Dietary Intake of Micronutrients in Normal State and During Pregnancy

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Introduction

Vitamins and minerals are important micronutrients to sustain normal life.They help in the production of energy and other chemical reactions in the body. Majority of the diseases begin when biochemical imbalance occur in the cellular level.

Vitamin A is essential for growth, vision, maintenance of epithelial tissues in a healthy state and for tooth development.[1] Vitamin A deficiency and its two most obvious resultant condtions, xerophthalmia and nutritional blindness are endemic in large parts of Africa and Asia.[2] Mild anaemia has also been associated with vitamin A deficiency due to impaired mobilization of iron from liver [3,4]. The role of vitamin A and its derivatives in the prevention of certain types of cancer of epithelial origin has been suggested.[5] The homeostatis of thyroid hormone appear to be disturbed by Vitamin A deficiency.[6]

Vitamin C is a very important scurvy-preventing substance found in nature primarily in citrus fruits and in fresh vegetables. It is a powerful reducing agent and takes part in a variety of hydroxylation reaction. The best known hydroxylation reaction which is impaired due to vitamin C deficiency is the synthesis of collagen.[7] Vitamin C participate in other cellular functions such as regulation of oxidation reduction potential and transfer of hydrogen in the electron-transfer system; involving of ascorbic acid in microsomal drug metabolism has been reported[8]. Vitamin C also acts as an antioxidant element which prevents oxidation of vitamin A, E and active form of folic acid.[9]

The essential functions of iron are oxygen transport and oxygen utilization. Haemoglobin helps accomplish the former and iron-containing enzymes help accomplish the latter function. Dietary deficiency of iron is quite common. Iron deficiency can cause severe symptoms before iron deficiency anaemia results.[10]

The body contains more calcium than other minerals. Calcim is important to heart health, nerves, muscle, skin and of course, strong bones and teeth. Calcium also helps to releive aches in muscles and bones, muscle spasms, nervousness, tension tremors, insomnia and several other disorder in those individuals who have become calcium deficient over the years.[11] Calcium also helps to control blood acid alkali balance, plays a role in cell division, muscle

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growth, iron utilization, activates certain enzymes, and helps transport nutrients through cell membranes. It also forms a cellular cement called ground substance that helps hold cells and tissues together.[11]

Nutrition survey of rural Bangladesh (1981-82) indicated that 70 percent of the population are anaemic. However, dietary intake of iron was not low as per daily requirement. It was explained that dietary intakes of vitamin C and vitamin A were lower than RDA and they are responsible for absorption and utilization of iron. It was also reported that only 7 percent households fulfill their daily calcium requirement.[12] Nutrition survey in 1975-76 also indicated deficient dietary intake of calcium.[13] Vitamin A was found to be serverely deficient in rural Bangladeshi diet[12,13]. Those surveys were conducted long time ago and were done in rural Bangladesh. As because vitamin A, vitamin C, iron and calcium play important roles in numerous biological and biochemical processes, the present study was designed to observe dietary intakes of those micronutrients in a small segment of urban apparently normal females and at differen stages of gestation

Materials and Methods

Dhaka University female resident students belonging to high socio-economic group were offered an opportunity to participate in the present study. Sixty apparently normal female resident students voluntarily participated. On the other hand, 51 females working in garment factory and 52 pregnant women belonging to low socio-economic group attending the Maternity Health Centre for antenatal care were also included in this study. The results presented here are for those pregnant women whose dietary history was possible to collect at 12-16 weeks and 24-28 weeks of gestation and at before delivery. A standard questionnaire was developed in which daily food intake and other related information were recorded by direct interview. Dietary history was recorded on the basis of normal intakes of daily food. (recall method) Dietary intakes of vitamin A, vitamin C, iron and calcium were calculated by using nutritive value of Bangladeshi foodstuffs[14].

Results

Mean dietary intakes of vitamin A and vitamin C in apparently normal females and at different stages of gestation are shown in Table 1. The intake of vitamin A was more than double in female resident students than in female workers. However, both the non-pregnant non-lactating (NPNL) women (resident girl students and the working females) were deficient in their vitamin A intake as compared to present Recommended Dietary Allowances (RDA) for Bangladeshis. Dietary intake of vitamin A was increased during second trimester than that of first trimester and remained same until delivery. The intake of Vitamin A was extremely low at any time during

Table 1 : Dietary intakes of vitamin A and vitamin C in normal state and during pregnancy.

