*Recent Research in Science and Technology 2011, 3(1): 67-72*
*ISSN: 2076-5061*
*www.recent-science.com*

PHYSICAL EDUCATION & SPORT SCIENCES

# INFLUENCE OF ASANA AND AEROBIC EXERCISES ON SELECTED PHYSIOLOGICAL VARIABLES OF PREGNANT WOMEN AND THEIR FETUS

K. Jothi *

*READER, YMCA College of Physical Education, Nandanam, Chennai – 35, India*

## Abstract

The purpose of the study was the influence of selected asana and mild aerobic exercises on selected physiological variables at prior to and immediately after exercises of pregnant women and their fetus from 28th to 36th weeks of gestational age. 30 pregnant women were taught asana and aerobic exercises for three weeks. A pilot study was conducted to ensure an optimum training programme. On the day of experiment pregnant women's fetal heart rate, maternal heart rate, systolic and diastolic blood pressure, mean arterial blood pressure and oxygen saturation were obtained which was followed by asana and aerobic exercises. Immediately after the exercise the subjects' response to the exercise on selected physiological variables were obtained. The experimental design used was 3 x 2 factorial design with repeated measures in one factor (Gestational age). The exercises caused a significant ($p<0.05$) increase in the Fetal heart rate, maternal heart rate to higher post exercise response when compared to the pre exercise response. However, this response did not differ for the three gestational age categories. There was no significant ($p>0.05$) interaction between the gestational age and the exercise response factors. Further the exercise programme did not cause any significant difference in the maternal systolic and diastolic blood pressure, mean arterial pressure and oxygen saturation in pre and post exercise response.

Keywords: Pregnancy, Asana, Aerobic exercise, Heart rate, Blood pressure, Oxygen saturation

## Introduction

In the absence of either obstetric or medical complications, pregnant women can continue to exercise and derive benefits. Women who have achieved cardiovascular fitness prior to pregnancy should be able to safely maintain their level of fitness throughout pregnancy and the post-partum period. Women who exercised regularly before conceiving and who had uncomplicated pregnancies did not adversely affect their own or their offspring's health by exercising in excess of the ACOG guidelines.(1) In the absence of medical contraindications, women should be encouraged to maintain their prepregnancy activity level (2,3) In the absence of medical or obstetric complications, 30 minutes or more of moderate exercise a day on most , if not all days of the week is recommended for pregnant women. (4, 5) Depending on the individual's needs and the physiological changes associated with pregnancy, women may have to modify their specific exercise regimen. Despite findings that suggest lower birth weights among off-spring of women who continue to exercise vigorously throughout pregnancy, there are no data to confirm that, exercise during pregnancy has any deleterious effects on the fetus.(6) While maternal fitness and sense of well being may be enhanced by exercise, no level of exercise during pregnancy has conclusively demonstrated to be beneficial in improving prenatal outcome (7).Chronic exercise also appeared to help preserve anaerobic working capacity in late gestation.(8)

The practice of asana will help to meet the challenges and transformation of pregnancy and birth with strength, confidence and clam. Pregnancy asana incorporates gentle safe movements and stretches to stretches and open body; breathing exercises to increase calm focus and balance and relaxation techniques to release deeply held tension and to promote the well being to mother and fetus. Regular practice of pregnancy asana, in conjunction with gentle cardiovascular exercises can:" boost energy and lessen fatigue, reduce physical and emotional tensions and stress enhance strength and confidence, improve posture, stability and balance ,create optimal health and awareness, reduce the likelihood and need of medical intervention during delivery, encourage a positive childbirth experience."(22,23)

Limiting women to normal daily activities is no way compromises maternal or fetal health; hence, there is need for aerobic exercises. Exercises have become an integral part of the life styles of many women. However, many women stop exercising during pregnancy because of concerns regarding the well being of the fetus. Although pregnancy is associated with several physiological changes and response to exercise is different in the pregnant state than in the no pregnant state. Exercise can be beneficial to the pregnant

* Corresponding Author, *Email*: kkk_kkkn@yahoo.co.in

women in the absence of obstetric or medical complications. Exercise physiologists have documented that more than fifteen minutes of regular aerobic activity leads to quantum improvement in the cardiovascular system, (20).

