

DYSPNEA DURING PREGNANCY AND FETAL OUTCOME: A LONGITUDINAL COHORT STUDY IN RURAL POPULATION OF WESTERN GUJARAT

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Introduction & Aim: Discrepancies in the available data for exertion rating and Dyspnea Index (DI) has motivated researchers to identify the more apt values for dyspnea during pregnancy. Dyspnea during pregnancy affects the fetal outcome, specifically in rural population since they are more vulnerable to various risks. Limited data for the longitudinal studies during pregnancy allowed to propose the aim of the study, to determine the perceived exertion during three trimesters of the pregnancy and correlated it with the fetal outcome. **Methodology:** A longitudinal Cohort study was conducted in 77 participants (37 females during each trimester and 40 non-pregnant as control group) attending antenatal clinic of OBGy. Dhiraj Hospital, SVDU. All the participants were studied for DI, RPE (Rating of perceived exertion) and Arterial oxygen saturation (SPO₂). Fetal outcome (N=32) was measured as gestational weight and Ponderal Index (PI). Data was compared for all the three trimester and was correlated with the fetal outcome and maternal SPO₂. **Results:** Significant decline was found for DI (Repeated measures ANOVA, $p < 0.05$) throughout the trimesters, although values were within physiological limit. Participants of all the groups showed insignificant difference for RPE and showed moderate dyspnea in all three trimesters, although mean SPO₂ of all the groups were normal. DI showed no significant correlation with SPO₂ and RPE. The mean gestational weight was 1.986 ± 0.342 kg and PI was calculated as 2.01 ± 0.21 kg/m². **Conclusion:** The occurrence of dyspnea with advancement of gestation is minimal, as the DI values in all three trimesters are within physiological limit. There is no change in arterial oxygen saturation. Moderate exertion without affecting oxygen saturation is pretended to be psychological, since the values are not correlative at all the levels with DI. Compromised fetal outcome is may be due to poor socioeconomic status.

Key words: RPE, Borg Scale, Dyspnea, Pregnancy

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Introduction:

Dyspnea or breathlessness is the most common complaint expressed during the course of gestation in 60-70% of pregnant women specially during III trimester, commonly at 30th week of gestation.¹ The development of dyspnea in the pregnant woman raises the question as to whether she has underlying cardiopulmonary disease or whether her dyspnea is due to the pregnancy itself, this assessment requires an understanding of the cardiopulmonary changes during normal pregnancy, as well as recognition of the syndrome of dyspnea during normal pregnancy.² Studies found that dyspnea is prevalent in pregnant females and reported that 37.5% females experienced dyspnea, most frequently in the first or second trimester and are found to improve as the patient approaches term.³ Dyspnea or breathlessness is usually due to hormonal changes or mechanical factors and the mechanism of

physiological dyspnea during is thought to be increased tidal volume which lowers the blood PCO₂ slightly,⁴ although it is still not clear why gravid women feel dyspnic. Physiologic dyspnea in pregnancy is likely related to an increased awareness of this augmented drive to breathe.⁵ Modified Borg scale is a valid and reliable assessment tool for dyspnea, provide quick, easy, and rapid information about a person's subjective state of dyspnea on 0 to 10 rated scale.⁶

On the contrary Jensen et al (2007) examined the effects of human pregnancy and advancing gestation on the intensity of dyspnea, by borg scale during cycle exercise and reported that neither pregnancy nor advancing gestation were associated with increased respiratory discomfort during exercise.⁷

Dyspnea and arterial oxygen saturation is directly affects fetal outcome and community based studies in lower socioeconomic class, where fetal

growth is a burning issue, are comparatively overdue in India. Moreover discrepancies for the data available for the course of dyspnea during pregnancy and limited data for the longitudinal serial studies during pregnancy allowed to propose the aim of the study, to determine the perceived exertion during three trimesters of the pregnancy and its association with oxygen saturation and fetal outcome.

Material and Methods:

After Ethical approval from Institutional HRRP (SVIEC/ON/MEDI/PhD/1202), serial cohort study was conducted in the Department of Physiology jointly with department of Obstetrics and Gynecology, Dhiraj Hospital, Vadodara. Total 77 females were studied included 37 pregnant and 40 non-pregnant. Pregnant females studied serially and throughout pregnancy in each trimester. Pregnant women attending the antenatal clinic during morning hours (9.00 AM-1.00 PM) were selected for the study. All women were explained the purpose and importance of the study and only those who were motivated enough to give their consent and volunteered were recruited for the study. Determination of different trimester was based on subject's statement of last menstrual phase (LMP) and confirmed by the USG. The pregnant women were studied thrice during the course of the pregnancy and were studied as follows⁸

- I trimester- 4-12 wk
- II trimester-13-24 wk
- III trimester- 25-40 wk

The control group was studied once.

