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CrossFit Training During Pregnancy and Motherhood: A New Scientific Frontier

Dr. Cooker Perkins and Hannah Dewalt explore training intensity during pregnancy and call on CrossFitters to help them take their research further.

By Dr. Cooker Perkins and Hannah Dewalt

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The feats of the women who have continued CrossFit through their pregnancies are simply astonishing.

To most CrossFitters—who can be described as pretty health-minded and disciplined individuals with a "can do" spirit—it might be impressive that women have continued to do Nancy, Daniel or "death by clean and jerk" during the entire length of their pregnancy, but to a health professional or a researcher it is truly a new scientific frontier. And there is no question: CrossFit moms are the pioneers of this new frontier.

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Pregnant women are bombarded with messages about what to do and what not to do during their pregnancies. For the most part, this messaging is helpful. Science hasn't always known that what the mother does during pregnancy actually affects the baby. There was a time when a pregnant woman was thought of as two separate entities, where mom was just the womb and the baby was a perfect and impervious growing organism. Women used to continue smoking and drinking during their pregnancies without a hint that doing so might harm their babies. Today, this knowledge is common sense. However, in some ways—smoking and drinking aside—a lot of unknown territory still exists with respect to how other health behaviors influence pregnancy and birth outcome. I can imagine a day 20 years from now when people will be aghast at what we did not know.

One relatively new territory that has received a lot of attention in recent years is exercising during pregnancy. At this point, we know quite a bit about aerobic activity during pregnancy (e.g., walking, jogging, swimming). The first guidelines about what women can and can't do with respect to aerobic exercise during pregnancy were published in 1985. Because the guidelines were based on what science knew (and did not know), these guidelines were quite conservative.

Now, over 25 years later, with a surfeit of research studies to glean from, the recommendations for aerobic exercise during pregnancy have advanced quite a bit. To be brief, they essentially changed from "guidelines" to "recommendations" while they modified, expanded and clarified the details along the way. The terminology has changed from "women can do" to "women should do" aerobic exercise. This might seem like semantics to some, but to those of us who are either pregnant or in the research profession, it's a big difference.

Common questions a pregnant woman may ask herself include the following: But what about a training program that is higher-intensity or one that will improve strength and power during pregnancy? Will I harm my baby? *Can* women do it? *Should* women do it? If so, can I start a program when I'm pregnant? If I'm already well trained, can I continue the same program through my pregnancy?

A truly inexhaustible list of questions could be compiled.

Truth be told, we don't really know much yet. What we do know from the small group of studies that have been done is that "light resistance training" has been shown to positively affect some pregnancy and birth outcomes, and, perhaps more importantly, has not shown any negative effects (Table 1).

Studies	Intensity	Exercise Routine	Outcomes Measured
Based on summary of 6 studies conducted between 1987-2009	3 kg "light intensity" HR <140 bpm		Type of delivery
		1 set, 10-12 reps, 12 exercises, 3x per week "toning exercises" 1-2x per week	Labor duration
			Blood values
			Gestational age
			Low-back pain
			Apgar scores

Summary of findings: None of the studies showed a negative effect of exercise on the outcome measure of interest. Further, some studies found a positive effect in the exercise group (compared to a sedentary group of women) on some outcome measures (e.g., labor duration was shorter in the exercise group).

Table 1: Research studies on resistance training during pregnancy (based on qualitative evaluation of six studies 1987-2009).

These results should be interpreted loosely as the studies these results come from are quite conservative with respect to the intensity of exercise the researchers could prescribe to women enrolling in the study. Because these studies have to obtain approval by a board of people designated to protect the health and safety of human subjects involved in research (and rightly so), and because we do not yet fully understand the possibility of outcomes of high-intensity training, the exercise programs in these studies (exercise intensity, variety of exercises performed) are quite limited.

The conclusion from these studies sounds very familiar to the first recommendations for strength training for (non-pregnant) women in the late 19th century. At that time, leading scientists and physical educators (at Harvard University) encouraged the use of "resistance apparatus" but advocated only "light" repetitive training for women. Now in the 21st century, female athletes are training at intensities far beyond what was suggested in the early days of science.

