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EFFECT OF ALTITUDE ON FEV_1 AND FVC SPIROMETRIC PARAMETERS IN THE SECOND TRIMESTER ANTENATAL MOTHERS

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ABSTRACT **BACKGROUND:**Pregnancy is associated with various physiological and psychological changes in the antenatal mother. Among these, the changes in the respiratory functions are more significant. There are various factors which influence the respiratory function of the antenatal mother such as altitude of the residence, diet and life style. Of these, altitude of the residence plays an important role. **AIM :**To compare the pulmonary function of antenatal mothers living at high altitude and plains. **MATERIALS &METHODS:**This cross sectional study involves 60 healthy uncomplicated antenatal mothers in II trimester of pregnancy irrespective of either primi or multigravida within the age group of 18-30 years (30 of them residing at altitude of about 2268 meters from the sea level and 30 of them residing in plains). After measuring the height, weight and body mass index, pulmonary function of these antenatal mothers were assessed by using computerized spirometer in sitting position. Among the various parameters of lung function, forced expiratory volume during first second (FEV_1)and forced vital capacity (FVC)values(in liters) were taken. **STATISTICALANALYSIS:** The values are tabulated in a Microsoft excel sheet and statistically analyzed by "Independent t test" and Karl Pearson's coefficient of correlation by using SPSS 23 software. **RESULTS:** In the present study, when the data are analyzed by "Independent t test" , the p value of demographic variables, FEV1, FVC and FEV1/FVC of antenatal mothers in the second trimester living in high altitude and plains is not less than 0.005(statistically not significant). By correlating the demographic variables of the antenatal mothers living in high altitude and plains by using Karl Pearson's coefficient of correlation, statistically significant result between the demographic variables and spirometric parameters of antenatal women residing in high altitude and plains. **CONCLUSION:** The present study shows that there is no significant different in the pulmonary function test of antenatal mothers in the second trimester of pregnancy residing in high altitudes and plains.

KEYWORDS : Antenatal Cases (ANC), Forced Expiratory Volume during first second (FEV1), Forced Vital Capacity(FVC).

INTRODUCTION:

Pregnancy is a state of physiological adaptation which alter the functions of all the system of the antenatal mother which is necessary to accommodate the needs of the growing fetus[1]. These changes also depends on various factors such as residence, diet and life style.

In high altitude, barometric pressure decreases with low oxygen tension which leads to activation of compensatory mechanisms . Hence there is an increased ventilation, high pulmonary diffusion capacity, an increase in oxygen carrying capacity of the blood, adaptation of intracellular mechanism and microcirculation[2].

During pregnancy, the alterations in the respiratory physiology is characterized by congestion of upper airway. These changes occur in first trimester and persist throughout gestation. Chest wall configuration is altered and diaphragmatic position is also elevated. The important changes are seen in lung function and lung volume such as gradual decrease in functional residual capacity(FRC) and expiratory reserve volume and a corresponding rise in inspiratory capacity(IC) due to increasing size of the fetus which restrict lung expansion[3-7]. Most striking changes are seen in respiratory drive and minute ventilation due to changes in serum progesterone levels which either directly stimulate the respiratory centre or increase the sensitivity to carbon dioxide. Pregnancy in high altitude aggravate these mechanisms leading to exaggeration of the respiratory symptoms and signs[8].

Pulmonary function test(PFT) gives an accurate assessment of the functional level of the respiratory system and is also helpful in quantification of the severity of the diseases[9]. Of the various parameters of PFT, forced expiratory volume during first second (FEV_1) and forced vital capacity (FVC) values are taken as a predictor of pulmonary function[10].

A study by Anita Teli et al showed marked changes in respiratory parameters in pregnancy, such as FEV1, FEV1%, FEF25-75%, FEF25% , FEF50%, FEF75% in all trimesters of pregnancy with maximum decrease in 1st trimester[11]. Fionnualamcauliffe et al found that the effect of pregnancy on the respiratory function of healthy women is influenced by altitude of residence[12].

AIM & OBJECTIVE

To compare the pulmonary function of antenatal mothers living in high altitude and plains.

