

Four World Cup gold medals—and a baby

July 20 2018, by Nancy Bazilchuk



Marit Bjørgen at the Royal Palace Sprint, part of the FIS World Cup 2012/2013,

in Stockholm on March 20, 2013. Bjørgen came second in the race. She has recently released her training data to researchers who want to understand how she managed to recover so quickly and win four gold medals after having a baby. Credit: Frankie Fouganthin - Own work. CC BY-SA 3.0 via Wikimedia Commons

Marit Bjørgen was the most successful cross-country skier in the world when she "dropped a bomb" (in her own words) in June 2015 and reported that she was pregnant. But pregnancy didn't stop the then 35-year-old world-class athlete from training, both before her son was born and after.

Her persistence netted results: after her son was born, she went on to win four gold medals in the next World Championship. But Bjørgen has done more than just train hard and consistently—she's sharing her training secrets with researchers who have just published an article in *Frontiers in Physiology* detailing her pre- and post-partum training regime.

Former XC- skiing athlete Guro Strøm Solli, now a Ph.D. candidate at Nord University and the Norwegian University of Science and Technology (NTNU), conducted the study with Øyvind Sandbakk, a professor at the Centre of Elite Sports Research at NTNU.

"This case study presents the detailed training and test data from the entire [pregnancy](#) and the year afterwards, which is truly unique data," Sandbakk says. "But it is important to keep in mind that this is a study of one athlete. Every pregnancy has several individual factors involved, and the numbers presented here cannot be directly transferred to other athletes."

The researchers hope that the study will contribute to more focus and research on the issue, to provide more accurate guidelines to women who want to return to elite sports after giving birth.

A limited number of studies

Bjørgen, now 38, is the most successful athlete in the history of the Winter Olympics. She has won a total of 15 medals since she began competing in the Salt Lake City games in 2002. She has also won 26 World Championship medals, 18 of which were gold.

Solli and her co-authors have previously detailed Bjørgen's pre-pregnancy training secrets—which led to five consecutive successful seasons—[in a separate journal article published in 2017](#).

But when Bjørgen became pregnant, she willingly shared the details of how she trained and how her body changed during this period. This offered researchers unparalleled insights into how an elite endurance athlete responds to the dual stresses of pregnancy and training.

"There just aren't that many studies that have investigated the impact of strenuous endurance training during pregnancy in elite athletes," Solli said. "We need more information to develop more specific recommendations for top competitors."

Her phenomenal physical condition notwithstanding, Bjørgen still experienced the same anatomical, physiological, and biomechanical changes during her pregnancy as non-athletes. For one thing, she gained weight—13.8 kg—and her percentage of body fat increased from 12.8 per cent before she became pregnant to 20.4 per cent during the first week after her son's birth.

Additionally, she had to balance her training load with the demands of

the foetus, Solli said. Although moderate physical exercise has been found to be safe for both the mother and child, there are almost no studies of the effects of extensive exercise that characterized Bjørgen's non-pregnancy training regime.

The baby's birth alters, but doesn't eliminate, the physiological challenges facing a new mother, Solli said. New mother-athletes have to contend with the demands of their newborns, including breast-feeding and altered sleep patterns.

Much less high-intensity training

So just how did Bjørgen tackle this new challenge?

First of all, Bjørgen trained a total of 555 hours in 316 different training sessions during the course of her pregnancy, Solli said. Most of this training, 465 hours, was what researchers considered low-intensity training, or 60-82 percent of maximal [heart rate](#). She trained just 2.2 hours at a high-intensity level, or at a heart rate that is greater than 92 percent of her max heart rate, and this only during the first five weeks of her pregnancy.

Solli pointed out that some studies have found that exercise intensities at greater than 90 percent of the mother's max heart rate may reduce the blood flow to the uterus, which can cause a slowed heart beat, or bradycardia, in the foetus.

However, Bjørgen continued with moderate-intensity training, where her heart rate was between 87-92 percent of her maximum. In fact, she trained at this level at higher amounts than pre-pregnancy during the second trimester.

