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Moderate Exercise throughout Pregnancy and a Decreased Risk of Unplanned Cesarean Sections

Larissa Hosler

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Moderate Exercise throughout Pregnancy and a Decreased Risk of Unplanned Cesarean Sections

Abstract
Background: Overall cesarean section rates have increased in the United States from 20.7% in 1996 to 32.9% in 2009. Research shows that maternal morbidity is higher among women who have cesarean deliveries versus patients who have vaginal deliveries. With the rate of cesarean sections increasing in recent years, there have been efforts put in place to reduce these numbers. One method of combating this trend could be increasing exercise throughout the course of pregnancy. This review assesses the current evidence of the benefits of moderate exercise in decreasing the risk of unplanned cesarean section.

Methods: An exhaustive search of available medical literature was conducted using MEDLINE-Ovid, Google Scholar, and Web of Science were used. The search terms pregnancy, exercise, and cesarean section. Applicable articles were assessed for quality using the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE).

Results: Two studies met eligibility criteria and were included. Both were randomized control trials. One study of 290 healthy, singleton pregnancies found that the percentage of cesarean deliveries were lower in the exercise group compared to the control group (16% versus 23%). The second study of 62 singleton pregnancies found that the percentage of cesarean deliveries was lower in the active group compared to the control group (6.4% versus 32.2%). Both studies had a moderate quality of evidence based on GRADE guidelines.

Conclusion: The two studies reviewed demonstrated a decreased rate of cesarean section in patients who exercised moderately throughout all 3 trimesters. Exercise throughout pregnancy did not have any negative effects on overall newborn health status. Providers should encourage moderate aerobic exercise to patients throughout the entire course of pregnancy.

Keywords: Exercise, pregnancy, cesarean section

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Degree Name
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Keywords
Exercise, pregnancy, cesarean section

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Moderate Exercise throughout Pregnancy and a Decreased Risk of Unplanned Cesarean Sections

Larissa Hosler

A Clinical Graduate Project Submitted to the Faculty of the
School of Physician Assistant Studies
Pacific University
Hillsboro, OR

For the Masters of Science Degree, August 2018

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Clinical Graduate Project Coordinator: Annjanette Sommers, PA-C, MS
Biography
[redacted]
Abstract

**Background:** Overall cesarean section rates have increased in the United States from 20.7% in 1996 to 32.9% in 2009. Research shows that maternal morbidity is higher among women who have cesarean deliveries versus patients who have vaginal deliveries. With the rate of cesarean sections increasing in recent years, there have been efforts put in place to reduce these numbers. One method of combating this trend could be increasing exercise throughout the course of pregnancy. This review assesses the current evidence of the benefits of moderate exercise in decreasing the risk of unplanned cesarean section.

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**Keywords:** Exercise, pregnancy, cesarean section
Acknowledgements

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Figure 1: Rate of Cesarean Section

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<th>Abbreviation</th>
<th>Meaning</th>
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<tr>
<td>HR</td>
<td>Heart rate</td>
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<tr>
<td>C-section</td>
<td>Cesarean section</td>
</tr>
<tr>
<td>ACOG</td>
<td>American College of Obstetricians and Gynecologists</td>
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</tbody>
</table>
Moderate Exercise throughout Pregnancy and a Decreased Risk of Unplanned Cesarean Sections

BACKGROUND

Overall cesarean section (C-section) rates have increased in the United States from 20.7% in 1996 to 32.9% in 2009. As of 2015, nearly a third of births continue to be delivered through C-section each year.¹ Risks of C-section include: infection, blood loss, deep vein thrombosis, injury to bowel or bladder, reaction to medications or anesthesia, placental problems in future pregnancies, neonatal respiratory difficulties, maternal respiratory complications, and longer hospitalizations.² Research shows that rates of maternal morbidity are higher among women who have a C-section compared to women who deliver vaginally. This includes a higher rate of transfusion and ICU admissions among primary C-section deliveries. Furthermore, the rate of ruptured uterus and unplanned hysterectomy are higher in women with repeat C-section deliveries. These findings were consistent among nearly all maternal age groups and for women of all races and ethnicities.³

With the trend of C-section rates increasing in recent years, there have been efforts set in place to reverse this trend. Healthy People 2020, an initiative designed to guide health promotion and disease prevention, objectives include reducing C-section births among low-risk females with no prior cesarean sections. Healthy People 2020 set a goal to reduce the number of cesarean sections among low risk females to 23.9%.⁴ One method to decrease rates of C-section among low risk women could be to encourage moderate exercise throughout pregnancy.

