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PRIMARY DYSMENORRHEA IN SCHOOL GOING ADOLESCENT GIRLS—IS IT RELATED TO DEFICIENCY OF ANTIOXIDANT IN DIET?

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ABSTRACT

Primary dysmenorrhea is the pelvic pain around the time of menstruation in the absence of pathological findings in adolescent girls. Increased oxidative stress is considered as one of the contributing factor in the pathogenesis of primary dysmenorrhea. The present study was to investigate the dietary intake status of antioxidants and primary dysmenorrhea. The present study was conducted among normal, healthy school girls of 12-17 years who attained menarche at least one year. 267 subjects of dysmenorrhea and 112 matched controls were included in this study. Weight and height were measured and dietary intake data were gathered by one day 24 hour recall method using an interview scheduled. The nutrient intake was assessed and compared with the recommended dietary allowances for the respective age group. The dietary antioxidant intake by each subject was computed in terms of Nutrient Adequacy Ratio (NAR). The subjects were categorized as those having an adequate ($\geq$ 1.00), fairly adequate (0.66 to < 1.00) or inadequate (< 0.66) NAR for various nutrients. Average daily intake of beta carotene, vitamin-E and zinc was significantly higher in girls without dysmenorrhea than dysmenorrhagic counterpart. NAR for all antioxidants was higher for the control group than the experimental group of adolescent girls. Difference was significant for all study antioxidants except vitamin-C. Thus deficiency of antioxidant vitamins (particularly vitamin-E and beta carotene) and mineral, zinc may be a contributing factor of primary dysmenorrhea. Finally, it may be suggested that the dietary intake of antioxidants should be adequate for adolescent girls to minimize primary dysmenorrhea.

Key words: Primary dysmenorrhea, vitamin-E, beta carotene, vitamin-C, zinc, antioxidant

INTRODUCTION

Adolescence is the transitional phase of physical and mental development between childhood and adulthood. The most striking changes in the adolescent girls are the onset of menarche. Menarche signals the start of women's reproductive life and is determined by environmental and genetic factors (1). After menarche, common menstrual abnormalities that the female adolescent may encounter include dysmenorrhea, irregularities in menstrual flow and premenstrual symptoms. 75% of girls experience some problems associated with menstruation (2). Dysmenorrhea is defined as difficult and painful menstruation (3). This condition is often associated with various other symptoms occurring prior to the menses, such as headaches, nausea, vomiting, diarrhea, tachycardia and sweating (4). Dysmenorrhea is categorized into primary and secondary. Primary dysmenorrhea occurs in women with no obvious pathological condition and occurs solely during ovulatory cycles. First instances of primary dysmenorrhea are observed almost always in women under the age of 20 (5). The prevalence of dysmenorrhea among adolescent girls is between 20-90% (6). A study suggested that frequency of fast food intake is associated with menstrual abnormalities including dysmenorrhea (7). Junk food is a high calorie or calorie rich food which lacks in micronutrients such as vitamins, minerals or amino acids and fibers but has high energy. Primary dysmenorrhea has been reported to lead to an increase in lipid peroxidation, an index of oxidative stress (8). Previous studies showed that serum malondialdehyde, marker of oxidative stress was significantly higher in subjects with dysmenorrhea compare to those in healthy subjects (9). It has been suggested that oxidative stress is one of the important contributing factor in the pathogenesis of primary dysmenorrhea (10, 11). Oxidative stress occurs when the balance between antioxidants and reactive oxygen species (ROS) are disrupted because of either depletion of antioxidants or increase formation of ROS. The human body is equipped with a variety of antioxidants that serve to counter balance the effect ROS. These can be divided into exogenous and endogenous categories. Exogenous antioxidant include vitamins (vitamin-E, vitamin-C, vitamin-A) and metallic micronutrients (e.g. Zinc). Hence it is important to evaluate foods habit and dietary intake of antioxidants on primary dysmenorrhea in adolescent girls. The present study was undertaken to investigate the association of dietary intake of antioxidant with primary dysmenorrhea.

