CASE REPORTS

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Aerobic physical exercise in the third trimester in pregnant woman with Hashimoto's thyroiditis – A case report

Fizičko vežbanje aerobnog tipa tokom trećeg trimestra kod trudnice sa Hašimotovim sindromom

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Abstract

Introduction. Physical exercise and thyroid function affect the course and outcome of pregnancy. Pregnancy conversely has an effect on exercise and the secretion of thyroid hormones. It is recommended that pregnant women without medical or obstetric complications engage in physical exercise, as correct exercise and suitable hormonal therapy reduce the risk of a negative course and outcome of the pregnancy. **Case report**. A 33-year-old marathon runner with diagnosed Hashimoto's thyroiditis continued to run until she was ready to give birth. The recorded parameters were body mass, and scope and intensity of running. In the third trimester, additional recorded parameters were blood pressure, pulse, blood glucose, prolactin, cortisol and thyroid hormones [thyroxine (T4 and thyroid-stimulating hormone (TSH)]. Foetus growth and development, as well as the status of the subject's health, were monitored at regular endocrinological and gynaecological examinations. There was an expected increase in body mass during pregnancy, which resulted in a reduction in the running distance and intensity. TSH, cortisol and prolactin blood levels were increased. Statistically, significant correlation has been obtained between TSH and the intensity of running ($r = 0.864$; $p = 0.027$). Using the method of cardiotocography (CTG), the average pulse rate in the lower reference range has been recorded (118 bpm). The delivery was induced at the scheduled date. There were no complications in the course and outcome of the pregnancy. **Conclusion**. Moderate to light aerobic physical exercise had no negative effect on the course and the outcome of the pregnancy in the subject with Hashimoto's thyroiditis.

Key words:
pregnancy; fetal development; hashimoto thyroiditis; exercise; delivery, obstetric.

Apstrakt

Uvod. Fizičko vežbanje i rad štitaste žljezde utiču na tok i ishod trudnoće, kao što i trudnoća utiče na vežbanje i lučenje tiroidnih hormona. Trudnicama bez medicinskih ili akušerskih komplikacija preporučuje se fizičko vežbanje. Pravilnim vežbanjem i odgovarajućom hormonskom terapijom smanjuje se mogućnost negativnog toka i ishoda trudnoće. **Prikaz bolesnika**. Prikazana je 33-godišnja maratonka sa dijagnostikovanim Hašimoto tireoiditisom koja je nastavila sa trčanjem do porođaja. Od parametara praćeni su: telesna masa, obim i intenzitet trčanja, a u trećem trimestru: krvni pritisak, puls, nivoi glukoze, prolaktina, kortizola i tiroidnih hormona [tiroksina (T4) i tiroidnog stimulišućeg hormona (TSH)] u krvi. Na redovnim endokrinološkim i ginekološkim pregledima praćen je rast i razvoj fetusa, kao i zdravstveno stanje trudnice. Tokom trudnoće došlo je do očekivanog povećanja telesne mase koji je uticalo na smanjenje obima i intenziteta trčanja. Nivoi TSH, kortizola i prolaktina u krvi bili su povećani. Utvrđena je statistički značajna korelacija između TSH i intenziteta trčanja ($r = 0,864$; $p = 0,027$). Kardiotahografijom (KTG) zabeležena je srednja vrednost pulsa (118 udara u minuti) koja se kretala u granicama donje referentne vrednosti. U predviđenom terminu indukovan je porođaj. Tok i ishod trudnoće protekli su bez komplikacija. **Zaključak**. Fizičko vežbanje aerobnog tipa, umerenog do lakog intenziteta, nije imalo negativnog uticaja na tok i ishod trudnoće kod trudnice sa Hašimoto tireoiditisom.

Ključne reči:
trudnoća; trudnoća, razvoj fetusa; tireoiditis, limfomatozni; vežbanje; porođaj.

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Introduction

Pregnancy is a state of various anatomic and physiological changes [1]. One of the factors that influence the quality of life during pregnancy is physical activity [2]. It is recommended that pregnant women without medical or obstetric complications engage in physical exercise [1]. In order to prevent possible adverse events, at least 30 minutes of light to moderate exercise is recommended daily [1]. Apart from preventing certain chronic illnesses (gestational diabetes, preeclampsia, hypertension, and obesity) exercise during pregnancy improves cardiovascular function, metabolic consumption and insulin resistance in pregnant women [1, 3].

In the case of an autoimmune disease spontaneous abortion, early parturition and foetal anomalies are more common [4]. Thyroid function disorders are also common during the woman's reproductive period [4]. Appropriate hormonal therapy helps to maintain mother's health and affects the foetus's growth and development [4–6].

