

Physical activity during pregnancy: benefits, risks, and recommendations

Stefan Kostić

Synergy Trening Centar, Novi Sad, Serbia

*Correspondence: kosticstefan029@gmail.com

Abstract: Physical activity during pregnancy is the subject of numerous fears and prejudices, although an increasing number of scientific works confirm the safety of exercise and multiple benefits for the mother and fetus. The aim of this paper was to review the literature related to the impact of physical activity during pregnancy, with special reference to potential risks, benefits, and recommended forms of exercise. The literature shows that exercise during pregnancy is not associated with an increased risk of preterm birth or miscarriage in healthy pregnant women. Controlled exercise during pregnancy contributes to the prevention of gestational diabetes, back and pelvic girdle pain, excessive weight gain, obesity, and pelvic floor muscle dysfunction. Physical activity has proven to be important in maintaining the metabolic health of pregnant women and preparing the body for the physical demands of childbirth. However, the choice and intensity of exercise must be individualized and coordinated with the health condition of the pregnant woman and the recommendations of the gynecologist. Based on the available literature, it can be concluded that adequate physical activity is desirable and safe during pregnancy.

Keywords: Spontaneous abortion; Premature birth; Excessive weight gain during pregnancy; Obesity; Gestational diabetes; Pain in the back and pelvic girdle; Incontinence

1. Introduction

Less than 20% of healthy pregnant women meet the minimum recommendations for exercise in the II trimester of pregnancy (at least 30 minutes/day of moderate-intensity activities), with walking being the most common exercise adopted by active pregnant women. The main reason pregnant women give for not exercising regularly is a lack of knowledge or evidence-based information on the topic [1].

2. Exercise During Pregnancy

Leading the STRONG MOMS program in the period from May 2025 to March 2026, statistics were collected showing the outcomes of the pregnancies of program participants (Figure 1). The data show that 36% of male children and 29% of female children were born in the mentioned period, while 35% of the participants are currently pregnant. These results indicate the continued growth and development of the community of women involved in the program, as well as the increasing interest in professionally guided physical activity during pregnancy. The STRONG MOMS program is based on safely programmed and individually adapted training with the aim of preserving the mother's health and support during all stages of pregnancy.

