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Short Communication

Dietary Intake and its Effect on the Iron Status of Pregnant Mothers in an Urban Slum Population of Colombo

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ABSTRACT. *The effect of diet on the iron status of pregnant mothers in an urban slum population of Colombo was assessed. Sixty one pregnant mothers, aged 18 –35 years, in the second trimester of pregnancy, attending antenatal clinics, comprised the study sample while age-matched twenty nine, non-pregnant, non-lactating mothers attending other welfare clinics were included as the study controls. The nutrient intake was assessed from a 3 day x 24-hour dietary recall with weighing foods on one day. Iron deficiency anemia (IDA) was assessed by measuring haemoglobin, serum ferritin and serum transferrin receptor (sTfR) concentrations.*

The mean (± SD) intake of energy (2245 ± 310 kcal, 2357 ± 480 kcal), protein (73 ± 17 g, 75 ± 19 g), and iron (21 ± 8 mg, 25 ± 11 mg) of both, control and sample groups, was adequate in terms of Recommended Daily Allowances. However, the mean intake of vitamin A (443 ± 260 µg) and calcium (765 ± 265 mg) was inadequate among pregnant mothers. The iron status of the pregnant and non-pregnant mothers was Hb: 115 ± 11 g/l and 124 ± 7 g/l; serum ferritin: 22.9 ± 14 µg/l and 30.2 ± 18 µg/l; sTfR: 2.5 ± 2 mg/l and 2 ± 1 mg/l, respectively. The prevalence of IDA (by all three parameters) was 11% and 3% among pregnant and non-pregnant mothers, respectively. The mean nutrient intake by the diet of both the IDA and normal population of pregnant mothers was not significantly (p=0.05) different. The results support the view that easy accessibility and the availability of a variety of foods may have contributed to an improved nutritional intake and iron status among the urban slum population.

INTRODUCTION

Iron deficiency is one of the most common deficiencies prevalent in developing countries and pregnant mothers and women in childbearing age are at a greater risk. During pregnancy iron deficiency anemia develops due to physiological adaptations, which are often insufficient to meet the increased requirements (Bothwell, 2000). Iron deficiency has also been linked with decreased immune function and resistance to infection, diminished work capacity and increased risk of delivery of pre-term and low birth weight infants (Cook, 1994). In Sri Lanka 45% of non-pregnant and 39% of pregnant women were anemic based on hemoglobin levels (Mudalige and Nestel, 1996).

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Iron supplementation is the most common strategy adopted by developing countries to combat iron deficiency and iron deficiency anemia during pregnancy. On the other hand, dietary intervention programmes are advantageous over supplementation with respect to compliance, long-term acceptability, cost effectiveness, risk of iron overload and total beneficial effect of the iron intake on families (Amanda *et al.*, 2001). Food intake patterns among different communities, however, have shown to vary depending on the factors such as food habits, food availability, and level of knowledge of the population. In most developing countries, the high iron demand during pregnancy is not met through dietary sources due to poor bioavailability of iron from foods. The absorption of iron from food is influenced by the form, content of iron, the presence of modifying dietary factors such as inhibitors and enhancers of iron absorption, and host factors including iron status (Carlton and Bothwell, 1983). Given the magnitude of the problem, the present study was conducted to evaluate the dietary intake and the iron status of pregnant and non-pregnant mothers in an urban slum population of Colombo, with the objective of suggesting food-based strategies to improve the availability of dietary iron among the community.

MATERIALS AND METHODS

Sixty one pregnant mothers, aged 18-35 years, in the second trimester of pregnancy, attending antenatal clinics were recruited as the study sample from the slum areas of the Colombo Municipal Council areas. Pregnant mothers taking iron supplements were excluded from the study. Twenty nine, age-matched, non-pregnant, non-lactating mothers attending other welfare clinics participated as the study controls. A well-structured, pre-tested questionnaire was used to assess the socio-economic status, pregnancy history, food habits, and household information. A 24-hour dietary recall was conducted on three consecutive days with weighing the cooked foods on one day. The nutrient intake from the dietary sources was calculated using Food Composition Tables (Perera *et al.*, 1989).

Venous blood was drawn from the subjects at the antenatal clinics for the measurement of hemoglobin (Coulter MD II method), serum ferritin (Immunoenzymatic assay – DIA.METRA, Italy) and serum transferrin receptor concentrations (Immunoenzymatic assay – Orion Diagnostica test kit, Finland) (Akesson *et al.*, 1998). Blood analysis was carried out at the Department of Pathology, Faculty of Medicine, University of Peradeniya. The diagnostic cutoff for iron deficiency anemia (IDA) is defined as: Hb < 110 g/l, serum ferritin $\leq$ 12 µg/l, and sTfR > 2.8 mg/l for pregnant mothers, while for non-pregnant mothers the Hb cutoff point was 120 g/l. Iron deficiency (ID) is defined as serum ferritin $\leq$ 12 µg/l, and sTfR > 2.8 mg/l and Anemia is defined as Hb < 110 g/l and Hb < 120 g/l for pregnant and non-pregnant mothers, respectively (Allen *et al.*, 1998).