"This was probably an effective substitute for the reduced high-intensity

training to maintain performance level as high as possible during pregnancy," Solli said.

Highest-ever reported training volume during pregnancy

Bjørgen trained a weekly average of roughly 14 hours and 8 sessions. That's not all that much less than her 17-year average of 15 hours a week. But the timing of the athlete's training changed dramatically over the course of her pregnancy.

In the first trimester, from weeks 1-12, Bjørgen trained about 12.9 hours per week, which was 79 per cent of the same period's pre-pregnancy training. However, this period coincided with her recovery period after the competition season, where the training load normally is low.

Her training levels increased during her second trimester (weeks 13-28) to an average of 18.3 hours per week, or 86 per cent of her pre-pregnancy training load. Her training levels dropped during the last trimester, when she trained an average of 8.8 hours per week, or 46 per cent of her pre-pregnancy levels.

Not surprisingly, as her due date approached, she progressively dropped her training intensity and load, until by the last three weeks of her pregnancy, she was training an average of 5.6 hours per week.

"For example, the absolute volume done by our athlete is much higher than the average 8.4 h/week suggested for a rapid return to competitive sport without jeopardizing the foetus's health," Solli said. "It is definitely the highest training volume during pregnancy ever reported in the literature."

Different modes of training

Solli says that Bjørgen's ability to train at such a high volume might partially be due to the different exercise modes that are involved in training for XC-skiing, which reduces the mechanical stress on the body compared to running. Another factor is likely due to her high pre-pregnancy training volume —roughly 940 hours per year.

However, her advancing pregnancy did influence Bjørgen's decision to run.

"Marit reported increased soreness in the muscles around her hip after running sessions during the third trimester, and stopped running approximately 6 weeks before giving birth," Solli said.

Other studies have also found that pregnant athletes tend to cut back on running as their due dates approach.

"It's probably caused by increased body weight and the changes in biomechanical stress as the mother's centre of gravity changes during pregnancy," she said.

After the baby arrived

Once Bjørgen's son was born on December 26, 2015, she jumped right back into training—perhaps a little too rapidly. In week 1-6 postpartum, she progressively increased her training up to 11 hours a week. In week 7-12 postpartum, she further increased her training volume up to 19 hours a week. But in week 13-18, Bjørgen suffered a fracture in her sacrum, followed by a second fracture on the other side of her sacrum in week 19-24 postpartum.

Solli suspects Bjørgen increased her training load too quickly given that the calcium needed by growing foetus during the third trimester, coupled with the calcium drain that results from breast feeding made Bjørgen more susceptible to the fractures.

"It is likely that pregnancy is a vulnerable period for the mother's bones," Solli said. "This is something elite athletes especially should be aware of."

After this initial setback, Bjørgen reduced her amount of moderate- and high-intensity training and substituted running with cycling for the seven subsequent weeks.

Exceeded pre-pregnancy measures

In total, Bjørgen trained for 923 hours over 540 sessions during the 61-week period after delivery until she successfully participated in the World Championships in Lahti, Finland.

By the time she reached the World Cup competition, Bjørgen had returned to or exceeded different pre-pregnancy measures of fitness. For example, her post-pregnancy VO₂max and lactate thresholds were back to or above pre-pregnancy levels. While her post-pregnancy weight increased by 0.6 kg, her overall percentage body fat had dropped from 12.8 percent to 11.3 percent.

Solli says Bjørgen shows that world-class cross-country skiers can indeed tolerate high training loads during pregnancy and during a postpartum year.

"But it seems to be important to eliminate high-intensity training during pregnancy, as well as gradually reduce the training load and modify any strength [training](#) routines," Solli said.

More information: Guro S. Solli et al, Training Characteristics During Pregnancy and Postpartum in the World's Most Successful Cross Country Skier, *Frontiers in Physiology* (2018). [DOI: 10.3389/fphys.2018.00595](https://doi.org/10.3389/fphys.2018.00595)

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