Pulmonary Function Assessment in Young Female Medical Students Suffering from Anemia

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Introduction: Anemia is common problem in people of high socioeconomic status of all age group. This is usually seen with reduced work capacity, early fatigability, mental irritation, dyspnea etc. Despite of good and easy availability of food, young girls of high socioeconomic status still remain anemic mainly due to lack of self care in terms of nutritional diet, somewhat hate for green leafy vegetables, charm of junk foods devoid of nutritional substances including iron, inadequate physical exercise. Present study was conducted to assess the pulmonary functions in young anemic female medical students belonging to high socioeconomic status. **Methods**: Based on Hemoglobin level subjects were divided in to 2 groups. Group 1 comprised of obese students (Hb>12 gm/dl) and group 2 comprised of anemic students (Hb<12gm/dl). Age, height and weight, of all subjects were noted. Body mass index was calculated by dividing weight (in Kg) with height in meter². Data obtained were analyzed using t-test. **Result**: Forced Vital Capacity (FVC), Peak expiratory flow rate (PEFR), FEV1 and Maximum voluntary ventilation (MVV) in anemic group subjects were significantly lower in comparison to control group. However FEV1/FVC did not show any significant difference. **Conclusion:** Anemia leads to decreased pulmonary functions which further hampers the oxygenation of the tissue and may worsen the physical and mental capabilities.

Keywords: Anemia, Pulmonary function, Hemoglobin

INTRODUCTION

Anemia is a common medical problem in Indian population especially in young girls of low as well as high socioeconomic status. Anemia is a clinical condition with RBC count less than 4 million/mm³ or hemoglobin content less than 12 gm/dl or both. In high socioeconomic status problem is increasing with great pace due to vegetarian diet, less physical activity, eating junk food and frequent fasting/dieting for the sake of slim look. Among various types of anemia, iron deficiency anemia is most common in India.

Iron deficiency anemia is related in part to abnormal iron metabolism. The balance of iron metabolism in the organism is tightly controlled and designed to conserve iron for reutilization. There is no excretory pathway for iron, and the only mechanisms by which iron is lost from the body are blood loss (via gastrointestinal bleeding, menses, or other forms of bleeding) and the loss of epidermal cells from the skin and gut. The margin between the amount of iron available for absorption and the requirement for iron in growing infants and the adult female is narrow.

Vegetarians are at an additional disadvantage because certain foodstuffs that include phytates and phosphates reduce iron absorption by about 50%. When ionizable iron salts are given together with food, the amount of iron absorbed is reduced. This is particularly true with iron in the ferric state. When the percentage of iron absorbed from individual food items is compared with the percentage for an equivalent amount of ferrous salt, iron in vegetables is only about one-twentieth as available, egg iron one-eighth, liver iron one-half, and heme iron one-half to two-thirds. Infants, children, and adolescents may be unable to maintain normal iron balance because of the demands of body growth and lower dietary intake of iron.[1,2]

The narrowness of this margin accounts for the great prevalence of iron deficiency worldwide—currently estimated at one-half billion people. Poor dietary intake of iron and increase loss of iron in menses leads to higher incidence of iron deficiency anemia in young girls.[3,4] Iron deficiency exerts adverse effects on immune response and alters the metabolism and growth of pathogens. Low hemoglobin impairs tissue oxygenation and acts as an independent risk factor for developing lower respiratory tract infections (LRTI). It is also associated with dyspnea on mild exertion, easy fatigability, mood disorders and lack of alertness in studies. The present study was aimed to evaluate pulmonary functions of young anemic medical students. Pulmonary function

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tests provide valuable information about the status of an individual's respiratory system and work capacity.[5,6]

METHODS

A total of 50 female healthy young subjects of age 18-25 years, were chosen for the study with no history of pulmonary diseases. Subjects reported to the laboratory 2 hours after taking light breakfast.procedure was explained in detail to all subjects. Informed consent was taken from all subjects. Ethical clearance was taken from the ethical committee of the institute. Age, height and weight, of all subjects were noted. Body mass index was calculated by dividing weight (in Kg) with height in meter (Table 1).[2]

Inclusion criterion for the subjects were as follows
1. Subjects were not suffering from any chronic illness
2. Subjects not taking any medication
3. BMI< 25
4. Subjects were non smoker, nonalcoholic
5. Hemoglobin (Hb) level of all subjects was measured by Sahli's method in the laboratory. Based on Hemoglobin level, subjects were divided in to two groups; group A comprising of subjects Hb>12 gm/dl and group B comprising of anemic subjects with Hb<12 gm/dl. Pulmonary function tests were done using computerized spirometer. Peak expiratory flow rate (PEFR), forced expiratory volume in one second (FEV1) and Maximum voluntary ventilation (MVV) are most reliable and important tests to assess respiratory muscle strength and airway resistance.

