

Cardiopulmonary Changes In Pregnant Women In Sabon-Gari Local Government Area, Of Kaduna State, Nigeria

B Gaya, G Talatu, A Adelaiye

Citation

B Gaya, G Talatu, A Adelaiye. *Cardiopulmonary Changes In Pregnant Women In Sabon-Gari Local Government Area, Of Kaduna State, Nigeria*. The Internet Journal of Health. 2008 Volume 9 Number 2.

Abstract

The cardiopulmonary changes among pregnant women were studied in 400 subjects (100 non-pregnant and 300 pregnant). The cardiovascular parameters measured are blood pressure (systolic and diastolic), pulse rate and mean arterial blood pressure by auscultatory method using stethoscope and sphygmomanometer. The pulmonary parameters measured are peak expiratory flow rate (PEFR), using Wright peak flow meter and respiratory rate the number times thoracic cage expands and relaxes. The cardiopulmonary parameters of pregnant women decreased significantly ($p < .05$) when compared to non-pregnant. The anthropometric parameters in first trimester when compared to the control group did not decrease significantly ($P > 0.05$), while in second and third trimester the anthropometric parameters decreases significantly ($p < .05$) with positive correlation when compared to control. The cardiopulmonary parameters in pregnant women showed a significant changes ($p < .05$) when compare to non-pregnant.

INTRODUCTION

The physiologic, biochemical and anatomical changes that occur during pregnancy are extensive and may be systemic or local (15). Teleological alterations during pregnancy maintain a healthy environment for the fetus without compromising the mother's health (16). Although, sometimes determine small discomfort to the mother. During pregnancy, significant cardiovascular and pulmonary changes occur, which alters the cardiopulmonary parameters (7) like the blood volume, heart rate, stroke volume, cardiac output, lung volumes and minute ventilation (1). Understanding and appreciating (8) the normal physiologic adaptations to gestation are important for accessing health status of the pregnant women (11). Hormonal changes in pregnancy affect the upper respiratory tract and airway mucosa, producing hyperemia, mucosal edema, hypersecretion, and increased mucosal friability (14). Estrogen is probably responsible for producing tissue edema, capillary congestion, and hyperplasia of mucous glands.

The enlarging uterus and the hormonal effects produce anatomical changes to the thoracic cage. As the uterus expands, the diaphragm is displaced cephalic by as much as 4 cm; an increase in the anteroposterior diameter and transverse diameter of the thorax occurs, increasing the chest wall circumference (16). Hormonal changes do not significantly affect airway function; pregnancy does not

appear to change lung compliance, but chest wall and total respiratory compliance are reduced at term (13, 18). In light of this, the study is designed to evaluate the cardiovascular and pulmonary changes in pregnant women so that we can establish a baseline in this part of the world. We hypothesized that pregnancy would be associated with changes in cardiopulmonary functions.

MATERIALS AND METHODS

Materials: The following materials were used for the test; peak flow meter (S48917 Vitalograph Ltd Buckingham, England), weighing scale, measuring tape, sphygmomanometer, stethoscope, stopwatch, cotton wool, disinfectant (methylated spirit) and subjects (100 non-pregnant women and 300 pregnant women).

Data collection: The study was compiled with the ethical committee guidelines of Ahmadu Bello University Teaching Hospital, Zaria and the procedures followed were in accord with the ethical standards of Ahmadu Bello University, Zaria, Nigeria. The data of 400 female subjects (100 non pregnant and 300 pregnant) was collected using a questionnaire in Sabon Gari local government in antenatal clinics of Kaduna state, Nigeria. The data collected from all the subjects with an age range of 25-40 years by random sampling are; age (years), weight (kg), height (m), body mass index (BMI), blood pressure (mmHg), pulse pressure

(mmHg), heart rate (beat/min), peak expiratory flow rate (PEFR; L/min), mean arterial blood pressure (mmHg) and respiratory rate (breath/min).

Climate of the research area; The research was carried out in Zaria with the following climatic conditions: mean annual rainfall 1000mm, mean annual temperature 27°C, longitude and latitude 11° 3' N, 7° 42' E, height 670m above sea level and 664km away from the sea, with a dry and (12) wet season.

Statistical Analysis: All data are expressed as Mean $\pm$ S.E.M. The data obtained were analyzed using one way analysis of variance (ANOVA) and Turkey-Kramer post hoc (3) test for multiple comparisons. The ($P < 0.05$) will be accepted as significant.