MATERIALS AND METHODS

Study subject

The present study was conducted among normal, healthy school girls of 12-17 years studying in three schools in Hooghly district during their school hours. The prior written permission of school authority was taken. Written consent from the parents of the students experimented in the study was obtained. The subjects of this study were chosen at random irrespective of socioeconomic status and religion so that reflection of an overall picture of menstrual health status of study region could be achieved. All students who attained menarche and who were willing to participate in the study were included in the study. They were invited to answer the questionnaires, which dealt with menstrual history and dietary habit. We excluded the students who did not attain menarche at least one year, who are suffering from any chronic health condition and are using any medicines for long duration.

Study of dysmenorrhea

Dysmenorrhea is defined as acute spasmodic pain experienced in the lower abdomen which appeared on the first day of menses and rarely lasted more than two days. Primary dysmenorrheal is defined as painful menstrual cramps without any evident of pathology to account for them. The following criteria are used to define dysmenorrhea (11):

- Onset of pain within 6-12 hours after menstruation
- Lower abdominal or pelvic pain associated with onset of menses and lasting 8-72 hours
- Lower back pain during menses
- Medial or anterior thigh pain
- Menstrual pain with associated features such as headache, diarrhea, nausea and vomiting.

Measurement of body weight

Body weight was measured using bathroom scale accurate to 0.5kg. The scale was kept on a flat surface and adjusted with '0' mark. Now the subject was requested to step on it in bare feet. Weights were taken in light cloth. Weight was recorded to the nearest 0.5kg.

Measurement of body height

Height was measured using anthropometric rod. Height of the subject was recorded without footwear and expressed to the nearest 0.1cm.

Assessment of body mass index (BMI)

BMI was calculated from the height and weight using following equation: BMI (kg / m^2) = weight (kg) / height^2 (m).

Food consumption pattern

The precise information about a food consumption pattern of the subject was gathered through 24 hours recall method using an interview scheduled (12). Intake of nutrient was computed using the values given in the nutritive value of Indian foods (13). The nutrient intake was assessed and compared with the recommended dietary allowances (RDA) for the respective age group. The dietary antioxidant intake by each subject was computed in terms of Nutrient Adequacy Ratio (NAR). The subjects were categorized as those having an adequate (≥ 1.00), fairly adequate (0.66 to < 1.00) or inadequate (< 0.66) NAR for various nutrients (12).

NAR= Subject's nutrient intake on a day/RDA of the respective nutrient

Statistical analysis

Subjects are divided into two groups; control (no dysmenorrhea) and Experimental (dysmenorrhea). Results are expressed as mean ± SD. Student t test was used to compare dietary patterns among students having dysmenorrhea and those who do not have. P<0.05 was considered as significant.

RESULTS

Total 453 girls were interviewed, 397 were selected and remaining were excluded due to non development of menarche, menarcheare started less than one year ago or unsatisfactory answer regarding their food habit. Age wise distribution subjects were given in table 1.

Table-1
Age wise distribution of study subjects

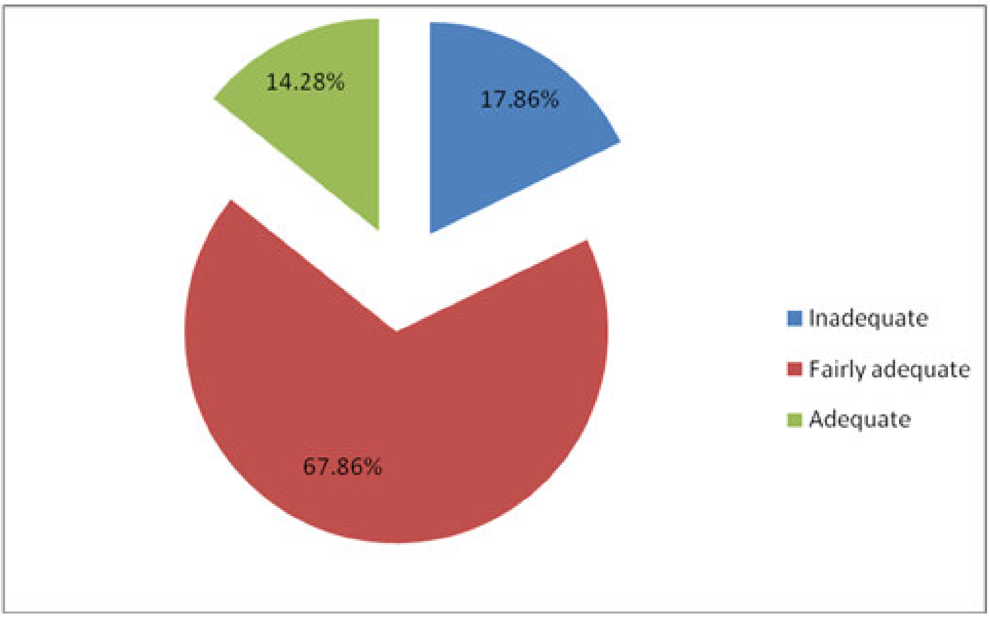
Age (year)	Control group	Experimental group
12	18	58
13	18	67
14	20	50
15	18	31
16	20	31
17	18	30