All data were statistically analyzed using a Minitab software package. The ethical clearance for the study was obtained from the Ethical and Higher Degrees Committee of the Faculty of Medicine, University of Peradeniya.

RESULTS AND DISCUSSION

Socio-economic status

In the study population, the average family size comprised of 40% of 2-4 members, 37% of 5-7 members, 19% of 8-10 members and 4% of over 10 members. Ninety eight

percent of study population lived in houses with cemented floors and metal/asbestos roofing. Twenty seven percent did not have access to pipe-borne water within their own premises and also shared common toilets built for the community. Fifty percent of the mothers were educated up to grade 10 but only 5% of the mothers were employed. Fifty three percent of the population received a monthly income of less than Rs. 5000 (Table 1).

Iron status

The prevalence of iron deficiency anemia (IDA) as indicated by all three parameters was 11.5% in the study sample and 3% in the study control (Figure 1). The mean values for the iron status indices of pregnant mothers were: Hb: 115 ± 11 g/l, serum ferritin: 22.9 ± 14 µg/l and sTfR: 2.5 ± 2 mg/l while that of the non-pregnant mothers were Hb: 124 ± 7 g/l; serum ferritin: 30.2 ± 18 µg/l; sTfR: 2 ± 1 mg/l. Although the mean haemoglobin concentrations showed that both pregnant and non-pregnant mothers were above the normal value, twenty eight percent and twenty seven percent of pregnant and non-pregnant mothers were found to be anemic, respectively. These percentages are lower than previously reported by Mudalige and Nestel (1996) showing an improvement in the nutritional status.

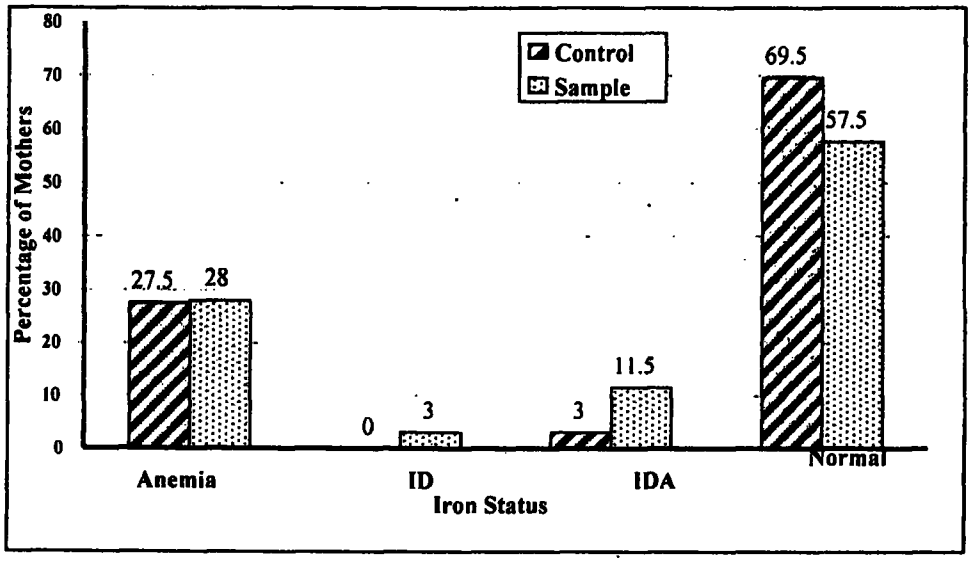

Fig. 1. .Iron status of pregnant and non-pregnant mothers

Table 1. Socio-economic status of the study population

Characteristics		% of the total ($n = 90$)
Type of housing	Metal roof/cement floor	30
	Tile/Asbestos roof and mud floor	2
	Tile/Asbestos roof and cement floor	68
Source of drinking water	Piped - in dwelling/premises	73
	Public tap	27
Toilet facility	Water sealed	70
	Pit Latrine	3
	None	27
Educational background	No schooling	7
	Primary (year 1 -5)	4
	Secondary (Year 6-10)	54
	GCE O/L	28
	GCE A/L	7
Mother's occupation	Employed	5
	Unemployed	95
Total family income/month	Below Rs. 3000	8
	Between Rs 3000 - 5000	45
	Between Rs 5000 - 8000	37
	Over Rs. 8000	11

Nutrient intake

The nutrient intake of the study population is shown in Table 2. The mean intake of energy, protein and iron were adequately met by both pregnant and non pregnant population. However, the calcium and the vitamin A requirements of pregnant mothers were twenty four percent and twenty six percent less than RDA, respectively. Nutrient intake as % of RDA among pregnant and non-pregnant mothers is shown in Figure 2.