In 2016, the American College of Obstetricians and Gynecologists (ACOG) recommended that healthy women with normal pregnancies exercise for at least 150
minutes of moderate intensity every week. Exercising throughout pregnancy can reduce low back pain, ease constipation, potentially decrease risk of gestational diabetes, preeclampsia, and cesarean delivery, promote healthy weight gain, improve overall general fitness, and aid in losing weight after the baby is born. Although moderate exercise is advised to pregnant women, only 15.1% of pregnant women report exercising at the recommended levels. The most likely reason for this is the common misconception that exercise during pregnancy can be harmful. This misconception likely stems from outdated recommendations from the ACOG (1985) that stated active pregnant women should limit the type, duration, and intensity of exercise to minimize risks to the mother and fetus. Currently, there is not a lot of research on women throughout pregnancy; however, it seems imperative to have a better understanding when we are treating women throughout the entirety of pregnancy. Given more current recommendations from ACOG, it is important to encourage women to participate in moderate exercise throughout all 3 trimesters.

With the rise in cesarean sections in previous years, it becomes imperative to begin examining different methods in combating this trend. Evidence based research continues to demonstrate the benefits of exercise throughout pregnancy and so the question should be asked: Can moderate, supervised exercise throughout pregnancy decrease the risk of an unplanned cesarean section?

**METHODS**

A comprehensive search of MEDLINE-Ovid, Google Scholar, and Web of Science with the terms ‘exercise’, ‘pregnancy’ and ‘cesarean section’ was conducted. Eligibility criteria included studies on pregnant women, human only studies, studies in
the English language, and randomized control trials. The articles were assessed for quality using the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE).  

RESULTS

The initial literature search yielded 87 articles for review. After screening abstracts for relevance, two articles were selected that met inclusion criteria. Both articles were randomized control trials. See Table 1.

Barakat et al

This randomized control study evaluated the influence of exercise throughout all 3 trimesters on type of delivery. The population was obtained through a hospital database. Participants that were chosen to participate in the study were healthy, had no pregnancy complications, and were singleton pregnancies. Exclusion criteria included: multiple pregnancies, risk of premature labor, and patients not planning on giving birth in study hospital, not receiving medical care throughout the entirety of pregnancy, participating in another physical activity program throughout pregnancy, or having a high level of physical activity prior to pregnancy.

The study used a computer-generated list of random numbers to allocate participants into an exercise (n=138) or a control (n=152) group. The exercise group was instructed to participate in three 45-minute sessions per week starting at weeks 6-9 of pregnancy and continuing until weeks 38-39. Each session was supervised by a fitness instructor in the Health Care Center, and attendance was taken to ensure adherence to the exercise program. The exercise session included 25 minutes of core training, and two 7-8 minute blocks of walking, light stretching, static stretching, and aerobic dance. Exercises
were chosen that targeted the arms and abdomen, which aimed to strengthen postural muscles, decrease low back pain, and strengthen muscles used in labor and delivery. To determine exercise intensity, participants used a heart rate (HR) monitor through each session to maintain a HR under 70% of age predicted values.9

The type of delivery and pregnancy outcomes were obtained through hospital records. The percentage of cesarean sections in the Exercise group (16%) was lower than those in the Control group (23%). The relative risk of cesarean section for participants in the Exercise group compared to the Control group was 69%, with an overall relative risk reduction of 31%. See Table 2. Pregnancy outcomes including gestational age, maternal weight gain, blood pressure, 1 hour glucose tolerance test, gestational diabetes, birth weight and length, pH of umbilical cord, and Apgar scores were obtained. There was no significant difference between groups. However, maternal weight gain was lower in the Exercise group (11.9%) compared to the Control group (13.7%) (p=0.0001).9

Investigators concluded that there is an association between supervised resistance training throughout all 3 trimesters and a lower percentage of cesarean sections. There was no significant difference in newborn health status among both groups as indicated by Apgar scores. Furthermore, maternal weight gain was less in the exercise group which could be protective against other pregnancy complications.9