Particular of the study subjects are given in a table-2. There was no significant difference between control and experimental group in respect to age, height, weight, BMI etc.

Table-2
Particular of the study subjects

Particulars	Control group	Experimental group	p-value
Age (year)	14.5 ± 1.70	14.0 ± 1.65	>0.05
Height (cm)	149.6 ± 6.60	150.34 ± 5.68	>0.05
BMI (kg/m^2)	19.51 ± 7.48	19.70 ± 3.55	>0.05
Schooling status	Class VII to XII	Class VII to XII	--------
Marital status	Unmarried	Unmarried	---------
Type of food habit	Nonveg	Nonveg	---------
Habitat	Semi urban	Semi urban	---------

Dietary antioxidant intake status of study subjects were represented in figure 1 to figure 4. Intake status of vitamin-E, vitamin-C, beta carotene and zinc was poor in experimental group than control group.



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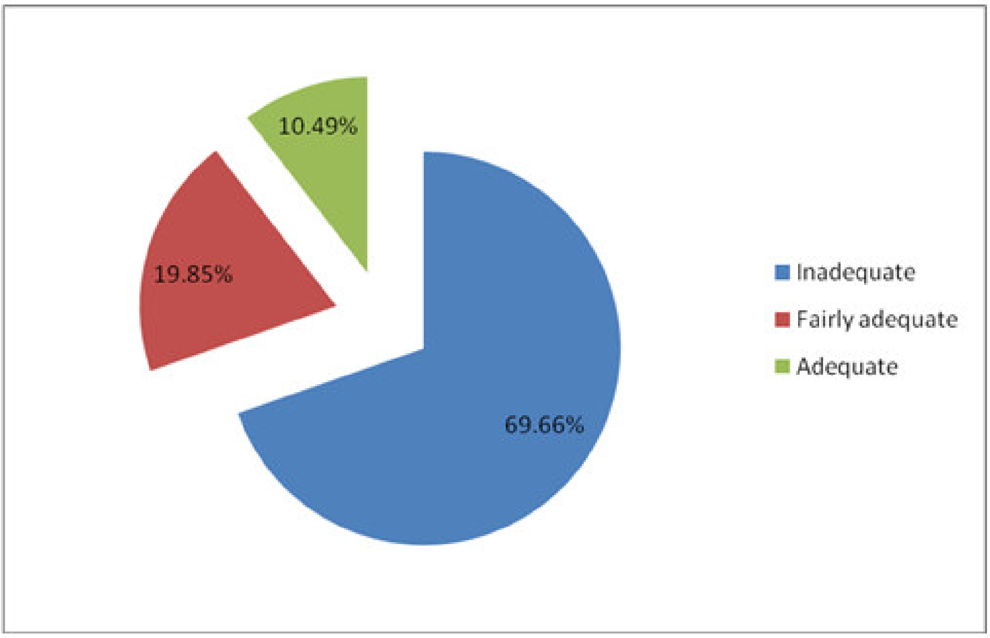