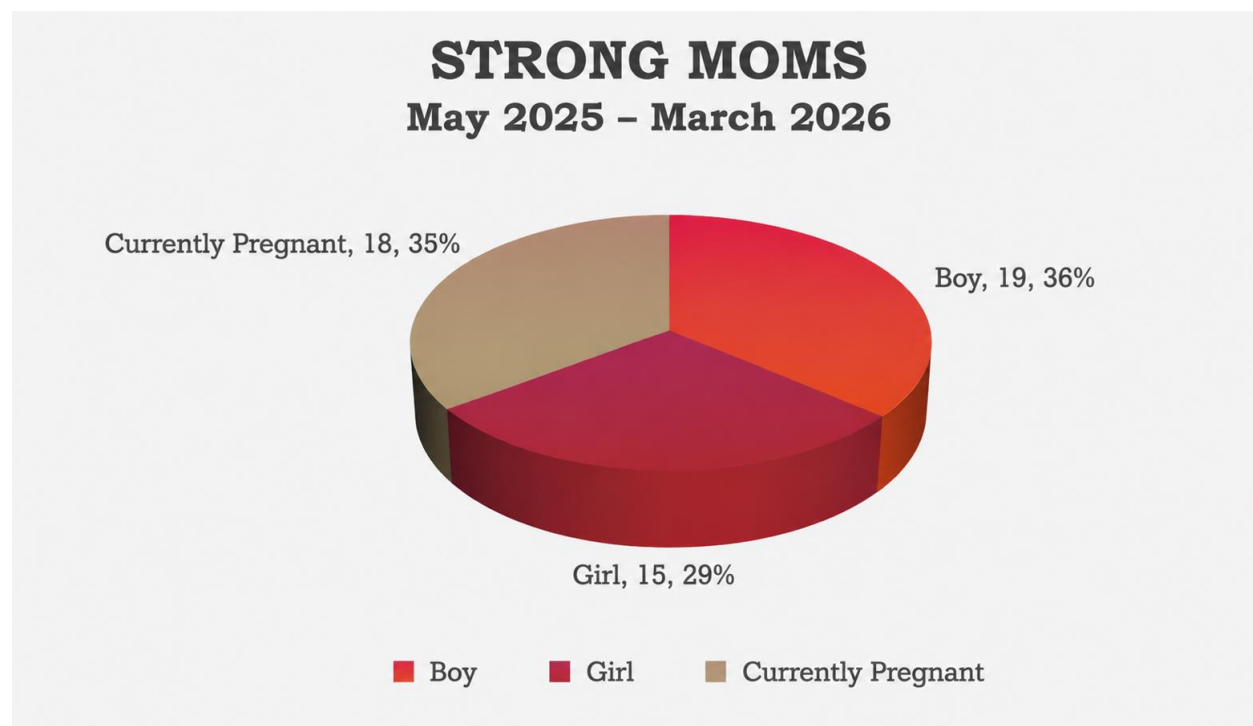


Figure 1. Statistics of pregnancy and childbirth in the STRONG MOMS program (May 2025 - March 2026)

The presented data represents descriptive statistics of the STRONG MOMS program participants and are provided for illustrative purposes only, without the intention of drawing statistical or causal conclusions.

2.1. Risk of miscarriage as a consequence of exercise

Spontaneous abortion is the unwanted loss of pregnancy before the 20th week (although in some countries, the 22nd-24th week is also mentioned as the upper limit). Miscarriage is a common adverse outcome, occurring in approximately 15% of all

pregnancies [2]. Perinatal mortality (PM) rates in the United States are about six per 1,000 live births [3].

A systematic review of all studies on this topic concludes that there are no published studies on spontaneous abortions, therefore, exercise during pregnancy is beneficial and safe [4]. The risk of miscarriage in women who exercise during pregnancy was assessed by a meta-analysis and a systematic review, and neither found a significant correlation, suggesting that exercise is not associated with this outcome [5].

One study found that the risk of miscarriage for a fetus with normal chromosomes was reduced in women who exercised, compared to those who did not. Exercise may have a protective effect [6]. Regarding higher-intensity exercise, research is limited, but so far, there is no evidence to suggest that vigorous exercise is harmful (in women with a previously high level of fitness) [7].

Two studies suggest that there is an association between exercise and miscarriage in very specific situations. The first shows that there was a gradually increasing relationship between the amount of exercise and the risk of miscarriage in women who exercised more than 7 hours per week compared to women who did not exercise. In particular, high-impact exercise was associated with an increased risk of miscarriage. No association was observed between exercise and the risk of miscarriage after 18 weeks of gestation [8].

By "high impact" activities, it was understood, first of all, sports with a ball, which are definitely not recommended during pregnancy due to the risk of falling and injuring the mother and child or a blow to the abdomen, due to similar consequences. Also, the amount of exercise of more than 7 hours per week is very high and is fulfilled in a very limited number of cases.

Another study speaks of the existence of a sensitive period around implantation during which short-term, very intense physical exertion can increase the risk of spontaneous abortion [9].

Given that the period of implantation occurs around the 3rd week of pregnancy, when most women still do not know that they are pregnant, the question arises of the practical application of the results of this research in the context of training programming.

2.2. Risk of premature birth as a consequence of exercise

It has been shown that the risk of preterm birth (PTB) in women who exercised during pregnancy was not only not increased, but was actually reduced [5]. Several studies

that focused on intense sports training several times a week during pregnancy found that it was associated with a reduced or unchanged risk of preterm birth [10].

Considering specific population types, PTB was not associated with exercise in overweight and obese women [11], previously inactive women [12], or women of normal weight [13].

MoBa (The Norwegian Mother and Child Cohort Study) with 61,098 pregnant women showed lower rates of preterm birth in women who exercised 3 to 5 times a week at 30 weeks of gestational age [14].

Women with a shortened cervix, after diagnosis, in the vast majority of cases, receive a recommendation from the doctor to reduce the amount and intensity of their physical activity as a precautionary measure, although Saccone et al showed that in asymptomatic singleton pregnancies with a short cervix, exercising >2 days a week for >20 minutes each day does not increase the risk of preterm birth [15].