Subject	Vitamin A intake (IU/day)	% RDA	Vitamin C intake (mg/day)	% RDA
Female resident student (n=60)	971±322	39%	48±19	160%
Female workers (n=51)	475±131	19%	28±10	93%
During pregnancy (n=52)				
at 12-16 weeks	439±224	18%	29±13	97%
at 24-28 weeks	650±230	26%	40±13	133%
Before delivery	656±252	26%	42±11	140%

Values are mean + SD. Mean age of subjects: resident student, 22 yrs.; female workers, 17 yrs.; pregnant women, 23 yrs. Recommended dietary allowances (RDA) for Bangladeshi women according to age and during pregnancy are used from the figures used in calculating data for the Nutrition Survey of Rural Bangladesh (1975-76), 1981-82). RDA: Vitamin A, 2500 IU/day for the age 22 yrs., 17 yrs. and during pregnancy: Vitamin C,30 mg/day for the age 22 yrs., 17 yrs. and during pregnancy.

gestation. However, vitamin C intake was not low in all the groups studied as compared to the RDA. The intake was found highest (48 mg/day) in female resident students. At late pregnancy vitamin C intake was also found higher than in the first trimester.

Results of mean dietary intakes of iron and calcium are mentioned in Table 2. The intake of iron was almost adequate compared to the requirement for the females residing in University halls. But it was low in both normal female workers and at different stages of gestation. However, the intake of iron increased from 11.5 mg/day at 12-16 weeks of gestation to 16.4 mg/day before delivery. Calcium intake fulfilled the requirement of female resident students. The intake of calcium of female workers belonging to low-socio-economic group was found 376 mg/day which was 68 percent of RDA. At 12-16 weeks of gestation, calcium intake was very low (280 mg/day), but it increased to 479 mg/day at the end of the gestational period, but still being 26 percent lower than the daily requirment.

Table 2 : Dietary intakes of iron and calcium in normal state and during pregnancy.

Subject	Iron intake (mg/day)	% RDA	Calcium intake (mg/day)	% RDA
Female resident student (n=60)	19.1 ± 4.9	91%	468 ±188	104%
Female workers	14.6 ± 4.0	70%	376 ±100	68%
During pregnancy (n=52)				
at 12-16 weeks	11.5±3.4	51%	280±120	43%
at 24-28 weeks	14.8±4.0	66%	462±147	71%
Before delivery	16.4±4.4	78%	479±174	74%

Values are mean+SD. Age of different categories of female subjects are mentioned in Table 1. RDA source same as inTable 1. RDA: iron, 21 mg/day for 22 yrs. and 17 yrs. old females, and 22.5mg/day for pregnant women; calcium, 450 mg/day for 22 yrs., 550 mg/day for 17 yrs., and 650 mg/day for pregnant women.

Discussion

Micronutrients play an important role in numerous biological and biochemical processess. Among them vitamin A, vitamin C, iron and calcium are the most important micronutrients involved in various metabolic processes. Nutrition survey of rural Bangladesh conducted by the Institute of Nutrition and Food Science, Dhaka University during 1975-76 and 1981-82 revealed that among the above 4 micronutrients, consumption of vitamin A, vitamin C and calcium are extremely low in rural Bangladeshi diet as compared to their daily requirement. Iron intake was more than RDA but higher number of rural Bangladeshis are suffering from anaemia [12,13].

It can be seen from Table 1 that both the apparently normal female groups (high and low socio-economic group) are extremely deficient in their daily intakes of vitamin A. However, resident students belonging to high socio-economic group had more vitamin A intake than that of working females belonging to low socio-economic group. During pregnany, the women from low socio-economic group also had lower intake of vitamin A. The increase in vitamin A intake during second and third trimester than that of first trimester was due to the fact that normally in the first trimester, pregnant women eat less food, and later, food intake increases. During 1981-82 nutrition surevey of rural Bangladesh, it was observed that females within 16-19 years of age consumed vitamin A about 22 percent of RDA, and those between 20-30 years of age ate vitamin A 30 percent of RDA,[12]. Although the presnt study was

conducted on a small segment of population, it seems that vitamin A intake remains almost same as was found during 1981-82 nutrition survey. But, the intakes of vitamin C were found higher and fulfilled the RDA in all the 3 groups studied as compared to the intakes of the respective groups observed during the last nutrition survey (1981-82). In that survey (1981-82) it was observed that on average subjects of similar age groups and during pregnancy had vitamin C intake 50 percent of daily requirement[12]. This may be due to the fact that consumption of vitamin C enrich foods such a guava, amlaki and lemon recently increased. Peoples residing in cities are now concious about vitamin C and recently they eat those types of foods in more quantities.

