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EFFECTS OF PREGNANCY ON PEAK EXPIRATORY FLOW RATE IN WOMEN ATTENDING ANTENATAL AT THE UNIVERSITY OF PORT HARCOURT TEACHING HOSPITAL COMMUNITY CENTER ALUU

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ABSTRACT

The present study was designed to determine the effect of pregnancy on peak expiratory flow rate (PEFR) in women. A total of 150 pregnant women within ages of 18-42 years were studied while 100 non pregnant women were also studied as control. PEFR of all subjects were measured using a full range peak flow meter, questionnaires were administered to record their age, last date of menstruation, history of any allergy and occupation. Height and weight were measured using meter rule and bathroom scale. Results showed that PEFR decreased progressively ($p<0.05$) from first trimester to third trimester, also there's a significant difference between first and second trimester and between second and third trimester. This was analyzed using unpaired students' Test and ANOVA. Conclusion made from the research is that the progressive decrease or PEFR as pregnancy advances due to the effect of increased uterus size on the diaphragm which alters lung volume and capacities.

Keywords: Pregnancy; Peak Expiratory; Flow Rate; Women Attending Antenatal.

Introduction

The physiologic state of the human lungs can be estimated via various lung function tests, and the test used in this study is the Peak Expiratory Flow Rate (PEFR).

Peak expiratory flow rate by definition is the largest expiratory flow rate achieved with a maximally forced effort from a position of maximal inspiration expressed in liters/min. PEFR as a measurement of ventilator function was introduced by Hordon in 1942, and was accepted in 1949 as an index of spirometer (Jain, Kumar and Sharma, 1983). It is measured using a Standard Wrights Peak Flow Meter or a Full Range Peak Flow Meter. This test is used to monitor the progress of a disease and can detect worsening of a respiratory condition or the effectiveness of a respiratory condition or the effectiveness of treatment.

Factors affecting lung function

Age; Lung function is usually high during childhood and reduces with advancing of age. The aging process is associated with a decline in lung function. In healthy subjects this does not limit to daily activities due to large reserve capacity of the lungs.

Sex; For the same standing height and age adult males have larger wings than female,

therefore males have an increased lung volume than female, therefore males also have an increased lung function values than females. Males also have a large airway and more respiratory muscle build than females. According to Professor A.C Guyton's 7th Edition of the text book of Medical Physiology in page 471, states "All pulmonary volumes and capacities are about 20-25 per cent less in women than in men".

Size; This is often standing. Height and weight has been found to be equally good prediction of respiratory function. Respiratory volumes have been found to be related to height in young children. Height affects most respiratory function due to increasing muscularity effects and obesity effects.

Ethnicity; There are different ventilator functions between ethnic groups so that in general its best to apply prediction equations that best fits the ethnic group.

However, such equations are not always available, Ethic Group Adjustment of Predicted Values in Negroid and S. Indian – 13%, N. Indian, Pakistan J Polynesia -10%.

The lung function of off spring of a marriage of mixed ethnic group is intermediate between that of ethnic groups of the parents. According to some courses, mongoloids is intermediate between Negros and Caucasians, but it is assumed that mongoloids who grew up with western lifestyle have the same lung function as Caucasians.

Body build differences; Negroid's who have longer legs for the same trunk height , predicted volumes for the contents of the thoracic cage from standing height would be too high compared to Caucasians. This accounts for some 10 per cent differences in lung volume between black and white people (Yosef and Diresibachew, 2020).

Dietary; Respiratory patterns have shown to affect pulmonary function. Inadequate diets have leads to improper functioning of the systems including pulmonary systems.

Exercise; Exercise increases pulmonary functions due to the strengthening of the respiratory muscles.

Disease and Drug, Disease state affects all physiological systems and it obvious re respiratory system can be affected by such diseases as broadens, emphysema e.t.c. In a diseased state the normal respiratory volume values are altered and the values tend to differ from normal. Drugs can interferes the respiratory system and manifest lower or higher values of Forced Expiratory Volume (Yosef and Diresibachew, 2020)

Respiration

Respiration is the term used to describe two different but interrelate processes, cellular respiration and mechanical respiration. Its main function is to provide oxygen to the cells of the body and to remove excess carbon dioxide from them. Cellular Respiration is the cell process in which the cells drive energy by degradation of organic molecules (Mohamed, Seema and Sajeev, 2012).