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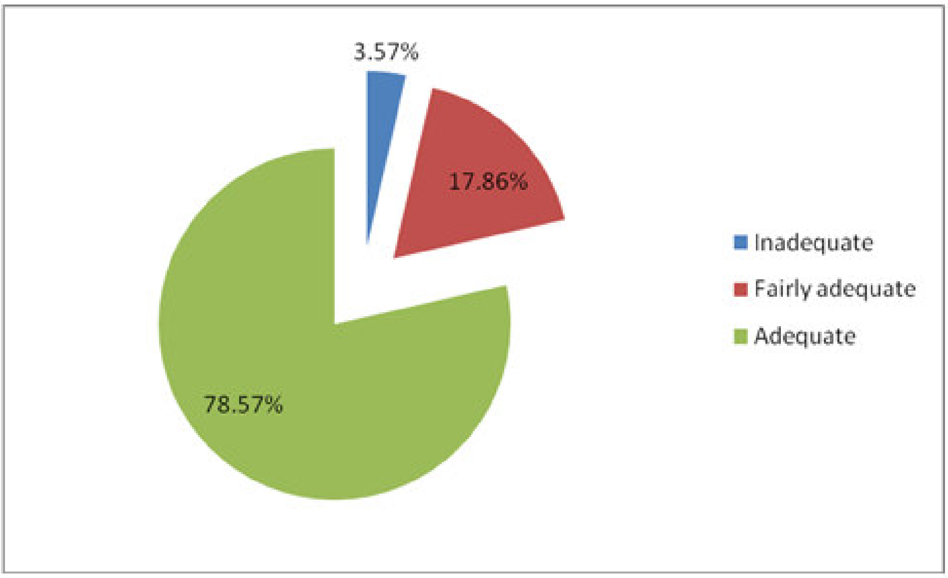
Figure 1

Beta carotene status of control (a) and experimental (b) group of adolescent girls



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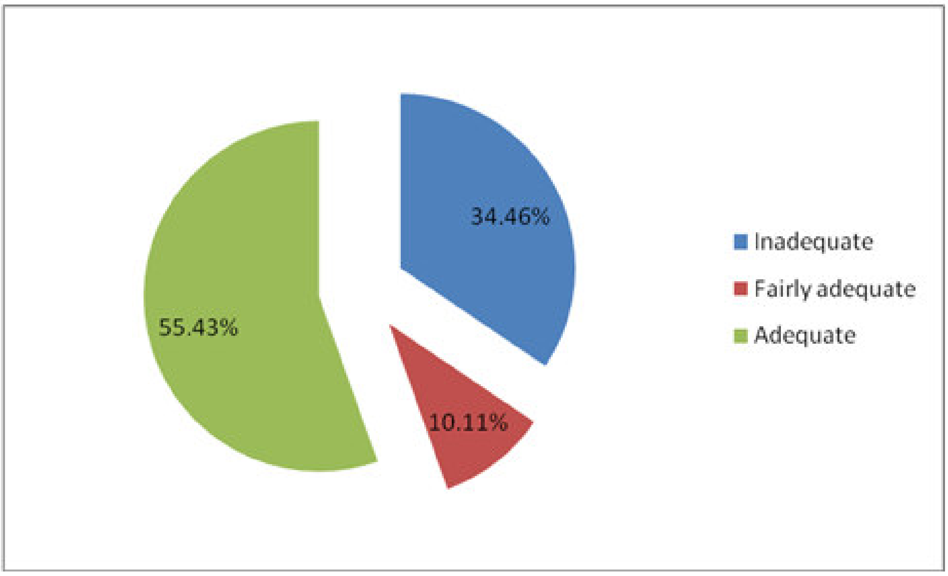

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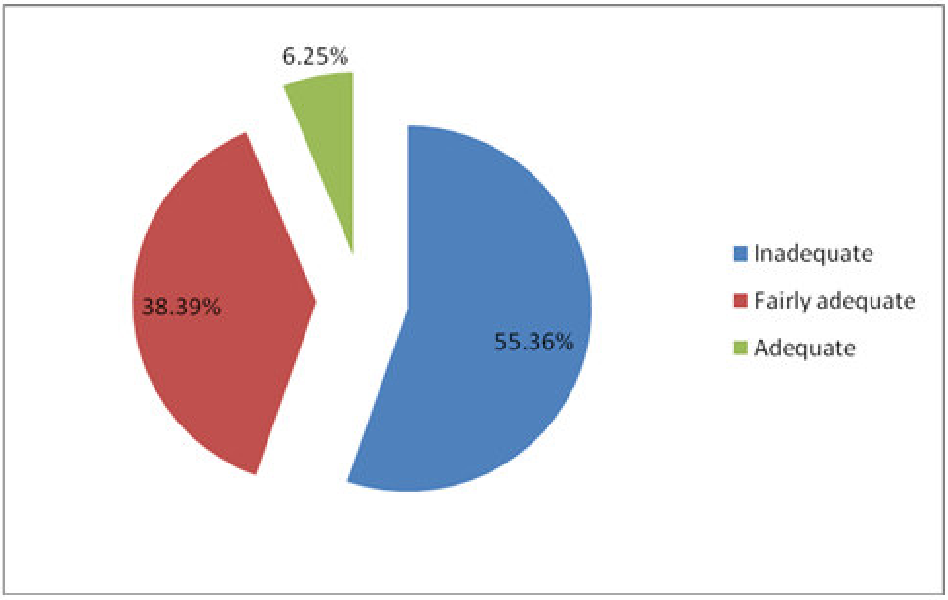
Figure 2
Vitamin-C status of control (a) and experimental (b) group of adolescent girls