MATERIALAND METHODS:

After obtaining institutional ethics clearance and written informed consent, this study was a conducted at the Department of Obstetrics and Gynaecology, Coimbatore medical college and hospital and Primary Health Care Centre in Coonoor, Tamil Nadu, India.By random sampling,sixtyclinically healthy antenatal mothers in second trimester of pregnancy irrespective of either primi or multigravida within the age group of 18-30 yearswere recruited for this study. They were divided into two groups.

Group I: 30 antenatal cases residing at altitude of about 2268 meters from the sea level.

Group II : 30 antenatal cases residing in plains.

Exclusion Criteria: The antenatal mothers 1)with irregular menstrual cycle, 2) diagnosed of having cardiovascular diseases, Diabetes Mellitus, Respiratory Diseases,Systemic Hypertension, Thyroid disorders and 3) taking medications other than iron and folic acid supplements for any systemic and localised diseases were excluded from the study.

Procedure:

Clear instructions were given to all antenatal mothers aboutthis study and adequate time was ensured they understand the study and procedure. After demonstration of how to perform lung function test.The height and current weight of the antenatal mother was measured and body mass index was calculated by using Quetelet's index, pulmonary function of these antenatal mothers were assessed by using computerized spirometer in sitting position. Among the various parameters of lung function, forced expiratory volume during first second (FEV_1) and forced vital capacity (FVC) values(in liters) were taken.The data were evaluated and analysed using SPSS .

Statistical analysis:

The data was tabulated in Microsoft excel sheet and it was analysed by comparing the means of various demographic particulars and FEV1, FVC and FEV1/FVC scores of mothers residing at high altitude and

plains by Independent t test and Karl Pearson's coefficient of correlation.

RESULT:

The demographic variables of antenatal mothers residing in the high altitude and plains are analyzed shows that Among antenatal mothers residing in high altitude 26.7% are in the age group <22 years , 43.3% are in the age group of 23 – 26 years and 30% are in the group of 27 to 30 years.

Among antenatal mothers residing in plains 20% are in the age group <22 years , 63% are in the age group of 23 – 26 years and 16.7% are in the group of 27 to 30 years.

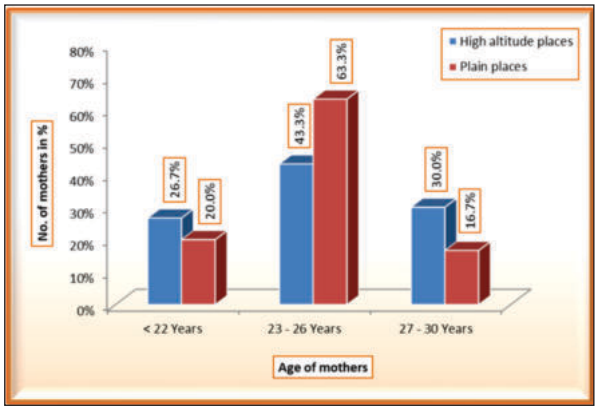

Fig :1 Age related distribution of antenatal mothers living in high altitudes and plains

Among antenatal mothers residing in high altitude 3.3% are in the BMI of <18.5 , 73.3% are in the BMI of 18.5 – 24.9 and 23.3% are in the BMI of 25 – 29.9.

Among antenatal mothers residing in plains 3.3% are in the BMI of <18.5 , 66.7% are in the BMI of 18.5 – 24.9 and 30% are in the BMI of 25 – 29.9.

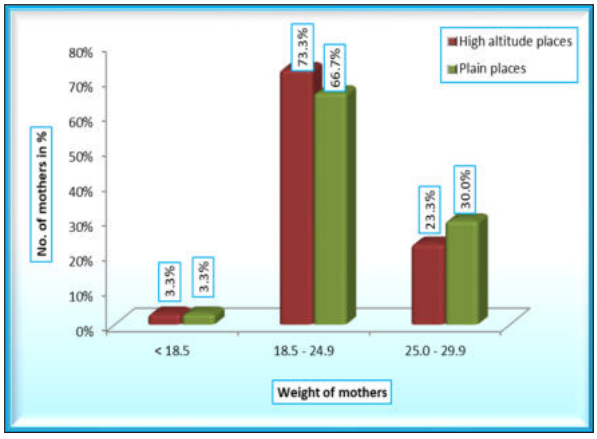

Fig :2 BMI related distribution of antenatal mothers living in high altitudes and plains