The purpose of the study was to investigate selected physiological responses at prior to and immediately after mild aerobic exercise and asana on pregnant women and their fetus from 28th to 36th weeks of gestational age.

## Subjects and Methods

### Experimental subjects

Thirty volunteer pregnant women whose age ranged between 20-36 years were selected as subjects. The subjects were under the care at Dr. E.V. Kalyani Medical Centre, Chennai, India. The subjects were trained in asana and aerobic exercises during pregnancy. The women between 28-36th weeks of gestational age were selected for the study and were further categorized into three groups of 28-30th, 31-33rd and 34-36th weeks of gestation in unequaled group. The selected subjects were examined medically and were declared fit and those with reactive in the non-stress test were taken up for the study. All subjects filled in an Informed Consent Form to participate voluntarily in the investigation. The guidelines designed by American College of Obstetrics and Gynecology for pregnancy and postnatal exercise programme ( 2,4) which were designed for a broad section of the population were adopted. Aerobic exercises like marching on the spot, V- step, power walk, A-step, diamond step, step touch, touch out, along with arm movements were performed. Asanas like Virabhadrasana, Ardhakatti chakrasana, Trikonasana, Janu Sirsasana, Baddha Konasana, Kneeling forward bend, breathing and relaxation were performed.

### Protocol and outcome measures

Under the care of a qualified and experienced obstetrician and gynecologist the pregnant women subjects were made to relax for a while in the left Lateral position. After three minutes rest the pre exercise response i.e., the fetal heart rate to recognize fetal cardiac , maternal heart rate, maternal systolic and diastolic blood pressure, mean arterial blood pressure and the percent oxygen saturation were obtained. After pre test the subjects performed asana and aerobic exercises. The programme involved warm up exercises session, aerobics and asana followed by measurement of subject's response to the exercise and then cool down session, and breathing and relaxation were performed.

### Experimental design

The experimental design used was the 3 x 2 factorial designs with repeated measure on one factor. The first factor (Gestational Age) was the independent measures factor, consisting of women falling at 28-30th, 31-33rd, 34-36th weeks of gestational age of unequaled group. The second factor (Exercise Response) was the repeated measures factor consisting of pre and post exercise responses. The third factor (Gestational Age x Exercise Response) for interaction between gestation age exercise response factors on the selected dependent variables.

### Data analyses and statistics

A two way ANOVA with repeated measure in one factor was used to find out the influence of each factor independently and also the interaction effect on each of the physiological variables.

Scheffe post hoc test was used to find out the significant differences, if any, for the main effects and the interaction effect at 0.05 level of significance. If the obtained "F" ratio for interaction was found to be significant, the simple effect test was calculated and also the Scheff's test was used as post-hoc test to find out the paired mean differences, if the simple effect was found significant.

## Results

### Fetal heart rate

The mean value of pre exercise response at 28 to 30$^{th}$,31 to33$^{rd}$ and 34$^{th}$ to 36$^{th}$ weeks of gestational age were 139.15, 139.50 and 140.40 respectively. The mean value of post exercise response at 28 to 30$^{th}$,31 to33$^{rd}$ and 34$^{th}$ to 36$^{th}$ weeks of gestational age were 146.38, 147.75 and 148.00 respectively.

The F-ratio for (factor A) gestational age 0.072 was less than the required table value 3.35 for significance with df 2 and 27 and was not significant at 0.05 level. Since the obtained F-ratio at 28 to 30$^{th}$, 31 to33rd and 34 to36th week of gestational age (factor A) was not significant, it was concluded that there were no significant difference in fetal heart rate among the three gestational age groups.

The F-ratio for (factor B) exercise response 41.687 was greater than the required tale value 4.21 for significance with df 1 and 27 and was not significant at 0.05 level. Since, the obtained F-ratio for exercise response (factor B) was significant, it was concluded that there was a significant difference in fetal heart rate between pre and post exercise responses. The F-ratio for (factor A X B) interaction 0.092 was less than the required table value 3.35 for significance with df 2 and 27 and was not significant at 0.05 level. Since the obtained F-ratio for interaction (factor A X B) was not significant, it may be concluded that there were no significant difference in fetal heart rate between three gestational groups and exercise responses.