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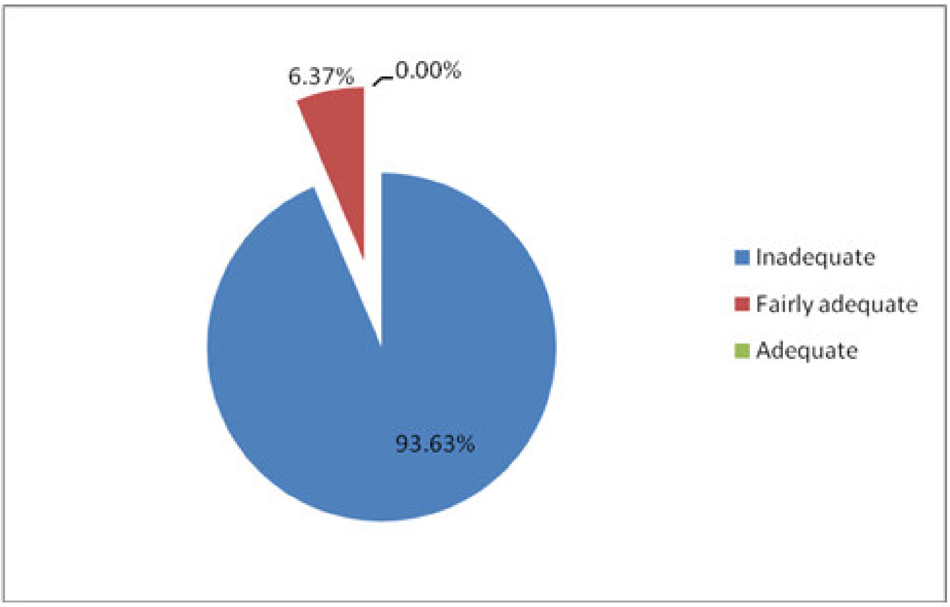

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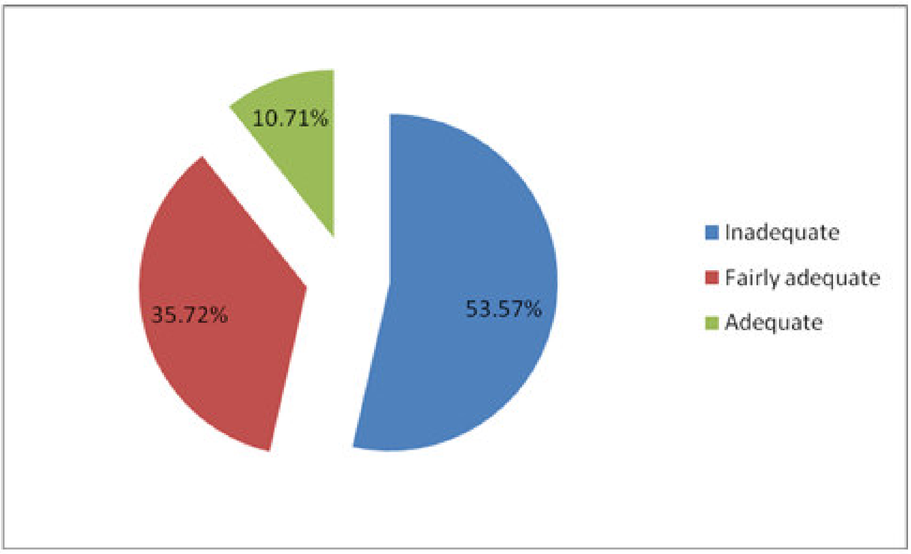
Figure 3
Vitamin-E status of control (a) and experimental (b) group of adolescent girls



