

Effect of Nutrient Intake on Haematology in Child Bearing Women of Different Age and Socio-economic Groups

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ABSTRACT

Nutrient intakes in 153 randomly selected lactating women of three socio-economic groups (low, middle and high) with monthly income upto Rs 4000, Rs 4001-10000 and above, respectively and age groups (< 25, 26-32 and > 33 years) of Faisalabad, Pakistan, revealed an overall intake of energy, protein and vitamin A to be 2275 ± 40.50 Kcal, 65 ± 14.35 g and 442 ± 182.0 $\mu\text{g}/\text{head}/\text{day}$. The average daily dietary energy intake (DEI) of mothers was below the recommended dietary intake (RDI) and it showed significant difference between socio-economic (SES) groups. The protein intake significantly declined with the decline in SES. Significantly lower levels of vitamin A intake were observed in mothers of low than middle and high SES. The overall mean haemoglobin (Hb) concentration, Haematocrit (Hct) value and total leucocytic count (TLC) during the present study was 9.40 ± 1.44 g/dL, $30.02 \pm 4.40\%$ and 8.86 ± 2.02 thousand/ μL , respectively. Hb concentrations of mothers in low SES were significantly higher than that of middle and high SES and the differences between the later were non-significant. The Hct and TLC declined significantly with the increase in SES. The Hb and Hct showed non-significant differences between age groups. The TLC showed significantly higher values at lower than at middle and high age groups. The differences between the later were non-significant.

Key Words: Nutrient intake; Haematology; Child bearing women; Socio-economic status

INTRODUCTION

The health indicators in Pakistan reflect poor performance in comparison with other countries of south East Asia. The infant mortality rate is the highest (93/1000 live births) in the world; while, maternal mortality is about 300-600 per 100,000 births (GOP, 1998). The protein energy malnutrition (PEM) is highest in those countries with high infant mortality rate and is closely linked with poverty, poor environmental hygiene and ignorance. Sixty per cent of women and 40% of children in Pakistan are malnourished (UNICEF, 1990). More than 50% of females have low haemoglobin levels during pregnancy and 43-47% of rural and 35-41% of urban females aged between 15-44 suffer with nutritional anaemia (NHS, 1994).

The populous countries of South East Asia, Middle East and Africa still account for the most cases of vitamin A deficiency, and Pakistan is no exception to it (Rawala *et al.*, 1975; Mahmood, 1977). The deficiency of vitamin A lowers resistance to infections (Gibson, 1990). It is, therefore, not surprising that a variety of haematologic disorders may be associated with the syndrome of PEM and vitamin A deficiency. The average daily dietary intake of vitamin A by un-supplemented women in developing countries have been reported by Newman (1994) which is less than half that of women from developed countries. Information regarding dietary intake among childbearing and lactating women is scarce. The present study was,

carried out to assess the nutritional status of mothers of different ages and socio-economic status (SES) by dietary survey and haematology.

MATERIALS AND METHODS

The study involved 153 women delivered in the five hospitals of Faisalabad including Allied Hospital, District Headquarter Hospital and National Hospital. These women were divided in three SES groups (low, middle and high), each comprising 51 women on the basis of monthly income. Each SES group was further divided into three (women < 25, 26-32 and > 33 years age) groups. Blood samples were collected from peripheral veins of the subjects within 48 hours of the delivery to determine various haematological parameters. Different parameters included for this study were, assessment of nutrient intake and haematology including haemoglobin (Hb), haematocrit (Hct) and total leucocytic count (TLC).

The assessment of nutrient intake by mothers under study was made through food frequency questionnaire. The respondent mothers were presented with a list of foods and were interviewed to assess how often each of the common foods was taken by them. Quantitative assessment of the foods eaten was made on the basis of the data thus obtained. Intakes of major nutrients were calculated using food composition tables for Pakistan (Hussain, 1985). The Hb concentration was estimated by acid haematin method using Sahli's apparatus. The Hct

was determined by micro-haematocrit method as described by Benjamin (1978). The TLC was made by the method described by Coles (1980) using improved Neubaur haemocytometer. The data thus obtained were subjected to GLM (General Linear Model for factorial experiments) by using Minitab computer software package. The means were compared by Tukey's test for confidence interval by using one way analysis of variance by using same statistical package. Correlation coefficients among different parameters were also worked out by using Minitab (10.2) computer software package (Anonymous, 1994).