3. Why It Is Dangerous NOT to Exercise During Pregnancy

A sedentary lifestyle during pregnancy is associated with numerous unwanted pregnancy conditions, such as obesity, i.e., excessive weight gain during pregnancy, then gestational diabetes, as well as problems related to the locomotor system, first of all, back and pelvic girdle pain and pelvic floor muscle dysfunction (incontinence).

Although in the prevention of excessive weight gain during pregnancy and gestational diabetes, proper nutrition is certainly a central topic, exercise is certainly a tool that contributes a lot to achieving these goals, both through direct physiological benefits and indirectly through a healthy, active lifestyle.

On the other hand, in the prevention of pain in the back and pelvic girdle, as well as incontinence, the only proven, effective approach is well-programmed and dosed exercise, which will improve the reduction of complaints by strengthening the surrounding musculature.

4. Exercise and Maternal Obesity

There is an association between excessive gestational weight gain (GWG), based on IOM recommendations, and an increased likelihood of being overweight or obese during the follow-up period.

Mamun et al followed 2,055 women over a period of 21 years and found a direct association between excessive gestational weight gain based on IOM recommendations and later overweight or obesity.

A woman who gives birth with excess weight compared to the weight she had before pregnancy faces real challenges in reducing body weight, such as the lack and impossibility of organizing free time, which would be used for physical activity aimed at this goal, then a bad self-image, a feeling of helplessness and depression, which arose after dealing with a changed body and an unexpectedly slow recovery after childbirth.

Due to all this, it is quite realistic to expect that a woman will enter the second pregnancy less prepared, compared to the first, after which, after repeating the same bad habits in terms of nutrition and physical activity, she will create even more extra pounds, which will be even more difficult for her to lose, due to the amplification of all of the above. This is what the practical implication of what Mamun et al. showed looks like [16].

Excessive weight gain during gestation is associated with a higher incidence of maternal and neonatal complications, including hypertensive disorders of pregnancy, fetal macrosomia, and increased cesarean delivery rates by as much as 30% [17].

In most of the scientific community, the recommendations of the Institute of Medicine (USA, Washington) from 2009 are still current (Table 1).

Table 1. Recommendations for gestational weight gain according to the 2009 Institute of Medicine and National Research Council report.

Pre-pregnancy BMI Category	Total Weight Gain (lb, kg)	Rate of Weight Gain (2nd and 3rd Trimester) (lb/week, kg/week)
Underweight (<18.5 kg/m ²)	28 – 40, 12.5 – 18	1.0 (1.0 – 1.3), 0.51 (0.44 – 0.58)
Normal weight (18.5–24.9 kg/m ²)	25 – 35, 11.5 – 16	1.0 (0.8 – 1.0), 0.42 (0.35 – 0.50)
Overweight (25.0–29.9 kg/m ²)	15 – 25, 7 – 11.5	0.6 (0.5 – 0.7), 0.28 (0.23 – 0.33)
Obesity (≥30.0 kg/m ²)	11 – 20, 5 – 9	0.5 (0.4 – 0.6), 0.22 (0.17 – 0.27)

4.1. Maternal Complications

There is an association between excessive gestational weight gain (GWG), based on IOM recommendations, and an increased likelihood of being overweight or obese during the follow-up period [16]. In conclusion, excessive GWG during pregnancy is associated with hypertensive disorders in pregnancy.

Previous studies have found an increased risk of hypertensive disorders, including preeclampsia and gestational hypertension, in women with excess GWG regardless of prepregnancy BMI. Hypertensive disorders in pregnancy are associated with a lifetime risk of cardiovascular disease.

A 2017 meta-analysis evaluated cesarean section as an outcome from 8 observational studies of singleton pregnancies and included 266,263 study participants. The analysis found a 30% increased chance of cesarean section in women who gained more than recommended by the IOM guidelines. In conclusion, excessive GWG during pregnancy is associated with hypertensive disorders of pregnancy [18].