### Maternal heart rate

The mean value of pre exercise response of maternal heart rate at 28 to 30$^{th}$, 31 to 33$^{rd}$ and 34 to 36$^{th}$ weeks of gestational age were 88.07, 92.33 and

88.96 respectively which are shown in the Table -1 below and the mean value of post exercise response at 28 to 30th, 31 to 33rd and 34 to 36th weeks of gestational age were 105.69, 108.41 and 104.40 respectively.

The F –ratio for (factor A) for the gestational age 3.18 was less than the required table value of 3.35 for significant with df 2 and 27 was not significant at 0.05 level. Since the obtained F-ratio at 28 to 30th, 31 to 33rd and 34 to 36th weeks of gestational age (factor A) was not significant, it was concluded that there were no significant differences in maternal heart rate among the three gestational groups.

The F-ratio for (Factor B) exercise response 126.41 was greater than the required table value 4.21 for significance with df 1 and 27 and was significant at 0.05 level. Since obtained F ratio for exercise response (Factor B) was significant in maternal heart rate between pre and post exercise responses.

The F-ratio for (factor A X B) interaction 0.69 was less than the required table value 3.35 for significance with df 2 and 27 and was not significant at 0.05 level. Since the obtained F-ratio for interaction (factor A X B) was not significant, it was concluded that there were no significant differences in maternal heart rate between the three gestational age groups and exercise responses.

Table – 1: Pre and Post Means and Obtained F ratios for Gestational Age and Exercise Response for Fetal Heart Rate, Maternal Heart Rate, Maternal Systolic Blood Pressure

| Gestational age | Fetal Heart Rate | | | | | Maternal Heart Rate | | | | | Maternal Systolic Blood Pressure | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre Exercise Mean | Post Exercise Mean | Obtained 'F' ratio A | B | AxB | Pre Exercise Mean | Post Exercise Mean | Obtained 'F' ratio A | B | AxB | Post Exercise Mean | Obtained 'F' ratio Mean | Obtained 'F' ratio A | B | AxB |
| 28-30 | 139.15 | 146.3 | | | | 88.07 | 105.69 | | | | 117.84 | 119.4 | | | |
| 31-33 | 139.50 | 147.75 | 0.072 | 41.68 | 0.092 | 92.33 | 108.41 | 3.18 | 126.41* | 0.69 | 116.16 | 117.5 | 0.214 | 0.401 | 0.079 |
| 34-36 | 140.4 | 148.0 | | | | 88.96 | 104.40 | | | | 120 | 120 | | | |

Table f = (2.27) (0.05) = 3.35; Table F = (1.27) (0.05) = 4.21 *p>0.05

Table – 2: Pre and Post Means and Obtained F ratios for, Gestational Age and Exercise Response for Maternal Diastolic Blood Pressure, Mean Arterial Blood Pressure and Percent Oxygen Saturation

| Gestational age | Maternal Diastolic Blood Pressure | | | | | Mean Arterial Blood Pressure | | | | | Percent Oxygen Saturation | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre Exercise Mean | Post Exercise Mean | Obtained 'F' ratio A | B | Ax B | Pre Exercise Mean | Post Exercise Mean | Obtained 'F' ratio A | B | Ax B | Pre Exercise Mean | Post Exercise Mean | Obtained 'F' ratio A | B | Ax B |
| 28-30 | 72.76 | 73.07 | | | | 87.46 | 87.9 | | | | 98.92 | 98.8 | | | |
| 31-33 | 69.5 | 70.83 | 1.18 | 0.6 | 0.114 | 84.83 | 96.3 | 1.414 | 0.009 | 0.44 | 99.0 | 99.6 | 1.237 | 0.529 | 0.521 |
| 34-36 | 76 | 76.8 | | | | 92.69 | 91 | | | | 99.4 | 99.6 | | | |

Table F = (2,27) (0.05) = 3.35; Table F = (1,27) (0.05) = 4.21 *p>0.05

Maternal systolic blood pressure

The mean value of pre exercise response at 28 to 30th,31 to33rd and 34th to 36th weeks of gestational age were 117.84, 116.16 and 120.00 respectively. The mean value of post exercise response at 28 to 30th,31 to33rd and 34th to 36th weeks of gestational age were 119.38, 117.50 and 120.00 respectively.