RESULTS AND DISCUSSION

The estimated mean intake of nutrient per head per day by mothers of different SES is given below:

Table I. Estimated mean intake of nutrient per head per day by mothers of different socio-economic status

Nutrients	Socio-economic status			Mean±S.E.
	Low	Middle	High	
Energy (Kcal)	1807.0c	2322.0b	2696.0a	2275.00 ±40.50
Protein (g)	52.3c	64.6b	77.9a	64.99 ±14.35
Vitamin A (mg)	230.1b	535.7a	561.1a	442.00 ±182.00

Different letters given with means in each row show statistically significant (P<0.01) differences

The dietary energy intake (DEI) of mothers ranged from 1635 to 3022 Kcal with a mean intake of 2275 Kcal /head/day. The recommended dietary intake (RDI) for lactating average Pakistani woman engaged in moderate activity is 2000V±550 = 2550 Kcal/day (Ali, 1993). The DEI of mothers varied significantly with SES. The DEI of mothers belonging to low SES ranged from 1635 to 1906 Kcal/head/day, the average being 70.74% of the RDI, while those belonging to middle SES ranged from 2048 to 2653 Kcal, average of which was 91% of RDI. The mothers in middle SES still could not receive adequate amount of energy. In high SES, the DEI was on an average 2696 Kcal. This group had DEI close to RDI but with wide variation among individuals (2415 to 3022 Kcal). Aslam *et al.* (1982) observed that some 40% of the rural population had energy deficit of 10% of the requirement. However, a world-wide increase in dietary energy supply (DES) by 11%, from 2180 to 2340 Kcal/day during the period 1969-71 and 1990-92 has been reported (FAO, 1996).

The average protein intake in mothers was 65 gm/day. Human milk contains on an average 1.2 g

protein per 100 ml and the amount of protein secreted in 850 ml milk daily comes to about 10 g. An additional allowance of 17 g of protein of the same quality as that of milk has, therefore, been recommended by Pakistan Council of Science and Technology (1993) over and above the normal requirements of 44 g for non-pregnant, non-lactating women and that the requirements equal to 61 g/day (Ali, 1993). The FAO/WHO experts have recommended 16 g extra protein per day during first six months and 12 g per day during second six months of lactation (WHO, 1985). The recommended safe levels of protein intake for lactating mothers according to FAO (1996) is 69 g/day. The average protein intake of mothers in the present study was close to the RDI, as well as safe levels suggested by FAO (Latham, 1997). However, there was a great variation among protein intake, between different socio-economic groups and individuals (28.99 to 95.30 g/head/day). The mothers belonging to low SES are however, consuming only 85.75% of RDI for proteins.

Mean vitamin A intake by lactating mothers in the present study was 442 µg/day. It ranged from 122 to 838 µg/day. The weighted average daily intake of vitamin A by lactating women in developing countries is less than that of women in developed countries (660 Vs 1540 RE / day) being lower than safe level for lactating women (850 RE/day), but above the basal requirements of 450 RE / day recommended by FAO and WHO (Newman, 1994). Recommended daily allowance of vitamin A for lactating mothers as proposed by committee of Pakistan experts (1979) is 1200 µg / day (Ali, 1993). The findings of the present dietary survey revealed that the average vitamin A intake in lactating mothers in all socio-economic groups is lower than the safe level, but it is above the basal level only in mothers belonging to higher and middle SES. The intake is also lower in mothers from all socio-economic status than RDI proposed for Pakistan. The result of the present study also support the findings of Nutrition Survey of west Pakistan (GOP, 1970) which revealed that dietary intake of vitamin A is very low in all SES groups and average consumption is about half the recommended allowance and the lower income groups are the worst sufferers.

As is evident from the findings of the dietary survey conducted during the present study, there was a widespread prevalence of malnutrition. There was a general low calorie intake at all SES levels, along with other nutrient deficiencies.

Haematology (Table II). The mean Hb concentration estimated during the study within 48 hours postpartum ranged from 8.74 to 10.30 g/dL. The Hb values were quite low, as compared to the reported normal values. Healthy females have been reported to have Hb

concentrations 13.1-15.0 g/dL (Diren *et al.*, 1991), 11.5-16.3 g/dL (Shirley *et al.*, 1955) and 11.77 g/dL (Khalique *et al.*, 1968). Reid (1986) also reported higher Hb value in pregnant women during first (12.06±0.094), second (11.66±1.16) and third (11.79±1.24) trimesters in comparison to non-pregnant, non-lactating women (13.29±1.01 g/dL). Simmons *et al.* (1982), during an island wide survey in Jamaica, reported that 61% of the pregnant women had Hb levels below 11g/dL and of lactating women 58.7% had Hb levels below 12 g/dL. The present study revealed that 95% of mothers had Hb levels below 12 g/dL, which indicates severe prevalence of anaemia.