4.2. Fetal Complications

Sridhar et al conducted a prospective cohort study in which 4145 women were evaluated. Among these women, 20.4% had excessive GWG and 14.5% had adequate GWG. The authors found a 46% increased likelihood of obesity between ages 2 and 5 in children born to women with excess GWG during pregnancy [19].

A 2017 prospective cohort study of 845 women and their babies found an increase in subcutaneous fat in babies whose mothers were obese or overweight [20].

Forno et al analyzed the results of 14 studies (N = 108,321 woman-child pairs), of which 5 assessed the association between GWG and childhood asthma. They found a slightly increased likelihood of childhood asthma in children of women with high GWG [21].

5. Exercise and gestational diabetes

Gestational diabetes mellitus (GDM) is defined as glucose intolerance that occurs or is first discovered during pregnancy. All the food that a person eats is eventually converted into glucose, and in that form, it enters all the cells of the body through the bloodstream to

provide them with energy. On the other hand, the pancreas secretes insulin that allows glucose to enter the cell (Figure 2).

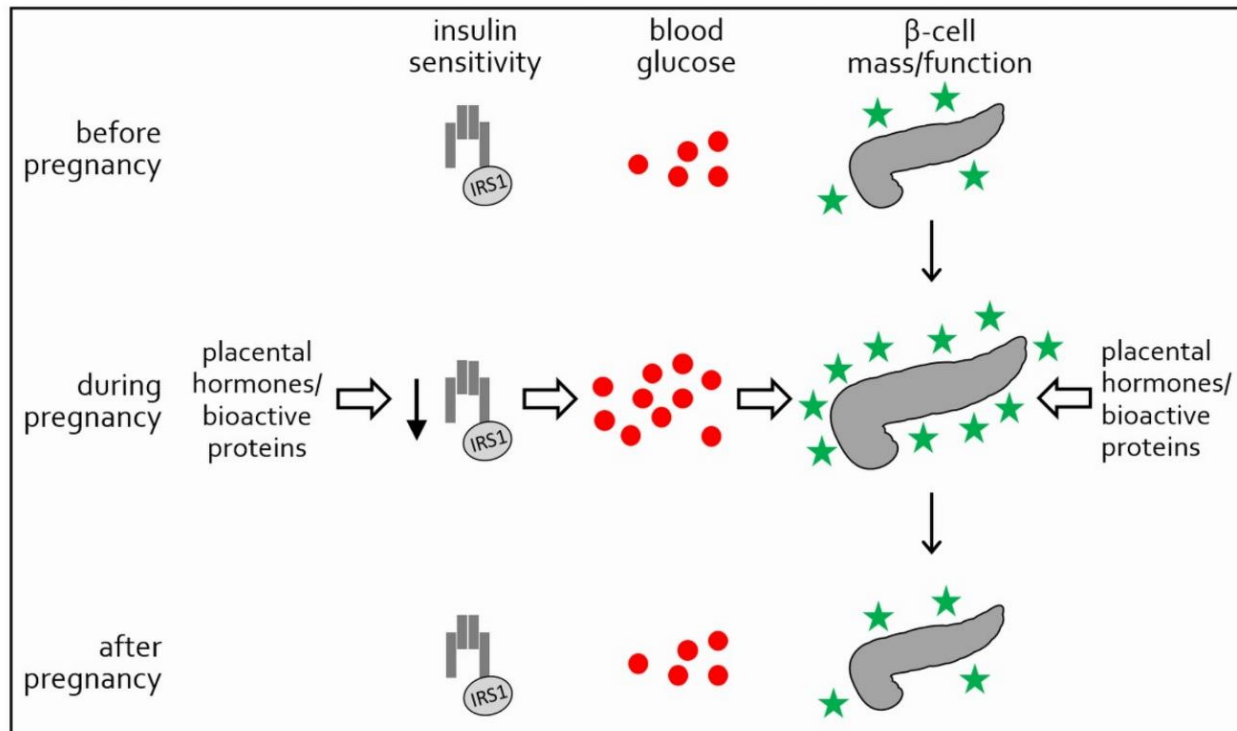


Figure 2. Insulin sensitivity, blood glucose, and β -cell mass and function during normal pregnancy. As a consequence of insulin resistance induced by placental hormones, blood glucose rises (red circles). Due to elevated blood glucose and several placenta-derived hormones and bioactive proteins, β -cells undergo hyperplasia and hypertrophy and produce higher amounts of insulin (green stars). Copyright [22]