Table: 1: Comparison between the means of various demographic particulars and FEV1, FVC and FEV1/FVC scores of mothers residing at high altitude and plains by Independent t test

S. No.	Variables	Group	N	Mean	SD	T value	P value
1	Age	Mothers in high altitude places	30	24.40	2.943	0.872	0.387
		Mothers in plain places	30	23.77	2.674		
2	Height	Mothers in high altitude places	30	154.30	5.832	0.546	0.587
		Mothers in plain places	30	153.53	5.009		
3	Weight	Mothers in high altitude places	30	53.93	6.192	0.240	0.811
		Mothers in plain places	30	53.47	8.665		
4	BMI	Mothers in high altitude places	30	22.66	2.412	-0.094	0.925
		Mothers in plain places	30	22.74	3.973		
5	FEV1	Mothers in high altitude places	30	2.48	0.210	0.109	0.913
		Mothers in plain places	30	2.47	0.216		
6	FVC	Mothers in high altitude places	30	2.84	0.235	0.097	0.923
		Mothers in plain places	30	2.84	0.241		
7	FEV1/FVC	Mothers in high altitude places	30	84.03	6.980	-0.289	0.774
		Mothers in plain places	30	84.43	2.956		

**-Significant at 1% level *-Significant at 5% level

The comparison between the means of various demographic particulars and spirometric values of antenatal mothers in second trimester of pregnancy residing in high altitudes and plains shows that, the p values corresponding to the factors "Age, Height, Weight, BMI, FEV1, FVC, FEV1/FVC" are not less than 0.05 and are not significant at 5% level and hence we can say that there is no significant difference between the mean scores of the factors "Age, Height, Weight, BMI, FEV1, FVC, FEV1/FVC" of the mothers residing at high altitude places and plain places.

Table: 2: Correlation between the factors of "Age, Height, Weight, BMI, FEV1, FVC and FEV1/FVC" of mothers residing at high altitude places by Karl Pearson's coefficient of correlation.

Correlation	Age	Height	Weight	BMI	FEV1	FVC	FEV1/FVC
Age	1.000	R = 0.168 P = 0.375	R =0.119 P =0.532	R =0.290 P =0.120	R = -0.293 P = 0.115	R = -0.273 P=0.144	R = -0.061 P = 0.748
Height		1.000	R = 0.453 P = 0.012*	R = -0.219 P = 0.244	R = 0.988 P = 0.000**	R = 0.990 P = 0.000**	R = 0.391 P = 0.033*
Weight			1.000	R = 0.768 P = 0.000**	R = 0.416 P = 0.022*	R = 0.423 P = 0.020*	R = 0.278 P = 0.136
BMI				1.000	R = -0.259 P = 0.167	R = -0.252 P = 0.180	R = 0.021 P = 0.914
FEV1					1.000	R = 0.999 P = 0.000**	R = 0.380 P = 0.038*
FVC						1.000	R = 0.378 P = 0.040*
FEV1/FVC							1.000

**-Significant at 1% level *-Significant at 5% level

From the above table, correlation values between the variables "Height and FEV1", "Height and FVC", "Weight and BMI" and "FVC and FEV1" are highly significant at 1% level since their p values are less than 0.01. Also the positive correlation shows the direction of changes of the values of the variables, i.e., if one variable is increases and the corresponding will be in increasing trend.

Similarly, the correlation values between the variables "Height and Weight", "Height and FEV1/FVC", "Weight and FEV1", "Weight and FVC", "FEV1 and FEV1/FVC" and "FVC1 and FEV1/FVC" are significant at 5% level since their p values are less than 0.05. Also the positive correlation shows the direction of changes of the values of the variables, i.e., if one variable is increases and the corresponding will be in increasing trend.