The F-ratio for (factor A) gestational age 0.214 was less than the required table value 3.35 for significance with df 2 and 27 and was not significant at 0.05 level. Since the obtained F-ratio at 28 to 30th, 31 to33rd and 34 to36th week of gestational age (factor A) was not significant, it was concluded that there were no significant difference in maternal systolic blood pressure among the three gestational age groups.

The F-ratio for (factor B) exercise response 0.406 was lesser than the required table value 4.21 for significance with df 1 and 27 and was not significant at 0.05 level. Since, the obtained F-ratio for exercise response (factor B) was not significant, it was concluded that there were no significant difference in maternal systolic blood pressure between pre and post exercise responses.

The F-ratio for (factor A X B) interaction 0.079 was less than the required table value 3.35 for significance with df 2 and 27 and was not significant at 0.05 level. Since the obtained F-ratio for interaction (factor A X B) was not significant, it may be concluded that there were no significant difference in maternal systolic blood pressure between three gestational groups and exercise responses.

### Maternal diastolic blood pressure

The mean value of pre exercise response at 28 to 30th,31 to33rd and 34th to 36th weeks of gestational age were 72.76, 69.50 and 76.00 respectively. The mean value of post exercise response at 28 to 30th,31 to33rd and 34th to 36th weeks of gestational age were 73.07, 70.83 and 76.80 respectively.

The F-ratio for (factor A) gestational age 1.786 was less than the required table value 3.35 for significance with df 2 and 27 and was not significant at 0.05 level. Since the obtained F-ratio at 28 to 30th, 31 to33rd and 34 to36th week of gestational age (factor A) was not significant, it was concluded that there were no significant difference in maternal diastolic blood pressure among the three gestational age groups.

The F-ratio for (factor B) exercise response 0.577 was lesser than the required tale value 4.21 for significance with df 1 and 27 and was not significant at 0.05 level. Since, the obtained F-ratio for exercise response (factor B) was not significant, it was concluded that there were no significant difference in maternal systolic blood pressure between pre and post exercise responses.

The F-ratio for (factor A X B) interaction 0.114 was less than the required table value 3.35 for significance with df 2 and 27 and was not significant at 0.05 level. Since the obtained F-ratio for interaction (factor A X B) was not significant, it may be concluded that there were no significant difference in maternal diastolic blood pressure between three gestational groups and exercise responses.

### Mean arterial blood pressure

The mean value of pre exercise response at 28 to 30th,31 to33rd and 34th to 36th weeks of gestational age were 87.46, 84.83 and 92.69 respectively. The mean value of post exercise response at 28 to 30th,31 to33rd and 34th to 36th weeks of gestational age were 87.92, 86.33 and 91.00 respectively.

The F-ratio for (factor A) gestational age 1.414 was less than the required table value 3.35 for significance with df 2 and 27 and was not significant at 0.05 level. Since the obtained F-ratio at 28 to 30th, 31 to33rd and 34 to36th week of gestational age (factor A) was not significant, it was concluded that there were no significant difference in mean arterial blood pressure among the three gestational age groups.

The F-ratio for (factor B) exercise response 0.009 was lesser than the required tale value 4.21 for significance with df 1 and 27 and was not significant at 0.05 level. Since, the obtained F-ratio for exercise response (factor B) was not significant, it was concluded that there were no significant difference in mean arterial blood pressure between pre and post exercise responses. Hence, the null hypothesis was accepted at 0.05 level of significance.

The F-ratio for (factor A X B) interaction 0.440 was less than the required table value 3.35 for significance with df 2 and 27 and was not significant at 0.05 level. Since the obtained F-ratio for interaction (factor A X B) was not significant, it may be concluded that there were no significant difference in mean arterial blood pressure between three gestational groups and exercise responses.