Pregnancy; First, Second and Third Trimesters

Pregnancy is often defined as, beginning when the embryo becomes implanted into the endometrial lining of a woman's uterus. In some cases where complication may have arisen, the fertilized egg might have implanted itself in the fallopian tube or the cervix, causing an ectopic pregnancy.
Most pregnant women do not have any specific signs or symptoms implantation, although it is not common to experience minimal bleeding at implantation. Traditionally, doctors have measured pregnancy from a number of convenient points, including the day of last ovulation, fertilization, implantation and chemical detection.
Pregnancy is subdivided into three phases such as

- First trimester.
- Second trimester.
- Third trimester.

First trimester (month 1 to 3); in the first 12 weeks of pregnancy the nipples and areolas darken due to a temporary increase in hormones.

Second trimester (month 4 to 6) of pregnancy. Most women feel energized in this period and begin to put on weight as the symptoms of morning sickness subsides and eventually fade away. In the 20th week (5months) the uterus; the muscular organ that holds the developing fetus can expand up to 20 times its normal size during pregnancy. Although the fetus begins moving and takes a recognizable human shape during the first trimester, it is not until the second trimester that movement of the foetus, often referred to as "quickening" is felt. This typically happens in the fourth month specifically in the 20 to 21 weeks, or by the 19th week if the has been pregnant before.
However it is not uncommon for some women not to feel the fetus move until much later. The placenta is now fully functioning and foetus is making insulin and urinating. The reproductive organ distinguishes the sex of the foetus, and the woman's stomach is usually upright.

Third trimester; (this is between 7 months to 9 months); final weight gain takes place, which is the most weight gain throughout pregnancy. The foetus will be growing the most rapidly during this stage, gaining up to 28g per day. The woman's belly will transform in shape as the belly drops due to the foetus turning in a downwards position ready for birth.

Now the woman's belly drops down quiet low and the woman would be able to lift her belly up and down. The fetus begins to move regularly and is felt by the woman. Fetal movement can become quite strong and be disruptive to the woman. The woman's navel will sometimes become convex, popping out, due to her expanding abdomen (Perkert and Smolandir, 1991).

Physiological Changes in Pregnancy
The body must change its physiological and homeostatic mechanisms in pregnancy to ensure the foetus is provided is provided for. Increase in blood sugar, breathing and cardiac output are all required. The changes include; Hormonal changes; levels of

progesterone and estrogen rise continually throughout pregnancy, suppressing the hypothalamic axis and pregnancy, suppressing the hypothalamic axis and subsequently the menstrual cycle.

The woman and the placenta produce many hormones. Prolactic levels increased due to pituitary gland enlargement by 50 percent. This mediates a change in the structure of the mammary gland from ductal to lobular alveolar. Parathyroid hormone is increased due to increases of calcium uptake m the gut and reabsorption by the kidney. Adrenal hormones such as cortisol and aldosterone also increases. Placental lactogen is produced by the placenta and stimulates lipolysis and fatty acid metabolism by the woman conserving blood glucose for the use by foetus. It also decreases maternal tissue sensitivity to insulin, resulting in gestational diabetes.

Pulmonary Status in Pregnancy

Musculoskeletal System, The body's posture changes as the pregnancy progresses. The pelvis tilts and the back arches to help keep balances. Poor posture occurs naturally from the stretching of the woman's abdominal muscle as the foetus grows. These muscles are less able to contract and keep the lower back in proper alignment. Step lengthens as the pregnancy processes due to weight gain and changes in posture. On average, a woman's foot can grow by a half-size or more during pregnancy. In addition the increased body weight of pregnancy, fluid retention and weight gain lowers the arches of the foot.

Cardiovascular changes

The blood volume increases by 40 per cent in the first two trimesters. This is due to an increase in plasma volume through increased aldosterone. Red blood cell numbers increase due to increased erythropoietin levels. Cardiac function is also modified, with increase heart rate and increased stroke volume. A decrease in vagal tone and increase in sympathetic tone is the cause. Blood pressure also fluctuates. In the first trimester it falls. Initially this is due to decreased sensitivity to angiotensin, and vasodilation provoked increased blood volume. Later, however it is caused by decreased resistance to the growing utero-placental bed.

