SHORT COMMUNICATION

EFFECT OF ANAEMIA ON RESPIRATORY AND METABOLIC PARAMETERS DURING THIRD TRIMESTER OF PREGNANCY

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Summary : Pregnancy involves a considerable increase of metabolically active tissue. Anaemia a common occurance during pregnancy hampers the normal metabolism of body due to Anaemic hypoxia. In present study oxygen uptake, Co_2 output, Respiratory Exchange Ratio (RE) Resting Metabolic Rate (RMR) and Peak Expiratory Flow Rate (PEFR) were compared in normal women in IIIrd trimester of pregnancy (Hb 12 gm% or above) with anaemic women. Oxygen uptake and Co_2 output were measured by Noyon's Dioferometer and PEFR by Wright's Peak Expiratory Flow Meter. RE and RMR were calculated. O_2 uptake, Co_2 output, RE and RMR were significantly increased whereas PEFR was significantly decreased in anaemic than in normal subjects during third trimester of pregnancy.

Key words : anaemia during third trimester of pregnancy respiratory exchange ratio resting metabolic rate C_2 output PEFR O_2 uptake

INTRODUCTION

Anaemia plays an important role in producing morbidity in tropical countries including India, during pregnancy. The important causes of Anaemia include Iron deficiency, nutritional deficiency, Malaria and Ankylostomiasis. In anaemia, extraction of some amount of oxygen could lead to greater Hb, desaturation and lower PO_2 at venous end. This results in destructive cellular hypoxia (3) and will hamper the normal metabolism of pregnancy. In severe maternal hypoxia, the cerebral hemisphere of foetus fails to develop or destroyed by the utero hypoxic insult (4).

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MATERIAL AND METHODS

Four normal healthy women (Hb 12.5 *gm*% or above) and ten anaemic women (Hb 10 *gm*% or below) in their IIIrd Trimester of pregnancy, were selected from Gynecology and Obstetrics Department, J.N. Medical College, Aligarh. Only those cases were included in the study who had no associated disease in clinical examination and were not taking any medicine except vitamins and nutrients. The subjects were instructed to take dinner by 7.30 p.m., the evening before experiment and were called to the laboratory at 8.00 A.M. next morning on empty stomach and were put on bed rest for one hr. Oxygen uptake and Co_2 output were measured by Noyon's Diaferometer and respiratory exchange ratio (RE) and Resting Metabolic Rate (RMR) were calculated. Peak Expiratory Flow Rate was measured by Wright's Peak Expiratory Flow Meter. The four normal healthy women had Hb between 12.5 - 14.5 *gm*% (mean 13.42±0.46) and were between 26 to 33 years (mean 29.75±1.40) in age, weighing between 54 to 65 *kg* (Mean 60±2.34) and their height ranged from 158 to 163 cm. (mean 160.5±1,19). Ten anaemic subjects with Hb between 3 to 13 *gm*% (mean 5.68±0.68) were 18 to 34 years (mean 23.9± 1.47) in age, weighing 40-78.5 *kg*. (mean 53±3.29) and height ranged from 149 to 164 cm (mean 154.1±1.82).

RESULTS

Table I shows that the oxygen uptake, and Co_2 output were significantly higher in anaemic subjects as compared to normal women ($P = <0.001$). Since the Co_2 output was greater than O_2 uptake Respiratory exchange ratio (RE) significantly increased in anaemics compared to normal women. The increase in resting metabolic rate in anaemic subject was statistically significant that normal women. The peak expiratory flow rate on the other hand was significantly lower in anaemic subjects ($P = <0.001$).

DISCUSSION

Molecular oxgen is necessary for proper functioning of all biological systems. Aberrations in the supply and utilization of oxygen produces profound changes in cell metabolism (9). Haemoglobin should be maintained between 12.5 to 14 *gm*% for adequate oxygen carrying capacity. In severely anaemic patients, as in the present study (Hb 5.68±0.68) (Table I) the oxygen carrying capacity is decreased significantly allowing the tissues to suffer from 0_2 lack. During oxygen deprivation, abnormalities of metabolic patterns occur and lactic acid accumulation occurs (5) in tissues as aerobic metabolism

TABLE I : Changes in oxygen uptake, Co_2 output, RE, resting metabolic rate and peak expiratory flow rate as produced during IIIrd trimester of pregnancy.