Price et al

This randomized control study10 evaluated the benefits and harms of moderate exercise during pregnancy. Study participants were found through announcements at local obstetric offices. Participants were chosen based on having no participation in aerobic exercise more than once per week over the past 6 months, single pregnancy, and
body mass index < 39 kg m\(^2\). Exclusion criteria included: chronic heart or lung disease, poorly controlled diabetes, hypertension, epilepsy, hyperthyroidism, hematocrit <27\%, orthopedic limitations, history of premature delivery, previous infant small for gestational age, or unexplained fetal death. Ninety-four participants were assessed for eligibility, 91 were randomized and allocated to either an active or control group. Out of the 43 participants allocated to the active group, 12 subjects dropped out due to logistics, anxiety, history of preterm pregnancy, or pain from leiomyomas. Out of the 48 participants allocated to the control group, 5 subjects withdrew to exercise independently and 12 subjects dropped out due to logistics or decision to exercise. Sixty-two participants were ultimately evaluated, 31 analyzed in each group respectively.\(^{10}\)

The intervention included 45-60 minutes of supervised aerobic exercise performed 4 times per week. To determine moderate intensity, exercise was performed at a 12-14 rating on the Borg Scale of perceived exertion. The exercise regime included aerobics, walking on hilly terrain, circuit training, and brisk walking. The circuit training included 1-10 minutes on the treadmill, elliptical, or stationary bicycle alternating with 1-10 minutes of weight training. The weight training consisted of sets of 20 repetitions of overhead press, seated bench press, seated rowing, pectoral flexion, triceps extensions, bicep curls, leg extension, hip abduction/adduction, back extension, loaded torso rotation, crunches, and supine bridges. Attendance was taken for each session to ensure adherence to the exercise program. The control group was advised to not participate in exercise throughout pregnancy. Control participants were told to only exert themselves as appropriate for work and household activities.\(^{10}\)
The study\textsuperscript{10} found that the percentage of cesarean sections was lower in the active group (6.4\%) compared to the control group (32.2\%). See Figure 1. The relative risk of cesarean section for participants in the active group compared to the control group was 20\%, with an overall relative risk reduction of 80\%. See Table 2. Exercise did not show any significant effect on pregnancy length, fetal birth weight, Apgar scores, and placenta weight. Limitations of the study were collecting complete data on all subjects at every data point and small sample size.\textsuperscript{10}

Investigators concluded that there is an association between supervised resistance training throughout all 3 trimesters and a lower percentage of cesarean sections. There was no significant difference in length of pregnancy, fetal birth weight, Apgar scores, or placenta weight. Furthermore, time to resume to household chores was shorter in the exercise group compared to the control group.\textsuperscript{10}

**DISCUSSION**

The GRADE quality of evidence for both studies\textsuperscript{9,10} was moderate. See Table 1.

**Clinical Relevance**

The two studies\textsuperscript{9,10} evaluated the effect of moderate exercise throughout the entirety of pregnancy on rates of C-section deliveries. Both studies reviewed demonstrated a reduction in cesarean sections in patients participating in moderate exercise throughout pregnancy compared to the control group. See Table 2. Barakat et al\textsuperscript{9} showed that the percentage of cesarean sections in the Exercise group (16\%) was lower than those in the Control group (23\%). Price et al\textsuperscript{10} demonstrated a similar trend with the percentage of cesarean sections to be 6.4\% in the active group compared to 32.2\% in the
control group. In the Barakat et al study\textsuperscript{9}, the number needed to treat is 14; therefore, if 14 women exercised moderately throughout pregnancy it could prevent 1 from having to have an unplanned C-section.

Cesarean sections result in increased rates infection, blood loss, deep vein thrombosis, injury to bowel or bladder, reaction to medications or anesthesia, placental problems in future pregnancies, neonatal respiratory difficulties, maternal respiratory complications, and longer hospitalizations compared to vaginal deliveries.\textsuperscript{2} With a lack of adverse effects reported when exercising throughout pregnancy, it seems imperative that clinicians discuss the importance of moderate exercise to all pregnant women. By encouraging more women to exercise throughout pregnancy, clinicians can potentially decrease rates of C-section resulting in improved maternal morbidity and decreased length of hospital stay with little to no risks to the mom and fetus.

\textbf{Limitations}

There are some limitations with these studies\textsuperscript{9,10}. Both studies did not distinguish between emergent and elective cesarean sections. However, Price et al\textsuperscript{10} showed that 6 out of 10 patients that received a cesarean section in the control group did so due to failure to progress. More research should be done to examine how exercise throughout pregnancy affects the likelihood of emergent cesarean sections. This could be of greater importance in terms of improving maternal and fetal morbidity and mortality.

