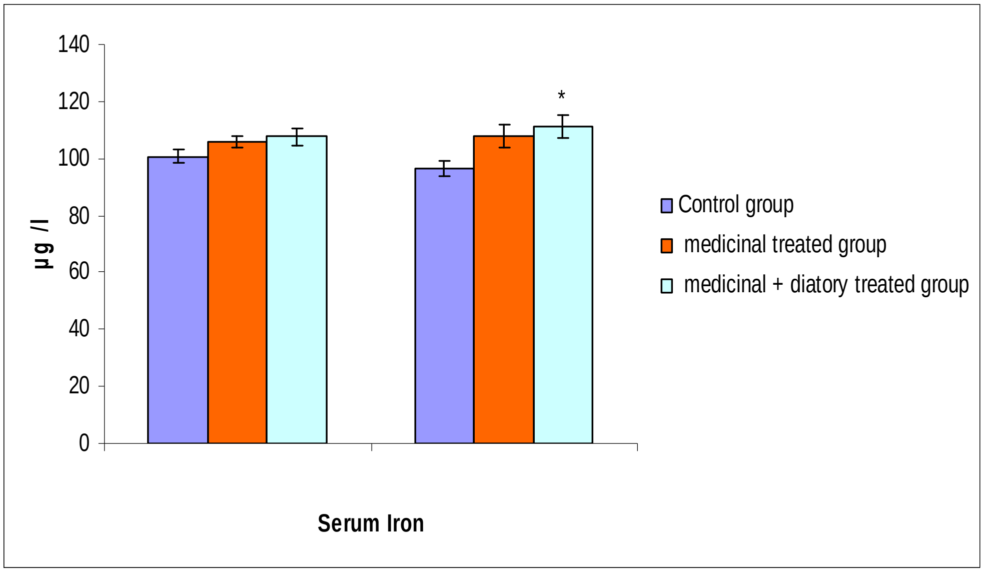
Value shows: Mean ± S.E *P<0.0001

Fig 2: BMI (Kg/m^2) of medicinal treated group, medicinal + dietary treated group after 30 and 60 days with control group.



Value shows: Mean ± S.E *P<0.01, * *P<0.001

Fig 3: Hemoglobin (g/100ml) of medicinal treated group, medicinal + dietary treated group after 30 and 60 days with control group.



Value shows: Mean ± S.E *P<0.01

Fig 4: Serum Iron (µg/dl) of medicinal treated group, medicinal + dietary treated group after 30 and 60 days with control group.

Discussion and conclusion

In several balance studies carried out on healthy adults it has been observed that about 10% of the 18-22 mg of iron present in the diets of those in the poor segments of India's population is absorbed (121) whereas the daily loss of iron has been estimated to be around 1.7-1.8 mg (122). Most subjects may, therefore, be considered as being just in balance. The iron loss due to menstruation has been found to be on an average 15 mg/cycle (123) or 0.5 mg/day. On their habitual diets a majority of women of childbearing age would, therefore, be in negative balance. The increased needs of iron for pregnancy have been quantitated well, and for an average Indian woman this would work out to about 400-500 mg/pregnancy. The increased requirement, however, does not appear to be uniformly spread over the entire gestational period as a larger proportion of tile needs are required during the last trimester. These considerations would suggest that over tile last hundred days of pregnancy, a woman requires an additional 4-5 mg/day to meet tile increased need for iron. As there is evidence to show that iron in medicinal form is better absorbed with dietary iron and that about 20% of a dose of ferrous sulfate is absorbed, time necessary additional dietary allowance will be about 25 mg/day. It was on this basis that a level of 70 mg of iron daily was used in these studies. The results of the study clearly demonstrate that a daily supplement of 60 mg of iron given from the 24th week of pregnancy is sufficient, not only to maintain hemoglobin levels above 10 g/ 100 ml in all subjects, but also to raise the levels in many pregnant women**.** This observation is somewhat different from that made by Dc Leeuw *et al.* (124) in a similar study. They observed that while supplements of 78 mg diatory iron/day were associated with satisfactory levels of hemoglobin, supplements with 39 mg/day were not associated with the same beneficial effects. Preliminary studies on some of the women studied here have shown that with supplements of 70 mg iron daily the increase in circulating hemoglobin mass was very similar to that reported by Dc Leeuw with 78 mg iron/day. The reason for this difference is not clear.

The 24-36th week of pregnancy have in fact shown that in all subjects receiving the supplements, tile absolute amount of hemoglobin was much higher than in time un supplemented subjects.

Analysis of hemoglobin levels in all tile 75 subjects, at the time of registration showed that the levels were not related to parity. This observation is somewhat contrary to that reported from these Laboratories that in a similar group of 120 pregnant women in the third trimester.

However, tile observations made here indicate that a daily supplement of 70 mg dietary iron given during time last 100 days of pregnancy is sufficient to prevent hemoglobin levels from falling below 10 g/ 100 ml and also increase the serum iron concentration after 60 days of Medicinal + dietary treated group but there is no improve of serum iron in medicinal treated group.

However, there is substantial evidence that maternal iron deficiency anemia increases the risk of preterm delivery and subsequent low birth weight, and accumulating information suggests an association between maternal iron status in pregnancy and the iron status of infants postpartum. Certainly, iron supplements improve the iron status of the mother during pregnancy and during the postpartum period, even in women who enter pregnancy with reasonable iron stores. The advisability of routine iron supplementation during pregnancy, regardless of whether the mother is anemic, has been heavily debated in the United States (84, 96), and routine supplementation is not universally practiced in all industrialized countries (97). In my opinion, the mass of evidence supports the practice of routine iron supplementation during pregnancy, although iron supplementation is certainly most important for those pregnant women who develop anemia.

In conclusion, the results of the present study show that anemia and iron deficiency are prevalent at Tamluk women of low socio-economic groups. It shows also the essentiality of combating iron deficiency among women of different physiological status, especially in low socio-economic group. Only medicinal treatment is not sufficient for prevention of iron deficiency anemia. As there is evidence to show that iron in medicinal form is better absorbed with dietary iron so dietary iron supplementation combined with medicine and other measures which increase the bioavailability iron intake for the whole population could be the suggested strategies to improve iron status.

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