Studies have shown that exercise and the proper functioning of the thyroid gland have a significant effect on the course and the outcome of pregnancy [1, 4, 7, 8]. The survey of the literature yielded no data regarding the effect of exercise in a complicated pregnancy. In this case report, the course and outcome of pregnancy in a woman with Hashimoto's thyroiditis who continued to exercise during pregnancy were presented by monitoring the cardiovascular, hormonal status, and training load.

Case report

The presented subject was a 33-year-old primipara with a single pregnancy. She had competed in marathons for the last five years. The important morphological pregnancy parameters measured before the pregnancy were: body mass index [(BMI = weight (58.7 kg) / height (1.764 m)^2 = 18.9 kg/m^2)], muscle mass (50%), and body fat percentage (8.7%). Family medical history shows cases of thyroid function disorder. She had been diagnosed with Hashimoto's thyroiditis prior to the pregnancy. In the fifth week of the pregnancy, the hormonal therapy with levothyroxine sodium was increased from 25 mg to 50 mg.

The subject continued to run regularly until the last week of the pregnancy. The subject's daily training load depended upon her functional ability and subjective wellbeing. In the third trimester the number of training sessions per week and the length of the runs were reduced (seventh month: 6 training sessions *per* week, 7 km each; eighth month: 5 training sessions per week, 5 km each, ninth month: 4 training sessions *per* week, 5 km each); and the intensity of the run remained moderate to light (4:30–6:15 min/km). Body mass and length of running were measured throughout the pregnancy. Additionally, in the third trimester blood pressure, pulse, blood glucose, prolactin, cortisol, and thyroid hormones [thyroxine (T4) and thyroid-stimulating hormone (TSH)] were measured. Foetus growth and development, as well as the subject's health status were monitored at regular endocrinological and gynaecological examinations.

A detailed analysis of the parameters was performed occasionally. The pulse and blood pressure were recorded before the training session, (at 8 a.m.), during the training session (3rd kilometer) and during the first and the second minute of the recovery period. At the end of each month, the average values of the measured parameters (scope, intensity, pulse, blood pressure, and BMI) were calculated. The instruments used were a pulsemeter (Garmin Forerunner 310XT), a digital blood pressure and pulse monitor (Omron M3), and a digital scale. The exercise load and subjective wellbeing were recorded in a log. Foetal pulse was monitored by a cardiotocography (CTG). Prior to each CTG examination, the subject's pulse was measured by a manometer device.

The parameters indicative of increased stress were measured before, at the end, and one week after a training cycle. Thyroid hormones (T4, TSH) were monitored regularly throughout the pregnancy every 4–6 weeks. Blood hormones were measured in laboratory conditions (using the electrochemiluminescence method) in the morning hours. Among the thyroid hormones (T4, TSH) results, which were monitored regularly throughout the pregnancy every 4–6 weeks, three results were isolated within the training cycle. An oral glucose tolerance test (OGTT) was carried out in the 28th week.

At the last sonography examination in the 39th week of the pregnancy, a reduction in the amount of amniotic fluid was observed. Rhythmic cardiac function and normal pulse were observed in the foetus (127 bpm). The umbilical artery blood flow was normal. The delivery was triggered by induction due to the low amniotic fluid. There were no complications in the course and outcome of the pregnancy. A eutrophic female infant, 48 cm and 3.060 g in size with the highest possible Apgar score (10/10) was delivered vaginally at the scheduled date (39th week + 4 days). The circumferences of the head, chest, and shoulders were 33 cm, 33 cm, and 35 cm, respectively. The pulse was 122 bpm and the respiration rate was 44. The infant was born with jaundice (bilirubin 184 μmol/L). Body fat was 0.5%. Natural nutrition by breast feeding was established.

One hour following delivery, the subject had a pulse (80 bpm) and low blood pressure (90/55 mmHg), with a body mass 68 kg. The morphological parameters one week after delivery were as follows: BMI = [weight (62.9 kg) / height (1.764 m)^2 = 19.9 kg/m^2)], muscle mass (34.7%), and body fat (20.3%).

The parameters measured were processed in the SPSS programme (IBM SPSS Statistics 20). By computing the Pearson's correlation coefficient, a high correlation and statistical significance between BMI and distance ($r = -0.845$, $p = 0.001$), BMI and intensity ($r = 0.860$, $p = 0.001$), as well as the distance and intensity of the running ($r = -0.866$, $p = 0.001$), was found. The values of running parameters are presented graphically (Figure 1). The comparison of thyroid hormone levels and training load showed the statistically significant correlation between the TSH levels and running intensity ($r = 0.864$; $p = 0.027$). Other blood parameters showed no statistically significant correlation with the training load during the third trimester. The results of the blood glucose tests were within the reference value limits,