The low levels of Hb observed in the present study could also be due to rapid decrease of Hb concentration after delivery as a normal event, however, it must be considered as a state of anaemia. Dietary intake data of individual mothers, collected during the present study revealed that foods rich in iron; like meat, poultry, fruits and vegetables formed an in-significant part of their diet. Moreover, an increased demand of iron by mother and foetus made the situation more critical. It was observed that Hb concentration declined with the elevation of SES having 10.30 in low and 8.74 in high SES. The SES alone has not been reported to positively relate with nutritional status (Johnson *et al.*, 1983; Ahmad, 1985; Monteiro & Szarfarc, 1987; Ahmad, 1997). Several workers have revealed a positive correlation between SES and nutritional status and Hb levels. Johnson *et al.* (1982) reported that the main factors related to low Hb values were inadequate intake of foods rich in erythropoietic nutrient, iron deficiency, along with household income and percentage of household income spent on foods. Mehta (1982) concluded that poor

availability of iron from Indian diet was a main factor resulting in widespread iron deficiency anaemia in India. Relatively higher values of Hb in low SES groups, as revealed by the present study, might be due to the more physical work performed by them to meet the growing expenses. For the higher amount of physical work, body needs higher amount of O₂ to cope with the increased energy demand; hence the RBCs increase in blood as a physiological phenomenon. This effect might also be due to the fact that more vegetables, specially leafy green are consumed by mothers of low SES and that might be a contributory factor towards higher Hb levels.

A very broad range of Hct (20-55) has been shown for normal adult woman (Benjamin, 1978). The present study showed Hct to range from 27.39 to 34.20% (Table II). Normal women have been reported to contain Hct 38.0 to 50.0 (Shirley *et al.*, 1955), 40.0 (Dirren *et al.*, 1991), 37 to 47 (Harper, 1993) and 31 to 45 (Khalique *et al.*, 1968). Reid (1986) observed Hct close to normal values for pregnant women during first (36.0±2.9), second (34.0±3.3) and third (35.0±3.6) trimester as compared to non-pregnant non-lactating women (39.8±3.0). The effect of socio-economic status on Hct was noted to be similar as in case of Hb. Significantly higher values were observed at low than at high SES. Although difference between middle and high SES was non-significant, relatively higher values were observed at middle than at high SES. This might be the reflection of Hb levels, which is positively correlated to the Hct (Wolde-Gabriel *et al.*, 1993; Molla *et al.*, 1993). A positive correlation between Hb and Hct was also observed during the present study ($r = 0.74$, $p < 0.05$). Similar correlation between Hct and Hb was reported by Baker *et al.* (1982) and Dacie and Lewis (1991). Kinoti

Table II. Mean haemoglobin concentration, haematocrit values and total leucocytic count of mothers of different ages and socio-economic status

SES	Age groups (years)			Overall Mean±S.E.
	< 25	26-32	> 32	
	Haemoglobin (g/dL)			
Low	10.22Ab	11.80a	8.88b	10.30±1.53A
Middle	9.24B	9.68ab	8.56b	9.16±1.40B
High	8.44B	9.00a	8.78b	8.74±0.92B
Overall Mean±S.E.	9.30±1.42	10.16±1.52	8.74±1.03	9.40±1.44
	Haematocrit (%)			
Low	33.40Ab	36.40a	32.80ab	34.20±2.54
Middle	31.20Ab	28.40b	25.80b	28.47±3.96B
High	27.80B	27.60b	26.76b	27.39±3.17B
Overall Mean±S.E.	30.80±4.16	30.80±4.52	28.54±4.38	30.02±4.40
	Total leucocyte count (000/μL)			
Low	10.60a	10.17a	8.85ab	9.87±1.24A
Middle	9.52Ab	6.31b	9.66ab	8.37±2.35B
High	9.4Ab	8.10ab	7.43ab	8.32±1.40B
Overall Mean±S.E.	9.85±1.65A	8.19±1.92B	8.54±1.60B	8.86±2.02

Different capital letters on overall means for SES and age groups and small letters on means of SES x age show significant ($P < 0.01$) differences

(1982) reported that low HCT value is one of the indices of iron deficiency anaemia.

Results of the present study showed that TLC ranged from 8.32 to 9.87 thousand/ μ L. TLC was higher in mothers of low SES. The mean total leucocytic count observed during the present study was $8.86 \pm 2.02 \times 10^3$ / μ L and it was comparable to count reported by Smith (1986) and Khalique *et al.* (1968). The increased TLC indicates that mechanism of body defence became more active after parturition to protect the exposed body surface i.e. the uterus from infective agents and also to make up the wear and tear of the uterine tissue. The count showed an increase with increasing severity of malnutrition that is, decline in SES. Findings of the present study are also in line with those of Tabbasum (1997). The TLC was affected significantly by the age. The values were significantly higher in younger than in middle aged and older mothers. Similar findings were reported by Ziai *et al.* (1975). A relative decrease in TLC with increase in age, was also reported by Tabbasum (1997).

CONCLUSION

The dietary intake of certain nutrients were much below the recommended levels specially in low SES. Prevalence of anaemia was very high among all SES and age groups.

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(Received 14 June 2000; Accepted 20 July 2000)