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Short Communication

Pulmonary Function Tests in Indian Women with Iron Deficiency Anemia

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Abstract: Iron deficiency anemia is the most common cause of nutritional anemias in Indian women. As the oxygen carrying capacity of blood decreases, most of the body systems are affected. The present study was undertaken to analyze the affects of anemia on lung functions. The study included 66 women of different socio economic status of the society. They were classified into three groups based on the severity of anemia and socio-economic status. The Body mass index, Body surface area, Forced vital capacity, Forced expiratory volume in 1 second, Forced vital capacity ratio expressed as percentage, Peak expiratory flow rate, Maximum voluntary ventilation were assessed using Medspiror. The results showed a significant increase in body weight with increase in hemoglobin, similarly there was increase in the weight, Body mass index and Body surface area in individuals with better hemoglobin. The mean values of percentage predictions of Forced expiratory volume in 1 second, Forced vital capacity ratio expressed as percentage, Peak expiratory flow rate were significant at p value less than 0.05 in all the groups. Increase in Forced vital capacity ratio expressed as percentage indicates restrictive broncho-pulmonary dysfunction. Further, the decrease in Peak expiratory flow rate indicated poor endurance and strength of respiratory muscles. To the best of our knowledge, there is hardly any standardized literature documented on affects of Iron deficiency anemia on dynamic ventilator tests.
Keywords: iron deficiency anemia, hemoglobin, Forced vital capacity, Forced expiratory volume in 1 second, Forced vital capacity ratio, Peak expiratory flow rate maximum voluntary ventilation.

INTRODUCTION

The commonest nutritional cause of anemia in India is Iron deficiency. It is well known that anemia reduces work capacity, increases susceptibility to infections and affects socio-economic wellbeing as well as physical health[1]. Large number of people, throughout the world has become inured to diet consisting of grains or cereals, meat poor diets, which provide inadequate quantities of iron. The availability of iron from predominately cereal based diet is inadequate and this is an important cause of iron deficiency anemia[2]. In women of reproductive age, the physiological iron loss includes both menstruation and pregnancy. Especially, it is common in women of lower socio-economic status, due to a poor diet, impaired absorption and diminished bio-availability. Considerable evidences have been accumulated for the past few years to show wide variation of transfer factors. The studies establishing relationship of hemoglobin and dynamic lung function tests are very limited. Hence, the present study was undertaken to observe the relationship of hemoglobin with dynamic ventilatory tests.

METHODS AND MATERIALS

The study was conducted for a period of 2 years, at Gandhi General Hospital, Hyderabad. A total of 66 women between 20 – 30yrs of age, and with microcytic hypochromic anemia, participated in the study. Women with history of acute or chronic cardiopulmonary diseases were excluded from the study. Institutional ethical committee clearance was obtained and written /informed consent was taken from each subject enrolled in the study. The tests were carried out during forenoon, between 9-12 a.m. The subjects were divided in to 3 groups based on hemoglobin (Hb) content, as per National Consultation on control of Nutritional Anemia in India. The Group I: included 10 females with Hb<7gm% & with monthly income betweenRs.2000 – Rs.4000 with more than 4 members in the family. Group II: included 33 females with Hb between 7 to 10.9gm%&with monthly income between Rs.4000 – Rs.8000 with 4 members in the family. Group III: included 23 females with Hb>11gm% with monthly income between Rs.8000 – Rs.10,000 with 4 members in the family.

The Body Mass Index (BMI) was calculated and Body surface area(BSA) was calculated using Dubois nomogram. The Forced vital capacity (FVC), Forced expiratory volume in 1 second (FEV_1), Forced vital capacity ratio expressed as percentage (FEV_1/ FVC), Peak expiratory flow rate (PEFR), Maximum voluntary ventilation (MVV) were also estimated using Medspiror. The data was expressed as Mean ± Standard deviation (SD) in all parameters. The Mean differences were assessed by Analysis of Variance (ANOVA) using SPSS statistical software (version 18).