The story is similar for the pattern of progression for aerobic training during pregnancy. The first few studies were done on pregnant sheep (yes, you can actually make them run), and eventually a few conservative studies were done on pregnant women. But what really helped advance our understanding in this area were those few bold women who refused to give up their distance training and who were determined to run a marathon in their sixth month of pregnancy. Their contribution to the advancement of science is nearly immeasurable; these women paved the way for future research in this area, which has positively affected the health of so many mothers and babies.

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So, as it is with the development of our understanding of the area of high-intensity and resistance/power training during pregnancy, what scientists like myself will depend upon are the results from women who simply refuse to give up their "resistance training" programs during their pregnancy and show, one by one, that resistance training and total-fitness training during pregnancy are safe, necessary and offer unique benefits to the growing baby. Furthermore, it may be beneficial for women to train for pregnancy, labor and motherhood. In fact, there may be a strong argument for developing this kind of "fitness" during the perinatal time period.

Training for Pregnancy, Labor and Motherhood

What type of training program would best prepare a woman for the demands of pregnancy, labor and postpartum responsibilities?



Scott Bolan

Kendra Killpatrick working out, and flexing, for two.

If pregnancy, labor and postpartum were athletic events (I think this is where we lobby for a new definition of "triathlete") and I were a coach for these events, I would want to know what training program would help my athletes perform at their best yet would not cause injury or harm. When elite athletes prepare for their respective competitions, their training programs are designed around the physical demands of the event: their training focuses sharply on the components of fitness they need to develop in order to win or succeed. In fitness and coaching, this principle is called "specificity of training." This principle is the general rule or belief that training programs should be designed and performed with the relative desired training outcome in mind (e.g., velocity specific, muscle-action specific, energy-source specific).

For example, consider an elite Olympic weightlifter. While some aerobic training will benefit this athlete, his or her training program would be designed to elicit the biggest improvements in strength and power for specific lifts.

While there are undeniable cardiovascular benefits associated with aerobic training (e.g., walking, jogging, swimming), unless you have hopes of competing in the Olympic marathon or winning the next Ironman, there is a considerable argument for the rest of us to have exercise programs that don't exclude aerobic activity (because it is beneficial) but are sufficiently aimed at improving functional strength and power as well as a variety of other components of physical fitness.

For example, the average elderly adult does not need to be able to run 5 miles a day. Rather, he or she needs to be able to cross the street before the red hand appears, walk two blocks to the grocery store, and carry a bag of groceries home—and perhaps up the stairs.

Likewise, unless you are a marathoner and hope to continue those competitions post-pregnancy, the average mom (and even the above-average mom) doesn't need to be able to run a faster 10K; she needs to know proper lifting technique as well as functional strength and power so she can appropriately accommodate her growing abdomen and avoid lower-back pain. And once the baby is born, she needs to be able to properly squat, pick up the baby, carry the baby up and down stairs, and place the baby uncountable times in and out of a stroller or a car seat. It goes without saying that baby does not stay 8 lb. 6 oz. forever.

The continual advancement of our understanding of how the human body adapts to different exercise stimuli will continue to cause experts to argue about the "winning" workout for their respective elite athletes. Nevertheless, the basic principle is undeniably true: an organism will adapt to the stimulus to which it is subjected. Suffice it to say that moms-to-be are about to enter the fitness challenge of their lives, and the winning program must improve strength and must be functional. If you are lover of CrossFit, it is easy for me to share the benefits of a training program that is designed for improving the 10 general physical skills and enabling you to meet the specific demands of a task—both of which, when combined, develop and require competency in the three major energy systems. After all, this is what you ascribe to.

Given the dynamic physical demands of pregnancy and postpartum, why are women only training for, at best, three or four of the 10 physical skills? What is the hesitation in training the short-term-power energy systems?

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This hesitation can be traced to the lack of evidence we have on this topic. The pregnant women who are performing the workout of the day (WOD) alongside their non-pregnant counterparts are creating an incredible opportunity to collect evidence about high-intensity functional training during pregnancy. That data will allow professionals to offer concrete advice on the benefits of such a program.

You pioneer CrossFit moms are opening a new scientific frontier: anaerobic exercise during pregnancy. Because you have refused to give up your training regimens, our understanding of this area of science is reaching new heights.