RESULTS

The results of cardiopulmonary changes among pregnant women were analyzed by comparing the mean $\pm$ SEM of non-pregnant and pregnant women using one way analysis of variance as shown in table 1. The blood pressure (systolic and diastolic) and mean arterial pressure of pregnant women decreased significantly ($P < 0.05$) when compare to non-pregnant women, while pulse pressure and heart rate increased significantly ($P < 0.05$) in pregnant women when compare to non-pregnant women. The peak expiratory flow rate (PEFR) decreased significantly ($P < 0.05$) when compare to non-pregnant women, while respiratory rate increased significantly ($P < 0.05$) when compare to non-pregnant women. The anthropometric values in pregnant women increased significantly ($P < 0.05$) when compared to non-pregnant women. The cardiopulmonary parameters of the non-pregnant when compared to each of the three trimesters. The anthropometric parameters in first trimester when compared to the non-pregnant did not decrease significantly ($P > 0.05$), while in second and third trimester the anthropometric parameters decreases significantly ($P < 0.05$) with positive correlation when compared to non-pregnant. In table 2 the changes of parameters in the three trimesters were compared to control group. The anthropometric parameters (weight and body mass index) showed significant increase ($P < 0.05$) only in the second and third trimester. The blood pressure (systolic and diastolic) showed a significant decrease ($P < 0.05$) in all the trimesters. Heart rate values in first trimester showed no level of significance ($P > 0.05$) while in second and third trimesters there was significance ($P < 0.05$) increase.

Figure 1

Table 1: Mean $\pm$ S.E.M. of Cardiopulmonary and Anthropometric parameters in non-pregnant and pregnant women

Parameters	Subjects type	N	Mean
Ages [years]	Non- pregnant women	100	23.01 $\pm$ 0.3
	Pregnant women	300	23.66 $\pm$ 0.1 ^{NS}
Height [M]	Non- pregnant women	100	1.55 $\pm$ 0.01
	Pregnant women	300	1.56 $\pm$ 0.01 ^{NS}
Weight [Kg]	Non- pregnant women	100	56.88 $\pm$ 0.8
	Pregnant women	300	66.12 $\pm$ 0.2 ^S
Body Mass Index BMI [Kg/m ²]	Non- pregnant women	100	23.68 $\pm$ 0.3
	Pregnant women	300	27.17 $\pm$ 0.1 ^S
Systolic Blood Pressure [mmHg]	Non- pregnant women	100	123.85 $\pm$ 1.0
	Pregnant women	300	113.75 $\pm$ 0.4 ^S
Diastolic Blood Pressure [mmHg]	Non- pregnant women	100	80.93 $\pm$ 0.9
	Pregnant women	300	60.86 $\pm$ 0.2 ^S
Pulse Pressure [mmHg]	Non- pregnant women	100	42.80 $\pm$ 0.5
	Pregnant women	300	51.88 $\pm$ 0.2 ^S
Mean Arterial Blood Pressure [mmHg]	Non- pregnant women	100	95.3 $\pm$ 1.0
	Pregnant women	300	81.4 $\pm$ 0.3 ^S
Heart Rate [beats/min]	Non- pregnant women	100	81.42 $\pm$ 0.5
	Pregnant women	300	77.21 $\pm$ 0.3 ^S
Respiratory Rate [breath/min]	Non- pregnant women	100	13.47 $\pm$ 0.1
	Pregnant women	300	14.80 $\pm$ 0.1 ^S
Peak Expiratory Flow rate [L/min]	Non- pregnant women	100	254.6 $\pm$ 3.0
	Pregnant women	300	182.0 $\pm$ 0.6 ^S
Parity	Non- pregnant women	100	1.54 $\pm$ 0.2
	Pregnant women	300	2.90 $\pm$ 0.1 ^S

NS=Not significant; S=Significant ($P < 0.05$).

Also in respiratory rate, the values in first trimester showed no level of significance ($P > 0.05$) while in second and third trimesters there was significance increase ($P < 0.05$). The values of peak expiratory flow rate decrease with significantly ($P < 0.05$) in all the trimesters.