During pregnancy, the cells' sensitivity to insulin changes - it decreases, and as a result, a larger amount of glucose is available in the bloodstream. The reason why this body works is most likely so that more energy is available for the development of the fetus. One of the key culprits for this adaptation is the temporary placental organ, which, among other things, secretes hormones that reduce cell sensitivity to insulin. After delivery and removal of the placenta, the sensitivity of cells to insulin, which in the third trimester is similar to the values of type II diabetics, returns to its pre-pregnancy state in just a few hours [23].

At the same time, the beta cells of the pancreas must produce more insulin to compensate for the reduced sensitivity of the cells to insulin. In the treatment of insulin resistance and type II diabetes, it is generally known that one of the basic therapies is

physical activity. Why is physical activity such an important tool in these conditions? Namely, the muscle tissue needs a large amount of energy in its work, which it receives, among other things, through the glucose found in the bloodstream. Also, muscle contraction activates GLUT-4 proteins, which move to the membrane and allow glucose to enter the cell, independently of insulin.

Pregnancy requires increased energy intake, which, according to available guidelines, is in the range of +90 kcal/day in the first trimester, +287 kcal/day in the second trimester, and +466 kcal/day in the third trimester. In practice, this means that as the pregnancy progresses, the woman will be much hungrier and very likely to eat more than she really needs. If we add to that the very present prejudices that a woman should reduce her physical activity during pregnancy, we have perfect conditions for the appearance of gestational diabetes.

Decreased sensitivity of cells to insulin, increased pressure on the pancreas to secrete a sufficient amount of insulin to compensate for this, then we have increased caloric intake that further increases blood glucose levels and insufficient physical activity, where we do not use muscle work as a tool to reduce blood sugar and relieve the overworked pancreas, lead to its inability to produce sufficient amounts of insulin and the appearance of gestational diabetes.

In addition to the short-term consequences of gestational diabetes, such as preeclampsia, difficult childbirth, and cesarean section, there are also much more far-reaching consequences that are not only related to pregnancy but also to the period after it, namely: type 2 diabetes, cardiovascular diseases, obesity, and malignancy.

This way of life also has consequences for the child. Short-term complications are fetal macrosomia, which increases the likelihood of injuries during childbirth, while long-term complications are glucose intolerance, obesity, and cardiovascular diseases. The likelihood of gestational diabetes can be reduced by at least 25% with 140 minutes of moderate-intensity activity per week [24].

The reduction in risk of gestational diabetes is greater when weight training and aerobic training are combined [25].

Long-term and short-term complications for mother and offspring in mothers with gestational diabetes mellitus are given in Figure 3.