CrossFit During Pregnancy: A Look at the Numbers

To better illustrate something I have deemed "astonishing," we can compare an average CrossFit workout (volume and intensity of exercise) that was completed during pregnancy to a resistance-training workout recommended during pregnancy. After approval from a human-subjects committee, we received permission to look at

the detailed exercise logs of two women who voluntarily continued their CrossFit workouts during pregnancy. We compared the exercise volume and intensity of a sample CrossFit workout during pregnancy with what a standard resistance-training session might look like as prescribed by current science for a pregnant woman.

A standard resistance-training session is shown in Table 2. A comparison of the exercise volume and intensity between a sample CrossFit workout and a standard resistance-training session is shown in Table 4. Based on this comparison, the CrossFit workout is approximately three times the prescribed exercise volume (in one session) and five times the prescribed exercise intensity. Astonishing.

Resistance Training During Pregnancy (Muscular Endurance)			
Frequency	Each major muscle group 2-3 days/week		
Sets	1		
Number of exercises	8-10		
Repetitions	8-12		
	Undefined ("light")		
Intensity	(Based on a rating of perceived exertion scale [RPE]: light = 11-12)		
	Based on a lack of supporting evidence:		
Additional considerations	Limit repetitive isometric or heavy weightlifting		
	Limit exercises that result in a large pressor effect; limit Valsalva maneuver†		

Table 2: American College of Obstetricians and Gynecologists (ACOG) guidelines and considerations for resistance training during pregnancy. The recommendations or guidelines for resistance training during pregnancy are not well defined. ACOG recommends following an exercise prescription (for non-pregnant women) that includes "resistive exercise" while watching for warning signs that exercise should be stopped (Table 3). Here we use the exercise prescription of ACOG and the intensity that has been most commonly used in the previous resistance-training studies during pregnancy: "light resistance training."

†The Valsalva maneuver is a technique where lifters inhale (fill the abdominal cavity with air) and hold this breath in order to exert more force and lift the weight.

Vaginal bleeding	Dizziness	Chest pain	Calf pain or swelling	Decreased fetal movement
Dypsnea	Headache	Muscle weakness	Preterm labor	Amniotic fluid leakage

Table 3: Warning signs to stop exercising during pregnancy.

	CrossFit Workout	Standard RT Routine	
	"Doublette"		
Workout	5 rounds of 30 pull-ups	1 set x 8 exercises x 10 reps	
	5 rounds of 21 burpees		
Body region trained	Whole body	Isolated movements by region	
Intensity (RPE scale of 6-20)	About 15-18 ("hard" to "very hard")	About 11-12 ("light")	
Type of training	Muscular strength, power and endurance	Muscular endurance	
Total exercise time	10 minutes	About 15 minutes*	
Exercise volume	255 repetitions	80 repetitions	
Estimated intensity (reps per minute)	25.5 (hard exertion)	5 (light exertion)	

Table 4: A comparison of a sample CrossFit workout during pregnancy to a standard resistance-training session.

	1st Trimester		2nd Trimester		3rd Trimester	
	Subject A	Subject B	Subject A	Subject B	Subject A	Subject B
Frequency (days per week)	1.2 ±1.4	4.2 ±1.3	2.4 ±1.4	4.8 ±1.2	1.6 ±1.4	4.5 ±1.3
Intensity (RPE)	17-18	13	14-15	15	11-13	15
					Deadlift	
Personal Record	Squat clean Thruster	Deadlift	1RM clean & jerk		Back squat	
					Shoulder	
					press	

Table 5: Summary of CrossFit workouts by trimester for two women.

^{*} Estimated exercise time includes time to complete 1 set of 10 reps for 8 different exercises, including rest periods and preparation. The estimated time is conservative; it assumes an athlete who knows proper form as well as how to properly use/set up any equipment needed to complete the workout.

Trimester	Subject	Exercise Stopped or Modified	Modification	
4.47	Subject A	Sit-ups*		
1st Trimester	Subject B	GHD sit-ups	AbMat sit-ups	
2nd Trimester	Subject A	Push-ups	Box push-ups	
		Burpees	Box burpees	
		Pull-ups	Pull-ups with bands	
		Jump rope (uncomfortable)		
	Subject B	Handstand push-ups	Dogular push ups	
		Hand-release push-ups	Regular push-ups	
3rd Trimester	Subject A	Running		
		Pull-ups with bands**		
	Subject B	No additional modifications after 22 weeks (see above)		

Table 6: CrossFit exercises modified during pregnancy.