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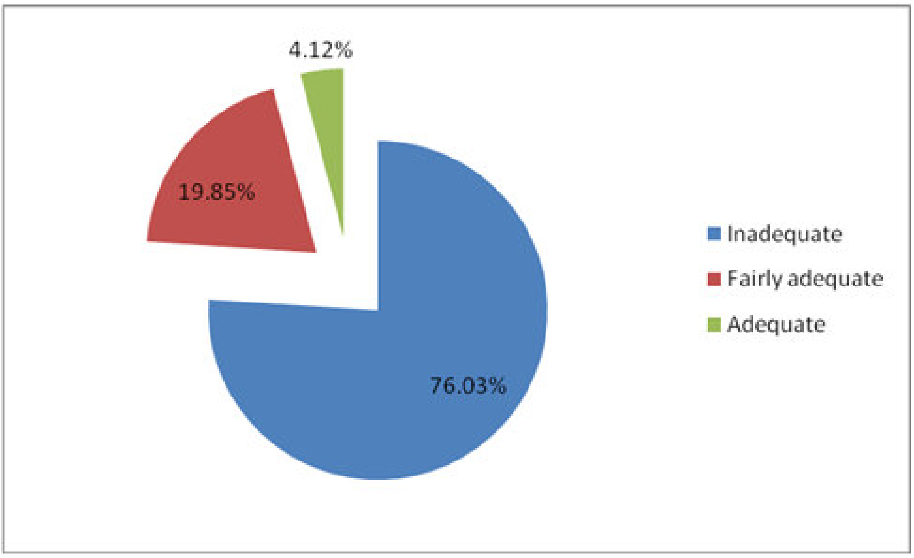

Figure 4
Zinc intake status of control (a) and experimental (b) group of adolescent girls

Average daily intake of beta carotene, vitamin-E and zinc was significantly higher in girls without dysmenorrhea than dysmenorrhagic counterpart (table-3). There is no significant difference of vitamin-C intake between control and experimental group of adolescent girls.

Table-3
Comparison of daily intake of various antioxidants between control and experimental group

Average daily intake (mg)	Control group	Experimental group	P value
Beta carotene	3791 ± 905	2934 ± 795	P< 0.05
Vitamin-C	69.63 ± 39.36	67.17 ± 38.24	P> 0.05
Vitamin-E	10.04 ± 4.06	5.81 ± 3.28	P< 0.05
Zinc	6.89 ± 2.89	5.40 ± 2.70	P< 0.05

Nutritional adequacy ratio of four antioxidants was represented in fig-5. NAR for all study antioxidants were less than 1 except for vitamin-C. The values were higher for all antioxidants in control group than experimental group of adolescent girls. Difference was significant for all study antioxidants except vitamin-C.

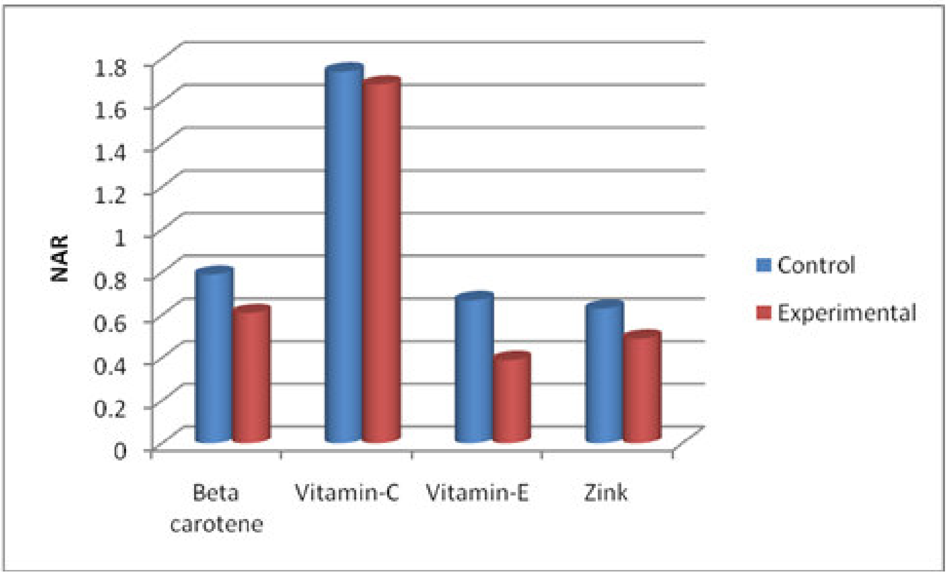

Figure 5
Comparison of NAR between control and experimental group of adolescent girls