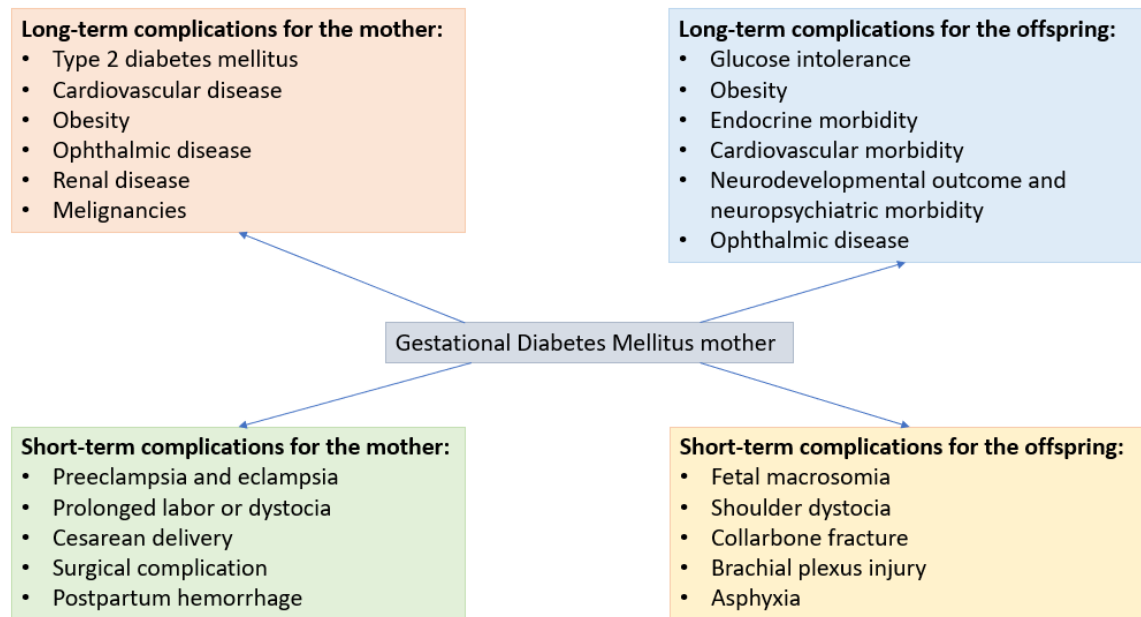


Figure 3. Long-term and short-term complications for the mother and offspring within gestational diabetes mellitus mother

6. Problems with the locomotor apparatus (pain in the back and pelvic girdle, incontinence)

Although the research shows that the frequency of pain in the back and pelvic girdle during pregnancy was 63%, most of the participants (80.4%) had both [26], while as many as 93% of women who experience these complaints during pregnancy experience a spontaneous recovery up to 6 months after childbirth [27]. This does not mean that these conditions are normal and that a woman cannot do anything to prevent or control them during pregnancy.

The main reasons for the occurrence and prevalence of these symptoms are the increased weight of the fetus, which puts pressure on the structures of the lower part of the body, as well as the increased flexibility of the joints under the influence of the relaxin hormone, which aims to prepare the woman for the opening of the sacral bone and childbirth itself.

7. Recommended Types of Physical Activity

In order to be able to recommend some form of physical activity to women, we first need to see what it offers. Several types of exercise are offered, namely: yoga for pregnant women, pilates for pregnant women, and weight training. Also, what should not be neglected is the walk, which, being the least intense, is the easiest to recommend.

One should be very careful in labeling some activities as good and some as bad, primarily due to the generally low level of activity in this population, so I would say that any type of activity conducted by a trained professional, which does not harm the woman and for which there is approval from the selected gynecologist, which will be reviewed at regular monthly gynecological examinations, is good.

Also, the question of comparison is a very complex request that requires a separate scientific work, however, I will present an interesting concept, which could lead to an answer. Namely, the ultimate goal of any training program during pregnancy should be the psychophysical preparation of the woman for childbirth itself. Therefore, we are interested in what kind of intensity profile a woman experiences during childbirth, so that we can prepare her for the same.

A study was conducted at the University Hospital in Geneva on 30 women, which looked at the women's pulse during childbirth, and also examined their levels of physical activity in the third trimester. The conclusions are fascinating:

- Maternal heart rate during the second stage of labor, and especially during active pushing, increases to levels comparable to those seen during moderate to vigorous physical activity.
- Maternal heart rate reaches higher levels during labor in women with lower usual levels of physical activity compared to those who are more physically active.
- Utilization of heart rate reserve for labor effort is increased in physically inactive women and may potentially limit the intensity and duration of pushing effort.
- Such greater cardiovascular effort in less physically active women may represent an increased cardiovascular risk during childbirth [28].

Therefore, childbirth is, according to its load profile, a moderate to heavy physical activity, with a distinctly interval character. In this light, we can easily conclude that activities such as walking, yoga, and pilates for pregnant women do not simulate this profile. By their nature, they are activities of low to moderate intensity with a very unified character.

The question arises, which activity best corresponds to this intensity profile. Based on the available data, it can be assumed that certain elements of interval training may

contribute to better physical preparation for the demands of childbirth, but further research is needed (Figure 4) [29].