RESULTS

The RBC count (as expressed in mean ± Standard deviation) in all the 3 groups is depicted in table 1. In group I, the RBC count (2.2 ± 0.26) was lowest, where as in group II and group III the values obtained were comparatively higher, 3.2 ± 0.47 and 3.8 ± 0.50 respectively. There was a statistically significant difference in mean values between the groups. Further, the Anthropometric parameters like height, weight, BMI and BSA were compared in different groups (Table 2). The results revealed a significant increase in body weight with increase in hemoglobin. Similarly there was an increase in the weight, BSA and BMI and was statistically significant at p value, $p<0.01$, $p<0.05$ and $p<0.01$ respectively. On the other hand, no difference was observed in the height of women, between the groups. The dynamic ventilatory tests were performed and FVC, FEV_1, FEV_1%, PEFR and MVV were estimated using Medspiror in all the groups. The various percentage predictions of FVC, FEV_1, FEV_1%, PEFR and MVV are depicted in table 3. The difference in the mean values of percentage predictions of FEV1, FEV_1% and PEFR was found to be significant at p value less than 0.05 in all the groups. The FVC did not vary significantly among the groups.

Table 1: Hematological parameters in different groups.

CATEGORY	NUMBER OF SUBJECTS	HEMOGLOBIN gm%	RBC millions/ mm^3 (Mean ± SD)
Group I	10	< 7	2.2 ± 0.26***
Group II	33	7 – 10.9	3.2 ± 0.47***
Group III	23	>11	3.8 ± 0.50***

*** significant ($p<0.001$)

Table 2: Analysis of anthropometric parameters in different groups.

CATEGORIES	HEIGHT IN CMS (Mean ± SD)	WEIGHT IN KGS (Mean ± SD)	BMI (Mean ± SD)	BSA (Mean ± SD)
Group I	150.40 ± 6.30	37.40± 3.78*	16.54± 1.40*	1.26± 7.07**
Group II	154.09 ± 7.22	46.81± 6.28*	19.73± 0.48*	3.22± 0.48**
Group III	154.30 ± 6.46	49.73± 8.62*	20.86± 3.24*	3.76± 0.50**

* Significant ($p <0.05$); ** Significant ($p <0.01$)

Table 3: Percentage predictions of pulmonary function tests in different groups

CATEGORY	FVC (Mean ± SD)	FEV_1 (Mean ± SD)	FEV_1% (Mean ± SD)	PEFR (Mean ± SD)	MVV (Mean ± SD)
Group I	60.52 ± 24.78	92.61±47.04*	100.40±24.52*	33.8 ± 10.01*	49.00 ± 8.30
Group II	55.76 ± 28.87	54.54±25.80*	104.78±26.40*	46.8 ± 14.44*	45.97 ± 18.15
Group III	61.17 ± 25.84	62.84±26.72*	107.63±26.40*	52.7 ± 17.9*	54.90 ± 19.10

* Significant ($p<0.05$)

DISCUSSION

The results of the present study indicated that, a significant difference in the hemoglobin and the total RBC count among the groups may be nutrition dependent, as better nutrition would result in improved hemoglobin and total RBC count [3]. Determination of ventilatory tests in different groups revealed that all the lung function tests were decreased in group I. FEV_1, which is a valuable aid of measuring resistance to air flow was found reduced in group III. The PEFR is more sensitive to muscular element of respiration, and was found significantly decreased linearly with severity of anemia. Hemoglobin should be retained between 12.5 to 14 gm% in order to maintain adequate oxygen carrying capacity. The reduction in oxygen carrying capacity of blood causes tissue hypoxia and accumulation of intermediate products of metabolism like lactate and other acids in the tissues leading to exhaustion of muscles including diaphragm [4,5] and respiratory effects become less powerful [6] which is evident from the significantly lowered PEFR. This finding is in accordance with the previous study done by Jain et.al. [7]. The lower MVV in group I and group II is consistent with the earlier reports, which is attributable to the small lung volumes and poor physical fitness[8]. Studies have even shown that anemia increases susceptibility to lung diseases like asthma even in children [9] and iron supplementation helps in relieving chronic unexplained cough in healthy females [10]. Anemia decreases immunity and effects many systems of the body.

CONCLUSION

The decrease in FVC and FV1 suggested a restrictive pulmonary impairment, even though the values are not statistically significant. Increase in FEV_1/ FVC indicates restrictive broncho pulmonary dysfunction. Decrease in PEFR could be due to weakness of respiratory muscles.

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