Figure 2

Table 2: Mean $\pm$ S.E.M. of Cardiopulmonary and Anthropometric parameters in non-pregnant and the three trimesters in pregnancy

Parameters.	[100] Non Pregnant	Trimesters in pregnancy [3]		
		[100] 1 st	[100] 2 nd	[100] 3 rd
Ages [years]	23.01 $\pm$ 0.3	22.19 $\pm$ 0.4 ^{NS}	23.64 $\pm$ 0.6 ^{NS}	23.17 $\pm$ 0.6 ^{NS}
Height [M]	1.55 $\pm$ 0.01	1.54 $\pm$ 0.01 ^{NS}	1.56 $\pm$ 0.01 ^{NS}	1.56 $\pm$ 0.01 ^{NS}
Weight [Kg]	56.88 $\pm$ 0.8	56.21 $\pm$ 0.7 ^{NS}	59.21 $\pm$ 1.1 ^S	64.94 $\pm$ 0.2 ^S
Body Mass Index BMI [Kg/m ²]	23.68 $\pm$ 0.3	23.70 $\pm$ 0.2 ^{NS}	24.33 $\pm$ 0.4 ^S	26.01 $\pm$ 0.4 ^S
Systolic Blood Pressure [mmHg]	123.85 $\pm$ 1	118.2 $\pm$ 0.9 ^S	111.2 $\pm$ 1.1 ^S	143.6 $\pm$ 0.4 ^S
Diastolic Blood Pressure [mmHg]	80.93 $\pm$ 0.9	67.40 $\pm$ 1.2 ^S	55.40 $\pm$ 1.0 ^S	63.03 $\pm$ 1.3 ^S
Pulse Pressure [mmHg]	42.80 $\pm$ 0.5	50.90 $\pm$ 1.0 ^S	55.80 $\pm$ 1.1 ^S	48.95 $\pm$ 0.2 ^S
Mean Arterial Blood Pressure [mmHg]	95.30 $\pm$ 1.0	91.16 $\pm$ 0.7 ^S	73.99 $\pm$ 0.9 ^S	79.05 $\pm$ 1.2 ^S
Heart Rate [beats/min]	81.42 $\pm$ 0.5	80.40 $\pm$ 0.5 ^{NS}	74.14 $\pm$ 0.3 ^S	77.09 $\pm$ 0.7 ^S
Respiratory Rate [breath/min]	13.47 $\pm$ 0.5	13.91 $\pm$ 0.1 ^{NS}	14.80 $\pm$ 0.1 ^S	15.71 $\pm$ 0.1 ^S
Peak Expiratory Flow rate [L/min]	254.6 $\pm$ 3.0	169.8 $\pm$ 5.8 ^S	190.4 $\pm$ 0.6 ^S	185.8 $\pm$ 5.3 ^S
Parity	1.54 $\pm$ 0.21	2.24 $\pm$ 0.17 ^S	2.99 $\pm$ 0.24 ^S	3.29 $\pm$ 0.25 ^S

NS=Not significant; S=Significant ($P < 0.05$).

DISCUSSION

The results of the present study reported that, the cardiopulmonary changes in pregnant women showed a significant statistical difference ($P < 0.05$) when compared to non-pregnant women. During pregnancy, significant cardiovascular changes occur, including changes in the blood volume, (6) heart rate, stroke volume, cardiac output,

and systemic vascular resistance (9). Furthermore, pregnant women also experience respiratory changes in lung volumes, minute ventilation, and acid-base status (7). The blood pressure (systolic and diastolic) and mean arterial pressure of pregnant women decreased significantly ($P<0.05$) when compare to non-pregnant women, while pulse pressure and heart rate increased significantly ($P<0.05$) in pregnant women. Systemic blood pressure declines during pregnancy (2). There is a little change in systolic blood pressure, but diastolic pressure is reduced (5-10mmHg) from about 12-26 weeks (10). Diastolic pressure increases thereafter to pre-pregnancy levels by about 36 weeks. The obstruction posed by the uterus on the inferior vena cava and the pressure of fetal presenting part on the common illiac vein can result in decreased blood return to the heart (13). This decreases cardiac output, leads to a fall in blood pressure, and causes edema in the lower extremities (6). The peak expiratory flow rate (PEFR) decreased significantly ($P<0.05$) when compare to non-pregnant women, while respiratory rate increased significantly ($P<0.05$) when compare to non-pregnant women. Alterations occurring in lung volumes and capacities during pregnancy include the dead volume increases, tidal volume increases and total lung capacity reduces while functional residual capacity, residual volume, and (17) respiratory reserve volume all decrease by about 20%. Functional respiratory changes include a slight increase in respiratory rate, a 50% increase in minute ventilation, a 40% increase in tidal volume, and a progressive increase in oxygen consumption of up to 15-20% above non-pregnant levels by term (4). With the increase in respiratory tidal volume associated with a normal respiratory rate, there is an increase in respiratory minute (18) volume of approximately 26%. As the respiratory minute volume increases, "hyperventilation of pregnancy" occurs, causing a decrease in alveolar CO_2 . This decrease lowers the maternal blood CO_2 tension; however alveolar oxygen tension is maintained within normal limits (5). Maternal hyperventilation is considered a protective measure that prevents the fetus from the (10) exposure to excessive levels of CO_2 . From this study, it can be inferred that, there is an appreciable change in cardiopulmonary parameters in pregnant women which are important for accessing their health status and understanding the normal physiologic adaptations to gestation.