*In general, exercises that require pregnant women to lie on their backs are not recommended. Some supine exercises can be performed if the time period is short and the woman is well informed about the physiological contraindication of this position.

**Subject A experienced "Braxton Hicks contractions," relatively painless contractions that happen prior to the due date. The onset of Braxton Hicks is a good indication to stop the activity that appears to be causing them and to consult a medical doctor. There is no current evidence that suggests a consistent link between certain exercises and the occurrence of Braxton Hicks. For example, Subject A experienced Braxton Hicks when performing normal activities of daily living (not during exercise).



Baby's first workout!

Based on the two logs we reviewed, these two women performed CrossFit WODs throughout their pregnancies with minor exceptions. Table 5 shows the average frequency and perceived intensity of CrossFit workouts by trimester as well as any notable accomplishments during their exercise (e.g., setting a personal record). Table 6 lists the exercises that either of the women mentioned that had to be modified or scaled. In general, the women did not find much need to scale but made some accommodations (modifications) as their pregnancies progressed and their bellies became larger. It is noteworthy to mention that of all the modified exercises mentioned by either women, neither woman had to modify any of the Olympic lifts and actually set several personal records in these lifts (see Table 5).

Perhaps the most critical result to report is that both women delivered healthy babies. Birth weight and gestational age are the best predictors of health of a newborn. The two women delivered babies of normal birth weight (7 lb. 8 oz. and 6 lb. 10 oz.), both between 40-41 weeks gestation (full term is considered 37-41 weeks). The women resumed CrossFit training 2.7 weeks and 1.7 weeks after delivery, respectively. While there is not a lot of research on resumption of physical activity after delivery, medical experts would advise caution in the first four-to-six weeks following delivery because physiological and morphological changes that occur with pregnancy persist into postpartum.

These two "case studies," more affectionately known as "Kendra and Lauren," are merely two examples of pioneer women, and we know other strong and stubborn women out there have independently and voluntarily continued to do CrossFit through your pregnancies. Because you have refused to give up your training regimens, our understanding of this area of science is reaching new heights.

In general, for any exercising pregnant woman, we advise increased awareness and good sense about your body as well as the environment.

In general, for any exercising pregnant woman, we advise increased awareness and good sense about your body as well as the environment. Drink a lot of water, then drink more water; avoid exercising in hot or humid weather; rise slowly if you have been seated or on the floor for an extended period of time; and if at any time you feel sick or hot, have a pounding chest or experience any of the warning signs to stop exercising (Table 3), then stop, sit down, and keep your head higher than your heart level. Be sure to seek medical attention for persistent illness or injury.



Lauren Joseph performs the workout Little Bear at CrossFit Solano eight months into her pregnancy.

We caution readers not to assume, based on the results of these two women, that CrossFit training during pregnancy is advised for any pregnant woman. While these preliminary results are definitely encouraging, they are not enough to support the safety and benefits of this level of training during pregnancy.

Those answers might be coming sooner rather than later: future research is underway! Dr. Perkins is currently in the process of conducting a larger study on women who participated in CrossFit during pregnancy. If you are interested in determining if you are eligible to participate, please contact her at cperkins@stanfordmedalumni.org.

The authors would like to acknowledge and commend the work of Andrea Nitz for the development of training, CrossFit Mom. Andrea's certifications. specializations and her experience training pregnant women have combined to create a great online resource for women who want to continue doing CrossFit during pregnancy: CrossFitmom.com. Among many things, the site offers pregnant woman a Workout of the Day as well as suggestions for some modifications as needed.

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Hannah Dewalt is currently a senior at Pepperdine University, majoring in sports medicine. She will complete a bachelor of arts degree in spring 2012. Hannah is an intern at CrossFit Malibu and aspires to be leader in the fitness industry with a focus on exercise training during pregnancy.

About the Authors



Cooker Perkins is a professor at Pepperdine University, where she teaches courses in sports medicine and conducts research on maternal and child health. She earned a Ph.D. in exercise physiology at Michigan State University and completed postdoctoral fellow training in disease prevention at Stanford University School of Medicine.