DISCUSSION

Primary dysmenorrheal is defined as pelvic pain around the time of menstruation in absence of an identifiable pathological lesion (14). Dysmenorrhea occurs due to myometrial contraction induced by prostaglandins originating from the uterine endometrial. The secretory endometrium contains arachidonic acid, which is converted to prostaglandin F2α and prostaglandin E2 during menses. During menstruation most of the prostaglandins are released within fast 48 hours which coincides with greatest intensity of the symptoms (15). It is well known that the presence of elevated concentrations of free radicals and/or lower antioxidant potential leads to oxidative stress. Dysmenorrhea has been reported to lead to an increase in lipid peroxidation, an index of oxidative stress (8,9). Prostaglandin-induced uterine contractions decrease blood flow to the myometrium resulting in ischemia. Substantial evidence suggests that hypoxia-ischemia activates phospholipase-A2. This phospholipase-A2 hydrolyses the acylglycerolipids and generates free fatty acids, especially arachidonic acid. Thus arachidonic acid accumulates during the hypoxic-ischemic period. Upon perfusion, when oxygen is available, arachidonic acid is metabolized mainly by three different groups of enzymes-cyclooxygenase, lipooxygenases and cytochrome P450. This leads to the formation of eicosanoid and reactive oxygen species (16). The human body is equipped with a variety of antioxidants that serve to counterbalance the effect of oxidants. Antioxidants are divided into two categories: enzymatic and nonenzymatic. The major enzymatic antioxidants are superoxide dismutase (SOD), catalase (CAT), Glutathione peroxidase, thioredoxin, glutathione transferase and peroxiredoxin (17). Nonenzymatic antioxidants include vitamins (vitamin-C and E), beta-carotene, and glutathione (17). Dietary antioxidants are vitamins, beta-carotene and the mineral zinc. Lipid soluble vitamin-E is concentrated in the hydrophobic interior site of cell membrane and is the principal defense against oxidant-induced membrane injury. Vitamin-E donates electron to peroxyl radical, which is produced during lipid peroxidation. It functions as a chain-breaking antioxidant (18).

Vitamin-E serves as 1st line defense against peroxidation of phospholipids. In our present study we noted that average intake vitamin-E was significantly lower in respect to RDA of both control and experimental group of girls. Average adequacy ratio of vitamin-E was 0.67 and 0.39 in nondysmenorrhea and dysmenorrhea group respectively (fig.5). Water soluble vitamin-C (ascorbic acid) provides intracellular and extracellular aqueous-phase antioxidant capacity primarily by scavenging oxygen free radicals. It converts vitamin-E-free radical back to vitamin-E and essential to recycle vitamin-E to prevent lipid peroxidation. There was no significant difference of vitamin-C intake between control and experimental group of girls (fig.2). Vitamin-C intake in both groups was more than their RDA. Beta-carotene has been found to react with peroxyl, hydroxyl and superoxide radicals. It inhibits the oxidant-induced NF-kB activation and interleukin-6. Daily intake of beta carotene was significantly lower in girls with dysmenorrhea in respect to their control counterpart (table-3). Zinc is a cofactor of the antioxidant enzyme, super oxide dismutase. Daily intake of zinc was significantly lower in girls with dysmenorrhea in respect to their control counterpart (table-3). Intake statuses of all study dietary antioxidants were worse among adolescent girls with dysmenorrhea (fig.1-4). Thus deficiency of antioxidant vitamins (particularly vitamin-E and beta carotene) and mineral, zinc may be a contributing factor of primary dysmenorrhea.

CONCLUSION

Menstrual health is a fundamental to women's sexual and reproductive health. Changes in the normal menstrual patterns of women in reproductive age group may affect physical and psychological well being. Life style modification particularly decreasing the intake of fast food and promoting healthy eating habits should be emphasized in school health education programmed to improve menstrual health. Improvement of menstrual health will not only help in improving the academic performance of the students, but also prevents future problems like polycystic ovarian disease, hyperlipidemia and infertility. Finally, it may be suggested that the dietary intake of antioxidants should be adequate for adolescent girls to minimize the risk of primary dysmenorrhea and improvement of menstrual health.

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