In the present study we found that resident female students nearly fulfilled their daily requirement of iron (See Table 2). But female workers and pregnant women belonging to low socio-economic group were deficient in dietary intakes of iron as compared to present RDA. It was observed that women from low socio-economic group usually do not eat iron rich foodstuffs. Nutrition survey of rural Bangladesh (1981-82) revealed that rural women of similar age groups and during pregnancy were not deficient in terms of their daily requirement of iron. However, mean dietary intake of calcium was found higher in the present study than those found during 1981-82 nutrition survey for similar age groups and during pregnancy. In the present study it was observed that females residing in halls fulfilled their daily requirment, but female workers consume 68 percent of their requirment. This is due to the fact that resident female students drink milk almost everyday. Again, as the gestational period progressed daily calcium intake increased from 43 percent to 74 percent of the RDA. On average pregnant women of rural Bangladesh (1981-82 nutrition survey) fulfilled 50 percnet of their daily requirement. ON thing must be mentioned that in the nutrition survey report only pregnant women is mentioned. In the present study we mentioned values at different trimesters. It is known that in the first trimester food intake is usually low which gradually increase as gestational period progresses.

Although the present study was conducted on small segment of city population engaged in different types of works and at different stages of pregnancy, so far we know this type of results were not reported earlier. From the present results we can have idea about the present situation of vitamin A, vitamin C, iron and calcium intakes of women of similar age and socio-economic groups residing in Dhaka cities.

Finally, we want to mention here that the intakes of such micronutrients of the subjects studied were compared with the RDA of similar age and during pregnancy used in both 1975-76 and 1981-82 nutrition surveys.

The daily requirment chart prepared for Bangladeshi population of different age and sex groups is outdated. The RDA for the population of different countries is being changed time to time on the basis of the report for recommendations of joint FAO/WHO Consultation Group. In the latest report of joint FAO/WHO Expert Consultation (1988), the recommended daily intakes of vitamin A and vitamin B_{12} were mentioned lesser than the report published in 1967[15]. For example, the RDA for vitamin A was 750/ug/day for adult females in 1967 report which was suggested to be 500/ug/day in 1988 report. similarly, RDA for vitamin B_{12} was sugested 1/ug/day in 1988 report as compared to 2 ug/day in 1970 report. The requirement of iron we still expressed as mg of iron required/day for different age groups. In many countries, the requirement is expressed as mg absorbed iron/day. Similar is the case of calories and macronutrient requirements. The requirement of calories we used for comparing the daily intake of calories of Bangladeshi rural population in different nutrition surveys are actually higher than the actual requirement. Recently, we mentioned it elsewhere.[16] So, we think the requirements of various nutrients and calories for different age and sex groups of Bangladeshi population should be reviewed. After completion of such chart we will be able to know whether we are deficient or taking any excess nutrients through our diet and only then necessary steps can be taken to solve the nutritional problems.

Summary

Dietary intakes of vitamin A, vitamin C, iron and calcium were estimated in small segment of urban normal women and at different stages of gestation. Vitamin A intake was found double in Dhaka University resident female students belonging to high socio-economic group than that of female workers belonging to low socio-economic group. The intake of vitamin A was also higher at late pregnancy as compared to the intake at 12-16 weeks of gestation. However, in all the cases mean dietary intakes of vitamin A were extremely low as compared to the present RDA for Bangladeshis. Vitamin C intake fullilled the requirement of all the categories of subjects studied. But dietary intake of iron fulfilled 91 percent of the requirement of resident female students. Females belonging to low socio-economic group whether in non-pregnant state (female workers) or during pregnancy were found deficient in their daily intakes of iron as compared to present RDA. Similar trend was also observed in the case of mean dietary intake of calcium. Among the subjects studied only female resident students had normal intake of calcium, others did not fulfill their daily requirement according to present RDA. However, as gestational period progressed both iron and calcium intakes increased as compared to the intake observed at first trimester.

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