Table: 3: Correlation between the factors of "Age, Height, Weight, BMI, FEV1, FVC and FEV1/FVC" of mothers residing at plains by Karl Pearson's coefficient of correlation

Correlation	Age	Height	Weight	BMI	FEV1	FVC	FEV1/FVC
Age	1.000	R = 0.123 P = 0.518	R = 0.105 P = 0.580	R = -0.151 P = 0.425	R =0.036 P = 0.849	R = 0.044 P = 0.819	R = -0.004 P = 0.982
Height		1.000	R = 0.077 P = 0.687	R = -0.321 P = 0.084	R = 0.563 P = 0.001**	R = 0.564 P = 0.001**	R = 0.072 P = 0.704
Weight			1.000	R = 0.918 P = 0.000**	R = -0.210 P = 0.266	R = -0.217 P = 0.250	R = 0.285 P = 0.126
BMI				1.000	R = -0.407 P = 0.025*	R = -0.415 P = 0.023*	R = 0.235 P = 0.212
FEV1					1.000	R = 1.000 P = 0.000**	R = 0.008 P = 0.967
FVC						1.000	R = 0.005 P = 0.979
FEV1/FVC							1.000

**-Significant at 1% level *-Significant at 5% level

From the above table, correlation values between the variables "Height and FEV1", "Height and FVC", "Weight and BMI" and "FVC and FEV1" are highly significant at 1% level since their p values are less than 0.01. Also the positive correlation shows the direction of changes of the values of the variables, i.e., if one variable is increases and the corresponding will be in increasing trend.

Similarly, the correlation values between the variables "BMI and FEV1" and "BMI and FVC" are significant at 5% level since their p values are less than 0.05. The negative correlation shows the direction of changes of the values of the variables, i.e., if one variable is increases and the corresponding will be in decreasing trend and vice versa.

DISCUSSION:

In this study we have found that there is a no significant difference in lung function of antenatal cases in the II trimester of pregnancy living in high altitude when compared to antenatal cases living in the plains.

Dixit R, latagupta et al conducted a study in 50 antenatal cases within the age group of 20 – 30 years belonging to middle socioeconomic group observed that peak expiratory flow rate(PEFR) decreases during the II trimester of pregnancy is due to the upward displacement of diaphragm, reduced strength of expiratory muscles and mechanical effect of the growing uterus[13].

Mclennan, oian P et al has found that during pregnancy, the pulmonary blood volume increases, osmotic pressure decreases and increase in capillary pressure. In addition to all these findings, the antenatal cases living in high altitude is associated with an increase in pulmonary vascular resistance which leads to increase the interstitial edema causing an increase in airway resistance and thereby decreases the peak expiratory flow rate(PEFR) in antenatal cases living in high altitude[14,15].

A cross sectional study conducted by Fionnualamcauliffe et al in 304 pregnant women at 7 – 41 weeks of gestation and 38 non-pregnant controls found that the lung function of Mestizo women living in high altitude when compared with those living at sea level differs significantly. The study demonstrated that the effect of pregnancy on respiratory function was influenced by the altitude of residence[12].

The birth weight of infants born at higher altitudes is generally attributed to a lack of oxygen that possibly contributing to low birth weight[16,17]. The infants born at high altitude were 300g less weight when compared to the infants born at sea level[18]. So it is essential to follow up the antenatal cases living in high altitude carefully to prevent the complications to the mother and the fetus.

CONCLUSION:

In this study we observed that there is no significant difference in the FEV1 , FVC and FEV1/FVC of antenatal mothers living in high altitude and plains by independent t test, but when the data was analyzed by Karl Pearson's coefficient of correlation show that there is positive correlation between demographic variables and parameters of pulmonary function such as FEV1,FVC and FEV1/FVC in antenatal mothers living in high altitude and plains.

Limitations of this study:

In this study, there is no significant association was established among the pulmonary parameters such as FEV1,FVC and FEV1/FVC of antenatal mothers living in high altitude and plains. This may be due to altitude of the residence of antenatal mother is 2268 meters from the sea level and small sample size. If we increase the height of altitude to more than 2268 meters and we analyze this parameters in large sample size, we might got a statistically significant result.

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