Pulmonary Status in Pregnancy

Peak expiratory flow rate; the effect of pregnancy on PEFR of women is controversial; It is said to decrease significantly in pregnant women (Puranik et al, 1995). A longitudinal study on the PEFR in Pregnancy). The decline begins in the first trimester and reaches its lowest value towards the end of the third trimester. Lack of proper nutrition during pregnancy, anemia of pregnancy and a reduction of overall muscle strength are some of the reasons cited. Western women did not show a reduced PEFR pregnancy (Beckleffe, and Kauflmann, 1995).

Apart from a decrease in functional residual capacity (FRC) secondary to decrease in the expiratory reserve volume, pregnancy does not affect the lung volumes (Pastuszak, et al 1994). That the outcome after maternal

varicella infection in the first 20 weeks of pregnancy). This fall in FRC begins from the fifth month of pregnancy and by third trimester is reduced by 10 per cent to 20 per cent.

Large airway function is not actually impaired by pregnancy, and forced expiratory volume and their ratios are unaffected (Flick, 1994).

Aim of Study

- To determine if the peak expiratory flow rate of pregnant women (without respiratory disease) is affected by gestation.
- To determine if changes in weight and body mass index affect peak expiratory flow rate of pregnant women (without respiratory disease)

Significance of Study

Used to discover the pulmonary changes that occurs due to the hormonal and mechanical effect pregnancy has on lung function. Also to monitor and manage any side effects alterations in weight and body mass index may have on peak expiratory flow rate during pregnancy

Hypotheses

a. Null; Pregnancy does not affect peak expiratory flow rate Alternative; Pregnancy affects peak expiratory flow rate.
b. Null; Weight does not affect peak expiratory flow rat during pregnancy. Alternative; Weight affects peak expiratory flow rate during pregnancy.
c. Null; Body mass index does not affect peak expiratory flow rate during pregnancy.
   Alternative; Body mass index affects peak expiratory flow rate during pregnancy.

Research Method

Ethics for Experiment

In carrying out this experiment research, the consent of both women in their reproductive age (pregnant and non-pregnant) and their Head of the Department of Gynecology, Antenatal unit was sought and accepted. After explaining the purpose of the experiment and non-hazardous process, the subjects (pregnant and non-pregnant) co-operated. A full range peak expiratory flow meter, weighing scale, standiometer, cotton wool, a bottle of methylated spirit and human subjects. This research was carried out using a total of one-hundred and fifty pregnant women, divided into three trimesters, fifty each. They were selected from the .Antenatal unit, University of Port Harcourt Teaching Hospital, Port Harcourt, River State. While the control (non-pregnant) subjects were selected randomly in the nearby villages of Alakahia, Omuoko, Omuechi, Choba and Alakahia. A total of hundred subjects were selected and examined as control (non-pregnant women). The parameters measured during the experiment are heights and weights. The weight is measured in kilograms, while height is measured in meters, and also the Peak expiratory flow rate in liters per second. All equipment used have international standardizations and were calibrated at interval to avoid errors.

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Method used in Result Analysis

Mean, Standard deviation, Variance, Analysis of Variance (ANOVA), unpaired student6t' Test and 'Z' Tests.

Presentation of Results

Table 1: Mean PEFR of Age group of subject

Control (years)	**Mean**	**Standard Deviation**	**Range**
18-25	344.62±6.49	52.32	250-460
26-33	295.79±8.73	38.05	250-400
34- 41	300.31±7.53	30.13	250 - 350
1st Trimester	**Mean**	**Standard Deviation**	**Range**
18-25	341.1U10.57	44.83	250-440
26-33	328.26±10.53	50.51	250-450
34- 41	296.67±16.50	49.50	230-400
2nd Trimester	Mean	Standard Deviation	Range
18-25	331.0±17.3	54.66	260 - 400
26-33	325.9±8.34	48.62	260-450
34- 41	306.67±22.0	53.91	250 - 390
3rd Trimester	**Mean**	**Standard Deviation**	**Range**
18-25	325.4±17.7	58.7	250 - 440
26-33	280.3^5.36	28.8	220 - 350
34- 41	282.0^10.31	32.59	250 -350

From Table.1 above, the mean PEFR values of pregnant women within mean ages 18 -25 decreases from first to third trimesters [341.11 to 325 4 L/min] those within mean ages 26-33 decreases from first to third trimester [328.26 to 280.3] while mean ages of 34-41 [296.67 to 282.0 L/min] decreases from second to third trimester but increases from second trimester. While the mean PEFR values for non-pregnant women within ages to 25 is higher [344.62 L/min] than pregnant women of first sec- no and third trimester within the same age group [341.11, 331.0 and 325.4 L/min] respectively. Non-pregnant women within mean ages 26 -33yrs have a lower mean PEFR compared to pregnant women of the same age range with higher mean PEFR which reduces towards third trimester. Those within 34- 41yrs have a lower PEFR compared to that of second trimester that is higher but decreased in first and third trimesters.