After informed consent and information about the study the participants were invited to the respiratory laboratory set up in the Department of OBGy, Dhiraj Hospital. The experiment was started with Trail and training of instrument which also include rest and measurement of anthropometric parameters followed by spirometry investigations (as per ATS guidelines). The parameters measured and calculated were MVV, VE and DI.

A portable pulse-oximeter (NECpath by Nector life science Ltd.) was used to measure the arterial oxygen saturation. The probe was then attached over the fingertip and a continuous pulse waveform displayed visually was studied. When a steady continuous pulse waveform displayed, the

digital reading of oxygen saturation is noted. Three readings at an interval of 5 minutes were taken and the average was considered.

Perceived exertion is "How hard you feel like when your body is working". It is based on the physical sensations a person experiences during physical activity, including increased respiration or breathing rate, increased sweating, and muscle fatigue. Perceived exertion of participants was noted on Modified Borg's scale (Borg's CR10 scale) for perceived exertion. This is an 0-10 scale that ask you to rate the difficulty of your breathing in last 24 hours during physical activity.^{9,10}

The perinatal outcome data were collected for 32 females, who delivered the child in Dhiraj Hospital, from the standard prenatal, labor, delivery and postpartum hospital records, as daily visit of each subject was not feasible. Neonatal outcome as neonatal birth weight, Ponderal index ($B/L^3 \times 100$, where B is birth weight and L is crown heel length) and gestational age were studied.

Statistical analysis was done by latest SPSS software. Repeated measure ANOVA and person correlation test were used to analyse the data and the alpha error was set at 5% level.

Observations & Results:

Table- I showed that the trimester variations were insignificant for MVV (Repeated measures ANOVA, $p > 0.05$) but significant for DI (Repeated measures ANOVA, $p < 0.05$). However significant decrease in DI (78.21 ± 17.31 vs 74.56 ± 10.36 , $p < 0.05$) was found when nonpregnant group ($N=40$) compared with I trimester group ($N=37$). Pregnant women of all the groups showed statistically insignificant difference for the RPE (Repeated measures ANOVA, $p > 0.05$) and found to be significantly more in I trimester ($N=37$) pregnant group (4.2 ± 1.17 vs 3.6 ± 0.95 , $p < 0.05$) when compared with nonpregnant group ($N=40$).

The mean and SD of arterial oxygen saturation (SPO₂) of pregnant women showed statistically insignificant difference (Repeated measures ANOVA, $p > 0.05$). SPO₂ was also found to be insignificantly less in pregnant group when compared with nonpregnant group. DI showed insignificant correlation with RPE ($r = -0.24$ $p > 0.05$) and SPO₂ ($r = 0.21$ $p > 0.05$).

Table I: Maximum Ventilatory Volume (MVV), Ventilation (VE), Dyspnic index (DI), SPO2 (Oxygen saturation) and RPE on Borg scale of pregnant women in three different trimesters and nonpregnant control

<u>Variables</u>		<u>I Trimester</u>	<u>II Trimester</u>	<u>III Trimester</u>	<u>control</u>	<u>Statistics</u>
MVV (Ltr/min)	M	61.19	59.06	58.36	64.21	ANOVA, P >0.05, NS I TM Vs NP (P<0.05), S
	SD	10.89	10.9	11.4	8.79	
VE (Ltrs/min)	M	14.14	15.29	14.59	12.53	ANOVA, P>0.05, NS I TM Vs NP, p<0.05), S
	SD	4.8	7.09	5.86	3.68	
DI (%)	M	75.18	72.41	71.12	78.21	ANOVA, P <0.05, S I TM Vs NP, p<0.05), S
	SD	7.9	8.62	9.71	7.31	
SPO2 (%)	M	98.36	97.67	97.57	98.03	ANOVA P>.05, NS
	SD	1.96	2.18	1.68	1.49	
RPE	M	4.14	4.02	4.12	3.61	ANOVA P>.05, NS I TM Vs NP, p<0.05), S
	SD	1.26	1.15	1.16	0.95	

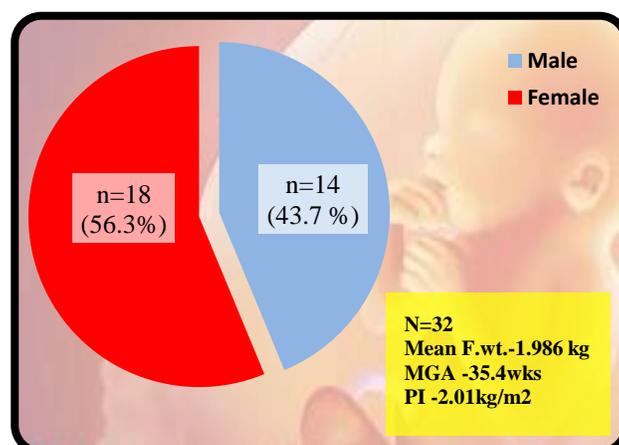
S-Significant, NS-Nonsignificant

Discussion & Conclusion:

Total ability to exchange air with environment is measured by MVV and failure to obtain the normal values indicate a poor effort, fatigue, poor compliance and more airway resistance.¹¹ In pregnant group insignificant progressive fall in MVV (Repeated measures ANOVA, p >0.05) was found within the group. Our results are in concordance with the studies, opines that muscular efficiency is not impaired or airway obstruction is not there in pregnancy.^{12,13} Studies reported increase in MVV during pregnancy, put forward their view that progesterone being the cause of increase as it relaxes smooth muscles leading to decreased resistance and increased lumen, hence free flow of air. Our study stated pregnancy as a phase of adaptation infers that growing fetus and agitation.