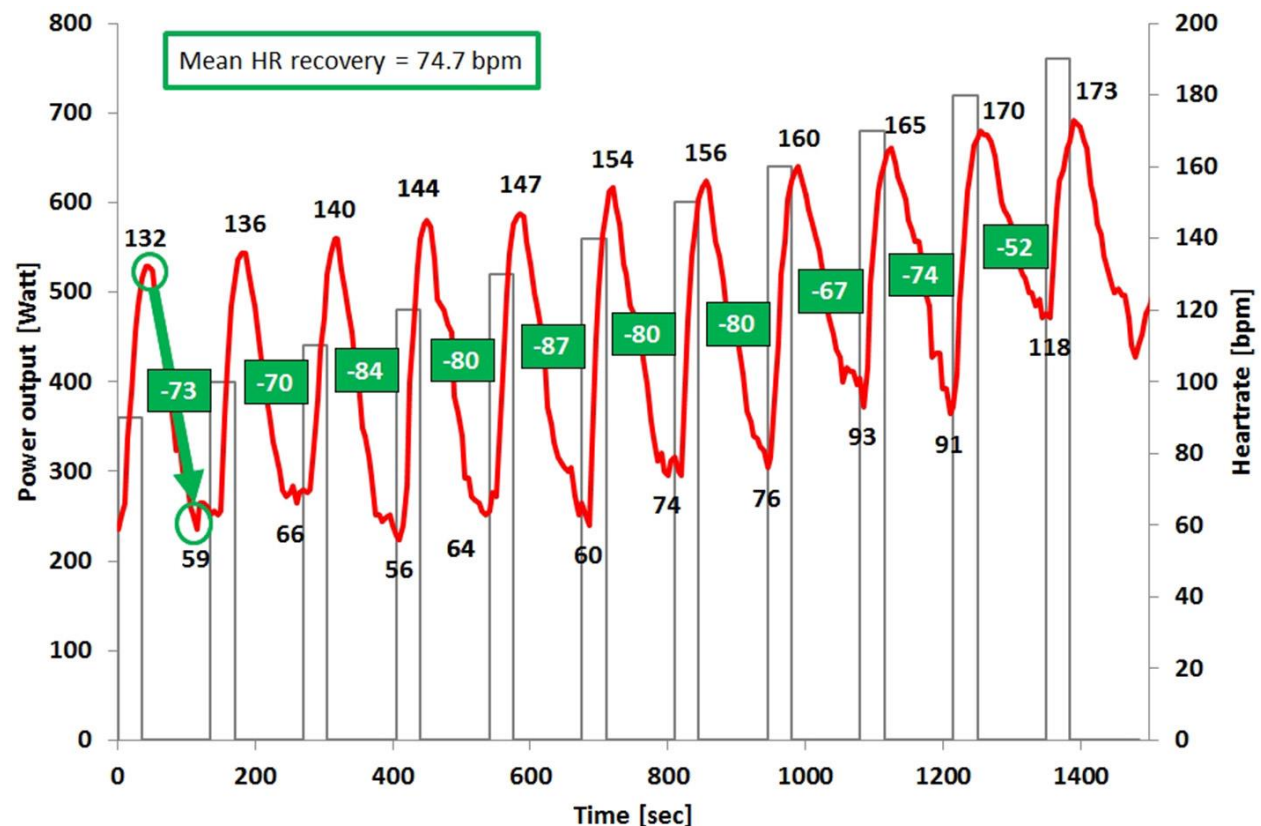


Figure 4. Illustration of the heart rate-time curve and the heart rate recovery calculation within the MART/MACT of one subject [29]

8. Conclusion

The question arises why a worryingly small number of pregnant women meet the basic criteria regarding the amount of exercise during this period. Is exercise during pregnancy really something to be avoided and feared? Based on a detailed review of scientific papers, we come to the conclusion that the absolute majority of papers speak affirmatively about exercise, with the exception of a few papers with very specific and, for the general population, completely irrelevant conclusions regarding the potential dangers associated with exercise.

So, not only is exercising during pregnancy safe, it is actually very unsafe not to be physically active during pregnancy. In fact, by far the most dangerous thing for a pregnant

woman is not lifting more than 5 kg, doing squats, or climbing stairs, but being physically inactive. Physical inactivity during this period increases the likelihood of developing conditions such as gestational diabetes, excessive weight gain during pregnancy, pain in the back and pelvic girdle, incontinence, etc.

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