RESULTS

Table 2 shows that Forced Vital Capacity (FVC) was significantly lower in anemic subject (2.8 ±0.18) in comparison to normal subjects (3.1±0.14). Peak expiratory flow rate (PEFR) was significantly lower (p<0.05) in anemic group (3.02±0.12) in comparison to control group A (3.72 ±0.15). FEV1 (2.18±0.06) and MVV (70.2±7.6) in anemic group subjects were significantly lower in comparison to control group A FEV1 (2.51±0.08) and MVV (110.3±5.1). However FEV1/FVC did not show any significant difference.

DISCUSSION

Anemia reduces the normal functioning of the body including respiratory system. Oxygen is necessary for proper functioning of each cell and whole biological system. It is required for various metabolic processes which are involved in catabolism of dietary nutrients. Proper cell functioning results in synthesis of proteins and synthesis of many other substances which provide strength to all muscles. Anemia may lead to mild to moderate weakness

Table 1: Comparison of anthropometric parameters and Hemoglobin in normal and anemic subjects

S. N.		Group (normal subjects)	Group-B (anemic subjects)
		N=25	N=25
1	Age (years)	20.05±1.2	19.98±0.9
2	Height (cms)	156.3±5.4	155.8±7.3
3	Weight (Kg)	50.2±5.9	49.8±7.2
4	BMI (kg/m^2)	20.54±2.4	19.66±3.1
5	Hemoglobin (gm/dl)	13.2±0.32	10.5±0.46

Table 2: Comparison of respiratory parameters in anemic and normal subjects

S. N.	Respiratory parameter	Group-A (normal subjects)	Group-B (anemic subjects)
		N=25	N=25
1	Forced vital capacity (L)	3.1±0.14	2.8±0.18*
2	Forced expiratory volume in one second (L)	2.51±0.08	2.18±0.06*
3	FEV1/FVC (%)	81.04±0.08	78.08±0.06
4	Peak expiratory flow rate (L/s)	3.72±0.15	3.02±0.12*
5	Maximum voluntary ventilation (L/min)	110.3±5.1	70.2±7.6

*p<0.05 significant

of strength of respiratory muscles and is associated with reduced cardio pulmonary efficacy and easy fatigability. Oxygen is delivered to the tissues via blood in dissolved form as well as in bound form with hemoglobin. Decreased oxygen supply to the tissues results in impaired functioning of the cells which ultimately affects organ systems including respiratory muscles which in turn worsens the oxygen intake by lungs from atmosphere. Hypoxia due to anemia is not very severe and it may remain unnoticed in resting state unless Hemoglobin level is too low to markedly hamper the oxygen supply to the tissues in resting state. But even on mild exertion, anemic person feel fatigue and their work performance is reduced. This is due to limited supply of oxygen to the tissues. Various studies have shown deleterious effect of anemia on various systems of the body like involvement of nervous system leading to insomnia, mental irritation, lightheadedness, impaired cognitive functions etc. It also affects the immune system of the body and reduces immunity. Decrease strength of respiratory muscles including diaphragm reduces the pulmonary functions.[6,7] Tidal volume is decreased while reserve volumes increase or remain unchanged in these anemic persons. However total lung capacity markedly decreases in these subjects suffering from anemia. Weakness of accessory muscles of respiration adds to decrease in Peak expiratory flow rate, forced expiratory volume in one second (FEV1). Maximum voluntary ventilation is markedly reduced due to decreased depth of respiration as well. Anemia leads to

decreased pulmonary functions which further hampers the oxygenation of the tissue and may worsen the physical and mental capabilities.

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