Table 2. Nutrient intake (Mean ± SD) of pregnant and non-pregnant mothers

Nutrient	Non-pregnant ($n = 29$)		Pregnant ($n = 61$)	
	RDA	Mean ± SD	RDA	Mean ± SD
Energy (kcal)	2020	2245 ± 310	2220	2357 ± 480
Protein (g)	44	73 ± 17	51	75 ± 19
Fat (g)	NS	49 ± 15	NS	56 ± 16
Calcium (mg)	400	689 ± 253	1000	765 ± 265
Iron (mg)	19	21 ± 8	23	25 ± 11
Vitamin A (μg)	600	180 ± 111	600	233 ± 111
β-Carotene (μg)		737 ± 481		1259 ± 895
Vitamin C (mg)	40	29 ± 20	40	45 ± 38

NS - Not specified . Total Vitamin A = β-Carotene/6 + vitamin A

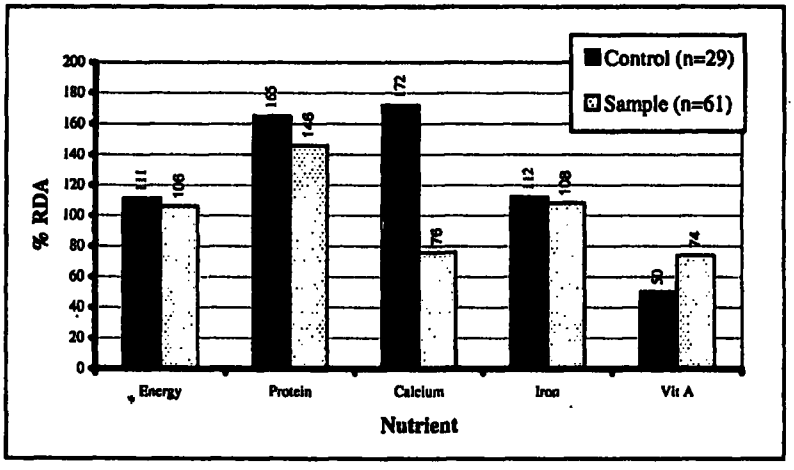

Fig. 2. Nutrient intake as % of RDA among pregnant and non-pregnant mothers

Comparisons of the daily intake of nutrients between IDA and normal population of the pregnant mothers showed no significant (p=0.05) difference.

Food habits and intake

Dietary intake of the pregnant population showed an increase in the intake of green leafy vegetables, fruits and milk but however was unable to meet the RDA requirements of vitamin A and calcium. (Table 3) Mukunuwanna (*Alternanthera sessilis*) and Gotukola (*Centella asiatica*) were most commonly consumed green leafy vegetables while banana and mango were preferred as fruits. Milk consumed was mainly as pasteurized milk.

Table 3. Daily dietary intake (Mean ± SD) of pregnant and non-pregnant mothers

Food Category	Mean intake (g) ± SD of non-pregnant mothers	Mean intake (g) ± SD of pregnant mothers
Cereals	448 ± 77	436 ± 105
Pulses	30 ± 39	31± 61
Green leafy vegetables	21 ± 26	32 ± 45
Other vegetables	36 ± 27	44 ± 59
Roots and tubers	26 ± 25	42 ± 90
Fruits	27 ± 37	119 ± 104
Milk and milk products	39 ± 42	102 ± 107
Fats and oils	36 ± 15	52 ± 70
Sugar	31 ± 9	50 ± 109
Meat and fish	87 ± 56	98 ± 88

Table 4. Food purchasing and consuming habits of the study population

Food purchasing and consuming habits		Study Control ($n = 29$)	Study sample ($n = 61$)
Selection and purchasing of food by the subject	Yes	59	25
	No	41	75
Frequency of buying food material	daily	62	66
	weekly	28	21
	2-3 times/week	10	13
Home gardening	Yes	0	5
	No	100	93
Consuming home garden foods	Yes	0	2
	No	100	98
No. of family members included in daily cooking	2 - 4	45	38
	5 - 7	38	41
	8 - 10	10	18
	> 10	7	3
No. of main meals taken outside home	0	24	16
	1	45	52
	2	31	33
	3	0	0

The main contributory source of iron to the diet was from green leafy vegetables (25%) and rice (24 %) The heme: non-heme iron intake ratio was 1:3 and 1:4.8 for non-pregnant and pregnant mothers, respectively.

The dietary intake of the population group could be markedly affected by the economic, social or geographical situations. Changes in income and food prices modify food consumption and other behavioral patterns and affecting the nutritional status of different population groups, particularly the lower income groups. Results show that 82% of the population received a monthly income between Rs. 3000-8000. The Household Income and Expenditure Survey of 2002 reports that the highest mean income per month of the urban sector is Rs. 23,436 showing the highest inequality in household income distribution.

Approximately 33% of the population purchased at least two meals per day, while only 16% - 24% prepared all three main meals at their homes. The total population had no home gardens to obtain any fruits or vegetables and had to purchase them from the market (Table 4).

The survey revealed that a variety of fresh vegetables, fruits and green leafy vegetables were available in the near by markets for purchasing them daily. The study also

showed that even though the income levels of this population were low, they had the advantage to purchase and access a variety of fruits and vegetables for their daily consumption when required. This fact could lead to favourable conditions for a satisfactory nutrient intake from the diet.

CONCLUSIONS

A number of factors were associated with the improved nutritional intake and iron status among the urban slum population. The favorable factors include, the mothers educational level, food availability and easy accessibility. However, socioeconomic factors such as low income and time constraints for cooking in the households were non-contributing factors.

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