S. No.	Hb gm%	O_2 uptake ml/kg/min	Co_2 output ml/kg/min	RE	RMR %	PEFR 1/min
Normal (n=4)						
1	12.5	3.51	3.86	1.1	34.01	320
2	12.8	3.58	3.65	1.02	38.02	350
3	13.9	3.56	3.59	1.01	36.04	360
4	14.5	3.54	3.46	0.98	32.08	380
Mean	13.42	3.54	3.64	1.02	35.02	352.5
SE	±0.46	±0.01	±0.08	±0.02	±1.28	±12.5
Anaemic (n=10)						
1	3	4.02	6.35	1.58	22.19	240
2	4	5.1	6.47	1.27	65.78	240
3	4.5	6.29	9.37	1.49	94.0	240
4	4.5	4.42	8.97	2.03	44.9	205
5	5	5.46	7.20	1.32	42.68	295
6	5	5.02	6.12	1.22	49.02	220
7	5.5	4.62	4.94	1.07	38.75	215
8	6.5	5.41	7.57	1.4	71	260
9	8.8	3.49	6.38	1.83	23.49	260
10	10	3.6	4.28	1.19	35.02	340
Mean	5.68	4.74	6.76	1.44	48.68	251
SE	±0.68	±0.27	±0.50	±0.09	±7.08	±12.81

turns to anaerobic metabolism of glucose. Tissue hypoxia leads to coarse adjustment in the physiological processes for oxygen transport (8). The anaemic hypoxia is a powerful stimulant to ventilation leading to significant increase in oxygen intake by anaemic patient as compensatory mechanism (fig). The increase in the efforts of respiration increases the oxygen demand of respiratory muscles. This demand could be as high as 30% of the normal level (7). Increase in O_2 uptake is utilized for making provision for hyper ventilation and this leads to associated increase in metabolic rate. In last trimester of pregnancy the metabolic rate is increased normally but in anaemic women the increase in metabolic rate is significant than the normal pregnant women. The increase in O_2 uptake and associated increase in metabolic rate observed in anaemic subjects result in the increase in Co_2 output, (Table I, Fig. 1) which causes right ward shift of oxyhaemoglobin dissociation curve and thereby facilitate the unleading of oxygen to the tissues (1,2).

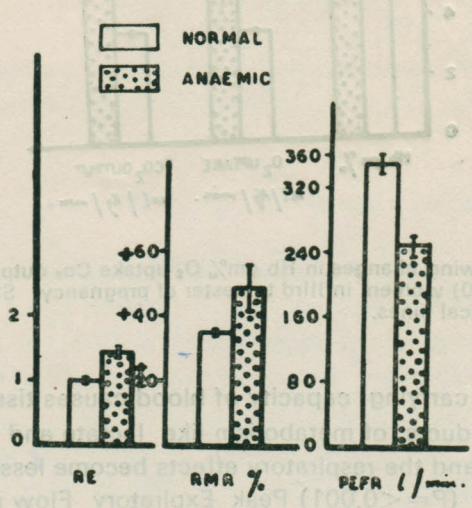

Fig. 1 : Histogram showing changes in Respiratory Exchange ratio (RE), Resting Metabolic Rate (RMR%) and Peak Expiratory Flow Rate (PEFR) in normal (n=4) and anaemic (n=10) women in IIIrd trimester of pregnancy. Standard error of mean is shown by vertical lines.

The respiratory exchange ratio (RE) also increased in anaemic (1.44±0.99) as compared to normal (1.02±0.02) (Table I, Fig. 2). Increase in (RE) is usually obtained in excitement, severe exercise or in hyper ventilation (10). The measurements in present study were taken at rest, the patients were therefore neither excited nor under any physical strain. So increase in RE appears to be a consequence of hyperventilation which is

associated with anaemia and directly proportional to the magnitude of anaemia. The hyperventilation requires energy and therefore increases the metabolism, thus increasing O_2 intake and Co_2 output.

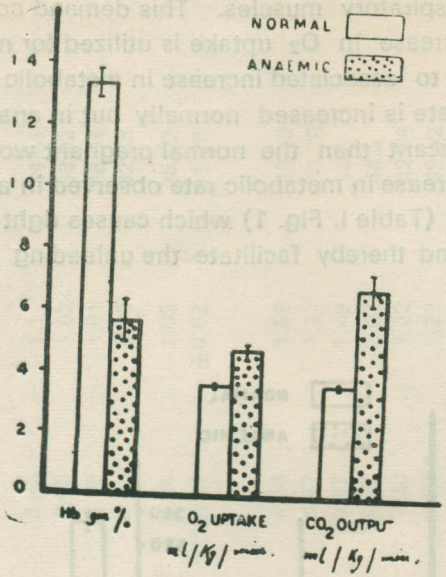

Fig. 2 : Histogram showing changes in Hb gm% O_2 uptake Co_9 output in normal (n=4) and anaemic (n=10) women in IIIrd trimester of pregnancy. Standard error of mean is shown by vertical liines.

The reduction of O_2 carrying capacity of blood causes tissue hypoxia and accumulation of intermediatry products of metabolism like lactate and other acids in the tissue (5) leading to exhaustion and the respiratory effects become less powerful. This is evident from the significant lower ($P=<0.001$) Peak Expiratory Flow rate in anaemic women (251 l/min±12.8) as compared to normal pregnant women (352.5 l/min±12.5). The PEFR is more sensitive to muscular element in respiration (6).

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