### Oxygen saturation

The mean value of pre exercise response at 28 to 30th,31 to33rd and 34th to 36th weeks of gestational age were 98.92, 99.00 and 99.40 respectively. The mean value of post exercise response at 28 to 30th,31 to33rd and 34th to 36th weeks of gestational age were 98.84, 99.58 and 99.60 respectively.

The F-ratio for (factor A) gestational age 1.237 was less than the required table value 3.35 for significance with df 2 and 27 and was not significant at 0.05 level. Since the obtained F-ratio at 28 to 30th, 31 to33rd and 34 to36th week of gestational age (factor A) was not significant, it was concluded that there were no significant difference in oxygen saturation among the three gestational age groups.

The F-ratio for (factor B) exercise response 0.529 was lesser than the required tale value 4.21 for significance with df 1 and 27 and was not significant at 0.05 level. Since, the obtained F-ratio for exercise response (factor B) was not significant, it was concluded that there were no significant difference in oxygen saturation between pre and post exercise responses.

The F-ratio for (factor A X B) interaction 0.521 was less than the required table value 3.35 for significance with df 2 and 27 and was not significant at 0.05 level. Since the obtained F-ratio for interaction (factor A X B) was not significant, it may be concluded that there were no significant difference in oxygen saturation between three gestational groups. and exercise responses.

## Discussions

The obtained results are discussed below focusing on related studies available in the area of exercise in pregnancy. An increase in mean value was obtained for the post fetal heart rate and maternal heart rate when compared to the pre test maternal heart rate due to asana and aerobic exercise. This concurs with the results of other studies on maternal and heart rate documented (13,21) where sub maximal exercise resulted in the increase in heart rate and enhanced cardiac output in pregnant women.

The increased post exercise fetal heart rate and maternal heart rate was be due to demand of exercise requiring redistribution of blood to splanchnic organs and circulatory adaptations that arise due to the need to compensate for continuing normal alterations of pregnancy (13).

In the present study a non significant ($p>0.05$) increase in the post test maternal systolic and diastolic blood pressure, mean arterial pressure and percent oxygen saturation were obtained for exercise response and for all the three gestational age categories.

This suggests that the systolic, diastolic and mean arterial pressure did not change significantly due to the mild intensity exercise. However aerobic in a study on sheep (7,16) found out that the mean arterial pressure did not significantly increase any further when the exercise level was increased from 70 to 100% $VO_2$ max or when the duration of exercise was extended from 10 to 40 minutes. An increased pressured response has been reported in pregnant women in response to treadmill and bicycle exercise (15) because both the cardiac output and the arterial pressure response to sub maximal exercise are only slightly altered by pregnancy, the exercise induced decrease in total peripheral resistance during pregnancy must be of a magnitude similar to that in the non pregnant state(18,19). A more marked decrease in total peripheral resistance during exercise in pregnancy has been reported in pregnant goats (12,15), which probably reflects a higher work load as a result of pregnancy weight increase.

The percent oxygen hemoglobin saturation of maternal and fetal blood has important implications for placental oxygen transfer. An increase of either maternal or fetal $O_2$ capacity will promote placental $O_2$ exchange. The longer the sum of maternal and fetal blood $O_2$ capacities, more oxygen will be exchanged before equilibrium is reached(20).

## Conclusions

Based on the results of the study the following conclusions are drawn:

1. The asana and mild aerobic exercise programme caused an increase in the maternal heart rate to a higher post exercise response when compared to the pre exercise response. However, this response did not differ for the three gestational age categories.
2. The asana and aerobic exercise programme did not cause an increase or decrease in the maternal systolic and diastolic blood pressure, mean arterial pressure and maternal oxygen saturation in pre and post exercise response and also for the three gestational age categories.
3. There was also no interaction between the gestational age and the exercise response factors in maternal heart rate, systolic, diastolic, mean arterial pressures and maternal percent oxygen saturation.

Thus, it may be concluded that performing asana and mild aerobic exercise during pregnancy is very safe for mother and fetus and would enhance pregnancy associated cardio respiratory fitness and well being of the mother.