ACKNOWLEDGEMENT

The authors are grateful to the following; All the technical staff in the Department of Human physiology Ahmadu Bello University Zaria, Hajiya Fatima of Kaduna state clinic, sister Magdalene, sister Margaret, aunty Halima, Hajiya Talatu of state clinic Sabon Gari LGA for the assistance they rendered in this research work. We also acknowledge the University Board of Research of Ahmadu Bello University, Zaria for supporting this research work.

References

1. Adashi S. Pregnancy: In Williams Obstetrics, New York McGraw Hill. 2006; pp.10-1120.
2. Artal R. Comparison of cardiopulmonary adaptations to exercise in pregnancy at sea level and high altitude. American J. of Obst. And Gynaecol. 2006; 172: 1170.
3. Betty RK. Jonathan AC. Essential medical statistics. Second edition. Blackwell science USA, 2003; pp. 15-409.
4. Capro JF. Effects of recreational exercise on mid trimester placental growth. American J. of Obst. And Gynaecol. 2005; 167: 1518.
5. Cotes, A. The act of breathing. News Physiol. Sci. 5:233.
6. Crapo RO. Normal cardiopulmonary physiology during pregnancy. Clin Obstet Gynecol. 1996; 39(1):3-16.
7. Elkus R, Popovich JJr. Respiratory physiology in pregnancy. Clin Chest Med. 1992; 13(4):555-65.
8. Gross, I. The first twelve weeks of gestation. Sixth edition Berlin, springer-verlag publishers. 2006; pp-146.
9. Hunter JJ, Densitometric analysis of body composition review of some quantitative assumption. Ann New York Acad. Sci. 2005; 110: 113-140.
10. Kim J. Pregnancy outcomes among active and sedentary women. J Obstet. And Gynaecol. Neonatal Nurs. 2006; 24:49.
11. Madama VC. Pulmonary function testing and cardiopulmonary stress testing. Second edition, Delmar publishers, USA. 1998; pp.151-214.
12. Marthins MI. Zaria and its region. Department of Geography Ahmadu Bello University, Zaria, 2006; pp-41.
13. Norwitz T. Predicting intra-abdominal fatness from anthropometric measures; the influence of stature. International journal Obstet. related to metab. Disord. 2005; 21:587-593.
14. Petraplia F. Neuroendocrine mechanism regulating placental hormone production. Obstet. And Gynaecol. 2006; 18:147.
15. Pierce PW. Life in the womb. In the origin of health and diseases. First edition, New York. Procnethaen press. 2005; pp-363.
16. Sadler TW. Langman's medical embryology. Ninth edition, Lippincott Williams and Wilkins publishers. 2005; pp. 117-123.
17. Seals DR, Silverman HG, Reiling MJ, Davy KP. Effect of regular exercise on elevated blood pressure in pregnant women. American Journal of Cardio. 2006; 80:49-55.
18. Weinberger SE, Weiss ST, Cohen WR, et al. Pregnancy and the lung. Am Rev Respir Dis. 1980; 121(3):559-81.

Author Information

Bako Ibrahim Gaya, M.Sc. in Human physiology

Department of Human physiology, Faculty of Medicine, Ahmadu Bello University, Zaria, Nigeria

Garba Habiba Talatu, B.Sc. in Human physiology

Department of Human physiology, Faculty of Medicine, Ahmadu Bello University, Zaria, Nigeria

Alexander Babatunde Adelaiye, Ph.D in Human physiology

Practicing clinician. Department of Human physiology, Faculty of Medicine, Ahmadu Bello University, Zaria, Nigeria