Also, both studies\textsuperscript{9,10} did not have 100% compliance with the exercise regime. Both studies included supervised exercise programs to measure compliance. The Price et al study\textsuperscript{10} demonstrated that the participants in the active group participated in 77% of the supervised exercise classes. To supplement the exercise class, participants performed
similar exercises individually. This increased compliance to the exercise program to 93% as reported by Price et al. Barakat et al reported an 87% compliance in the exercise group. Adherence to the exercise program was assessed using a sign-in sheet at each session. Access to structured exercise regimes, along with issues of compliance, may make this difficult for many mothers to achieve throughout pregnancy. Some barriers may include time, gym location, gym cost, reliable transportation, and childcare accessibility. Clinicians can recommend specific independent exercises and discuss the benefits of exercise throughout pregnancy to increase compliance. It is important to include family members or friends in the exercise regime to keep women motivated. Further research could be done to determine the most effective forms of exercise, along with minimum amount of exercise that could lead to positive outcomes so that this practice could become standard of care for pregnant women.

Also, the number of participants in the Price et al study was small. The sample size included 62 women randomized into the active or control group. Despite the small sample size, there is a large magnitude of effect based on the calculated risk ratio (RR=0.2). Therefore, the confidence in the results of this study are increased.

Despite these limitations, the evidence of both studies supports recommending moderate aerobic exercise throughout all 3 trimesters. Moderate exercise throughout pregnancy did not have any adverse effects on maternal and fetal outcomes in women with low-risk pregnancies. The recommendation of exercise throughout pregnancy should be case dependent and should be used cautiously in women with multiple pregnancies or risk of premature labor.
Lastly, more research could be done to understand the effects of moderate exercise on improving emergent C-sections. With a distinction of emergent versus elective C-sections, clinicians would have more evidence to support recommending moderate exercise throughout pregnancy.

CONCLUSION

Due to increasing rates worldwide and the potential complications of having a C-section, investigating ways to decrease a woman’s likelihood of a C-section is important for clinicians to consider. Risks, including infection and increased hospitalization, are more common among women that have a C-section when compared to vaginal deliveries.2 When counseling women on pregnancy, it is important to discuss the recommendations and benefits of exercise. The data from these studies9,10 supports that exercise throughout pregnancy is associated with lower rates of C-section in women with uncomplicated pregnancies. Both studies support the ACOG recommendations that healthy women with uncomplicated pregnancies should exercise for 150 minutes per week throughout pregnancy. The data found in both studies is strong enough to suggest that clinicians should provide an exercise regime to and at the very least encourage all women with uncomplicated pregnancies to exercise.
References


### Table 1: Quality Assessment of Reviewed Articles

<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Downgrade Criteria</th>
<th>Upgrade Criteria</th>
<th>Quality</th>
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<td>Barakat et al⁹</td>
<td>RCT</td>
<td>Serious*</td>
<td>Not Serious</td>
<td>None</td>
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<td></td>
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<td>Indirectness</td>
<td>Not Serious</td>
<td>Not Serious</td>
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<td>Inconsistency</td>
<td>Not Serious</td>
<td>Not Serious</td>
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<tr>
<td></td>
<td></td>
<td>Imprecision</td>
<td>Not Serious</td>
<td>Not Serious</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Publication bias</td>
<td></td>
<td>None</td>
</tr>
<tr>
<td>Price et al¹⁰</td>
<td>RCT</td>
<td>Serious*</td>
<td>Not Serious</td>
<td>Large Magnitude of Effect³</td>
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<td></td>
<td></td>
<td>Publication bias</td>
<td></td>
<td>None</td>
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* Do not separate emergent versus elective C-section

⁷ Sample size is very small, overestimates NNT

³ The Price et al study had an RR of 0.2

### Table 2. Summary of Findings

<table>
<thead>
<tr>
<th>Study</th>
<th>Number of Patients</th>
<th>Rate of Cesarean Section (%)</th>
<th>Relative Risk</th>
<th>Relative Risk Reduction</th>
<th>NNT</th>
<th>Importance</th>
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</thead>
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<tr>
<td>Barakat et al⁹</td>
<td>Exercise (n=138)</td>
<td>Exercise (16%)</td>
<td>69%</td>
<td>31%</td>
<td>14</td>
<td>Important</td>
</tr>
<tr>
<td></td>
<td>Control (n=152)</td>
<td>Control (23%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price et al¹⁰</td>
<td>Exercise (n=31)</td>
<td>Exercise (6,4%)</td>
<td>20%</td>
<td>80%</td>
<td>4</td>
<td>Important</td>
</tr>
<tr>
<td></td>
<td>Control (n=31)</td>
<td>Control (32,2%)</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Figure 1. The rate of cesarean section in active vs. control group from the Price et al study.\textsuperscript{10}