## Bibliography


1. Zeanah, M. and Schlosser, P.S. “Adherence to ACOG Guidelines on Exercise During Pregnancy: Effect on Pregnancy”. Journal Obstetrics Gynecology Neonatal Nutrients, 22(4),(July-Aug1993)
2. Clapp, J.F. 3rd et al,“Beginning Regular Exercise in Early Pregnancy: Effect Feto placental Growth”, American Journal of Obstetric and Gynecology, 183 (6), (December 2000).
3. American College of Obstetricians and Gynecologists Women and Exercise, ACOG Technical Bulletin, 189, Washington D.C. (1994).
4. American College of Obstetricians and Gynecologists Exercise during Pregnancy, Washington D.C. (1998)
5. ACOG Technical Bulletin, Exercise during Pregnancy and the Postpartum Period, 267, 171-3. (January 2002)
6. Jarski, W.R. and Trippett, L D., “The Risks and Benefit of Exercise During Pregnancy”, School of Health Sciences, Oakland University, Rochester, Michigan, Comment in: Journal Fam. Practice, 30 (6), (June 1990).
7. Koniak D Griffin, “Aerobic Exercise, Physiological Well-being and Physical Discomforts During

Adolescent Pregnancy", Research on Nursing and Health, 17:4, (August 1994).

8. Uzendoski, M.A., Latin, W R and Berg, E.K., "Physiological Responses to Aerobic Exercise During Pregnancy and Postpartum", Journal of Sports Medicine and Physical Fitness, 30 (1), (March 1990).
9. Wotte et al., "Effect of Pregnancy and Chronic Exercise on Respiratory Responses to Graded Exercise", Journal Applied Physiology, 76 (5), (May 1994).
10. Barteris, H. Prenatal Respiration, North Holland, Amsterdam, (1970).
11. Delyser, F. and Jane, F. New Pregnancy Workout and Total Birth Programme, Rockefeller Centre, New York. (1989)
12. Dhindsa, D.s., Metcalfe and Kummels D.H. "Responses to Exercise in Pregnant Pygmy goat", Journal of Applied, Respiratory and Exercise Physiology, 32, 299-31(1978). 1.
13. Feiner, B. "The Influence of Maternal Exercise on Placental Blood Flow measured by Simultaneous Multigate spectral doppler imaging". Obesteric Gynecology Journal. 15, 6, 456-501. (2000).
14. Fox, E.L. and Mathews, D.K. The Physiological Basics of Physical Education and Athletics. W.B. Sounder Company, Philadelphia. (1981).
15. Knuttgen, H.G.and Emerson, K. Jr., "Physiological Response to Pregnancy at Rest and During Exercise" Journal Applied Physiology.136,(1974)
16. Lotgesing, F.K. Gilbert, RD and Lango, L.D. (1983). "Exercise Response in Pregnant Sheep, Blood Gases, Temperature and Fetal Cardiovascular Systems". Journal Applied Physiology. 55, 812-850.
17. Sonia, K et al., "Physical Working Capacity During Pregnancy and Effect of Physical Work Tests on Fetal Heart Rate", Annals chirurgienu Gynecology, 53,(1963)
18. Veille, J.C. et al., "Left Ventricular Diastolic Filling Response to Stationary Bicycle Exercise During Pregnancy and the Postpartum Period", American Journal Obstetric and Gynecology, 185 (4), (October 2001).
19. Yeo, S. et al, "Effect of Exercise on Blood Pressure in Pregnant women with a High Risk of Gestational Hypertensive Disorders", Journal of Reproductive Medicines, 45(7), (July 2000).
20. Mittelmark, A.R., Wiswell, R.a. and Drinkwater, B.L. Exercise in Pregnancy. Williams and Wilkins, U.S.A. (1991).
21. Ureland, K., "The influence of Gestational Age on Maternal Cardiovascular Response to Posture and Exercise" . American Journal Obstetric and Gynecology. 104, 106-111. (1969).
22. Hoare Sophy, "Yoga and Pregnancy" Unwin Paperbacks, London.
23. Iyengar, B K S "Light on Yoga" 223A Randolph Avenue,London-W9.