Graph-I is showing fetal outcome of 32 females those who were studied serially and delivered the child in same hospital. The mean gestational weight was 1.986±0.342 kg for mean gestational age was 35.4±1.2 weeks. The PI was calculated as 2.01±0.21 kg/m². DI shows insignificant correlation (r=0.26, p>0.05) with fetal weight.

Graph-I: Foetal outcome in the pregnant females (N=32)



Although MVV changes within pregnant group is insignificant but significant fall was there when I TM group compare to nonpregnant group (61.19±10.89 in I TM vs 64.21±8.79 in control, p <0.05). Most of the studies reported decrease in MVV due to mechanical alteration,¹² suggests presence of obstructive element. Author presumes that low MVV in I trimester in compare to the nonpregnant group might be due to morning sickness, alkalosis on account of hyperventilation, lack of motivation and initial resistance of the pregnant state to exertion. Studies justified the decrease on the basis of the theory that pregnancy

as overall may hamper maximum contraction and relaxation of muscles required for performance causing fall in MVV.¹⁴

DI is one of the most important index in the diagnosis of dyspnea and if its value falls below 60%, dyspnea is generally present. Significant decrease is found in pregnant females within the three trimesters, but the values are not less than 60%, showing that dyspnea does not occur in true sense during pregnancy. Dyspnea during pregnancy is in some way related to the individual's adaptation to the inevitable hyperventilation that accompanies the gravid state.¹⁵ In the present study increase in VE and a proportionate decrease in MVV in pregnant group is observed, hence DI though declines, falls in normal range justifying pregnancy as an adaptive change.^{16,17}

Present study obtained RPE as 4.14, 4.02, 4.12 and 3.61 in all three trimesters of pregnant groups and in nonpregnant group. The discomfort experienced during Pregnancy can be termed as moderate dyspnea. In pregnant group the higher rating may be due to the psychological dyspnea reported by Gunnar AV Borg.¹⁸

Oxygen saturation is useful indicator of altered lung function in persons at risk for hypoxemia. In general, a pulse oximeter saturation of 94% is used as the cut-off point and low and/or decreasing saturation serves as a warning signal of the onset of hypoxia.¹⁹ In present study maternal oxygen saturation levels change minimally essentially because of an almost complete saturation of oxyhaemoglobin. Insignificant change in pregnant SpO₂ with nonpregnant subjects, indicates the bronchodilatory effect of progesterone in improving lung function and thus the maternal oxygenation.^{20,21} Study found an increase in maternal oxygen saturation during a bicycle exercise test at maximum work-load until 29 weeks of normal pregnancy compared with the response to the same test before pregnancy in the same women indicates that pregnant woman is able to maintain and even increase the oxygen saturation during short-term sub maximal exercise, will help the pregnant woman to keep her physical capacity at a high level long into the pregnancy.²¹

Any impairment in maternal homeostasis as lung disorder associated with significant airway obstruction which leads to maternal hypoxemia,

may have an adverse effect on fetal growth and development.²²⁻²³ Fetal weight is known to be the prime determinant of fetal growth and depend both on gestational age. The neonatal data of significantly low birth weight (<2500 gm) and PI (<2.2), indicates an established asymmetrical IUGR. Study found neonatal group (N=32) small for gestational age (SGA). It is established and documented that asymmetrical (type 1) IUGR is associated with the HC and length being relatively normal for the gestational age but with a reduced weight/length ratio and PI (<2.2) as reported earlier.²⁴⁻²⁵

Our study found insignificant correlation between Dyspnea and fetal weight, so the attention is being focused on the underlying maternal conditions/factors that may reduce the fetal birth weight. Author presumes that lower birth weight is may be due to the lower socioeconomic status or poor nutrition of subject recruited, although author is lacking in data for the nutritional status. Data related with passive smoking status and early detection of growth lag by serial ultrasound determination might proved to be beneficial.

In Conclusion the occurrence of dypnea with advancement of gestation is minimal, as the DI values in all three trimesters are within physiological limit. There is no change in arterial oxygen saturation. Moderate exertion without affecting oxygen saturation is pretended to be psychological, since the values are not correlative at all the levels with DI. Compromised fetal outcome is may be due to poor socioeconomic status.

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