Hypotheses Testing

Hypothesis 1: There is no significant difference in Body Weight among sampled subjects.

H_i: There is a significant difference in Body Weight among sampled subjects

Summary

Groups	Count	Sum	Mean	Variance

Summary

Groups	Count	Sum	Mean	Variance	4
Control	100	32825	328.25	2674.93	
1st trimester	50	16360	327.2	2485.88	
2nd trimester	50	16230	324.6	2486.57	
3rd trimester	50	14530	290.6	1724.12	

ANOVA

Source of Variation	SS	Df	MS	F	P-value	F crit
Between Groups	53662.15	3	17887.38	7.4210	8.88E-05	2.6413
Within Groups	592950.8	246	2410.37			
Total	646612.9	249				

Control	100	6574	65.74	124.78
1st	50	3263	65.26	99.01
2nd	50	3610.5	72.21	102.22
Trimester	50	3617.1	72.34	135.08

AN OVA

Source of Variation	SS	Df	MS	F	P-value	F crit
Between Groups	2698.301	3	899.43	7.6739	6.36E-05	2.6413
Within Groups	28832.67	246	117.21			
Total	31530.97	249				

Decision: We reject the null hypothesis and therefore conclude that there is a significant difference in Body Weight among sampled subjects since from the ANOVA table above since F-cal = 7.67 is greater than F- critical= 2.64 at 5% level (P < 0.05).

Hypothesis 2: There is no significant difference in PEFR among sampled subject
Hi: There is a significant difference in PEFR among sampled sub

Decision: We also reject the null hypothesis and therefore conclude that there is a significant difference in PEFR among sampled subjects since from the above ANOVA table since F-cal = 7.42 is greater than F- critical= 2.64 at 5% level (P < 0.05).

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Hypothesis 3: There is no significant difference in BMI among sampled subjects.

Hi: There is a significant difference in BMI among sampled subjects

Summary

Groups	Count	Sum	Mean	Variance
Control	100	2456.88	24.57	21.54
1st Trimester	50	1246.13	24.92	10.09
2nd Trimester	50	1352.21	27.04	11.44
3rd trimester	50	1368.02	27.36	14.39

ANOVA

Source of Variation	SS	Df	MS	F	P-value	F Crit
					3.45E-05	2.6413
Between Groups	386.36	3	128.78	8.1397		
Within Groups	3892.25	246	15.82			
Total	4278.61	249				

Decision: The null hypothesis is rejected since F-cal = 8.4 is greater than F-critical= 2.64 at 5% level. We therefore conclude that there is a significant difference in BMI among sampled subjects ($P < 0.05$).

Discussion

The results in this report is shows that there was significant differences ($p < 0.05$) in pregnant women compared to non-pregnant women. The mean and standard deviation of PEFR was highest, the mean age groups of 18-25 years among pregnant and non-pregnant women L/min, 331.0 L/min and 325.0 L/min) and 344.0 L/min respectively. Thus there is a strong relationship between PEFR and age group among pregnant and non-pregnant women. There is a weak relationship between mean and standard deviation of body mass index with mean and standard PEFR of pregnant women in each of the trimester. The mean BMI value of pregnant women in their third trimester is highest in 34-4lyrs as 28.39 ± 0-94 kg/m^2 does not corresponds to the lowest PEFR (282.0 ±10.31) L/min.

Also there is a weak relationship between mean and standard deviation of weight with standard deviation and mean PEFR of pregnant women from first to the third trimesters. In the raw data obtained from the results, it was observed that pregnant women and non-pregnant women who were younger and taller gave a higher PEFR value. Also PEFR value decreased from first to second trimester in all age groups with exception of age group 34-4lyrs that increased from second to third trimesters. In conclusion it can be inferred that the significant change in

PEFR from the first to third trimesters was due to the mechanical effect of progressive increase in uterus size which decrease lung volume and capacities, and this is similar to the results of Dipok, et al, (2005), also the work of Gaya, Talatu & Adelaiye and finally the study of Anita et al (2015).

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