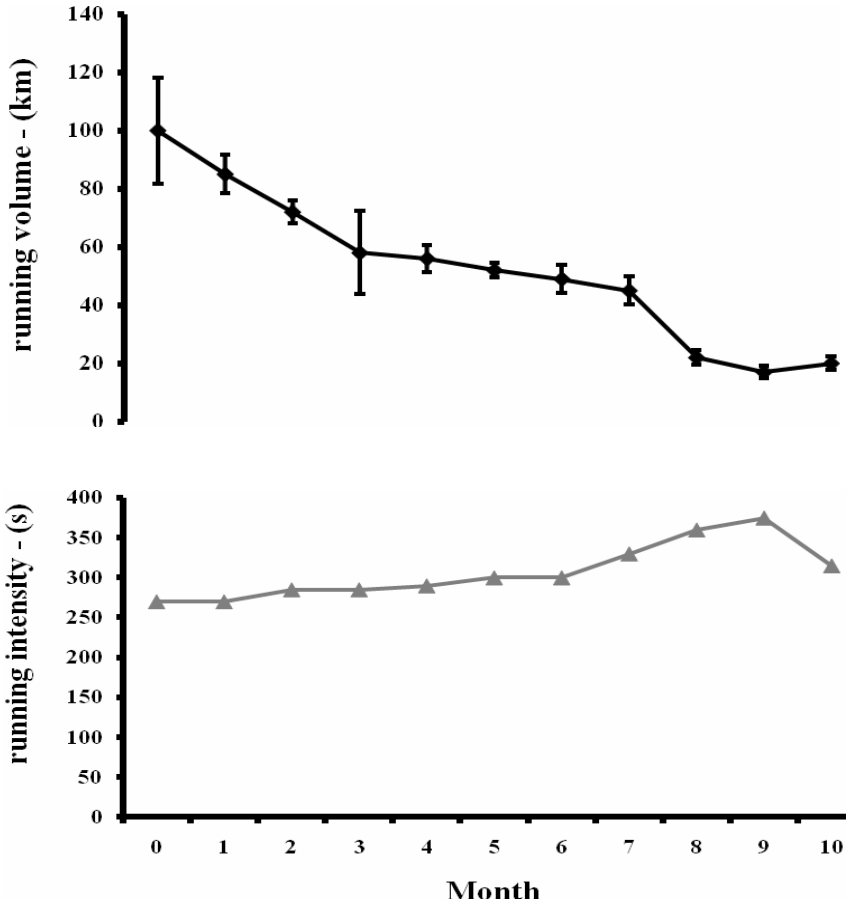

Fig. 1 – Average values of running volume (upper graph) and running intensity (lower graph) during pregnancy and one month after the delivery in marathon runner with Hashimoto thyroiditis; *0 – one month prior to pregnancy; 1-9 – during the pregnancy; 10 – one month after the delivery; running volume: kilometers/week; running intensity; running time in seconds/km/week.

while the OGTT results (with 75 g of glucose) showed hypoglycemia (immediately after ingestion: 4.5 mmol/L; after 1 hour: 4.0 mmol/L; and after 2 hours: 2.0 mmol/L). The T4 values were within normal limits, and the TSH values were slightly above the reference value for pregnancy. Cortisol and prolactin levels were also significantly higher than the upper reference value limit (Table 1). CTG images showed a mean foetal pulse (118.0 ± 14.8 bpm) within the lower reference value range (Figure 2). Before the CTG measurement, the subject's blood pressure (systolic: 114 ± 12.4 mmHg, diastolic: 74 ± 4.5 mmHg) was within normal value limits. Also, a CTG image from the 39th week of the pregnancy showed foetal pulse changes (Figure 3). In the third trimester normal values of morning blood pressure and pulse were recorded (approximately 114/62 mmHg and (57 bpm, respectively). Lower values of blood pressure (approximately 150/70 mmHg) and elevated pulse (approximately 119 bpm) were recorded during running in the last week of the pregnancy. During the recovery lower pulse values were recorded at the beginning of the third trimester (approximately 82 bpm), than during the last week of the pregnancy (approximately 107 bpm).

Table 1

The values of laboratory parameters

Measurement	Cortisol (mmol/L)	Prolactin (μU/mL)	Glucose (mmol/L)	T4 (pmol/L)	TSH (mIU/L)
	Rv 171–536	Rv 102–496	Rv 4.1–6.1	Rv 9.1–19.1	Rv 0.35–4.94
1st	1096	2752	4.4	11.9	2.73
2nd	1148	2798	4.3	13.1	3.57
3rd	837	4095	4.2	14.3	4.43

Rv – reference values; T4 – thyroxine; TSH – thyroid-stimulating hormone; 1st – at the beginning of the third trimester; 2nd – at the end of the third trimester; 3rd – one week after delivery.

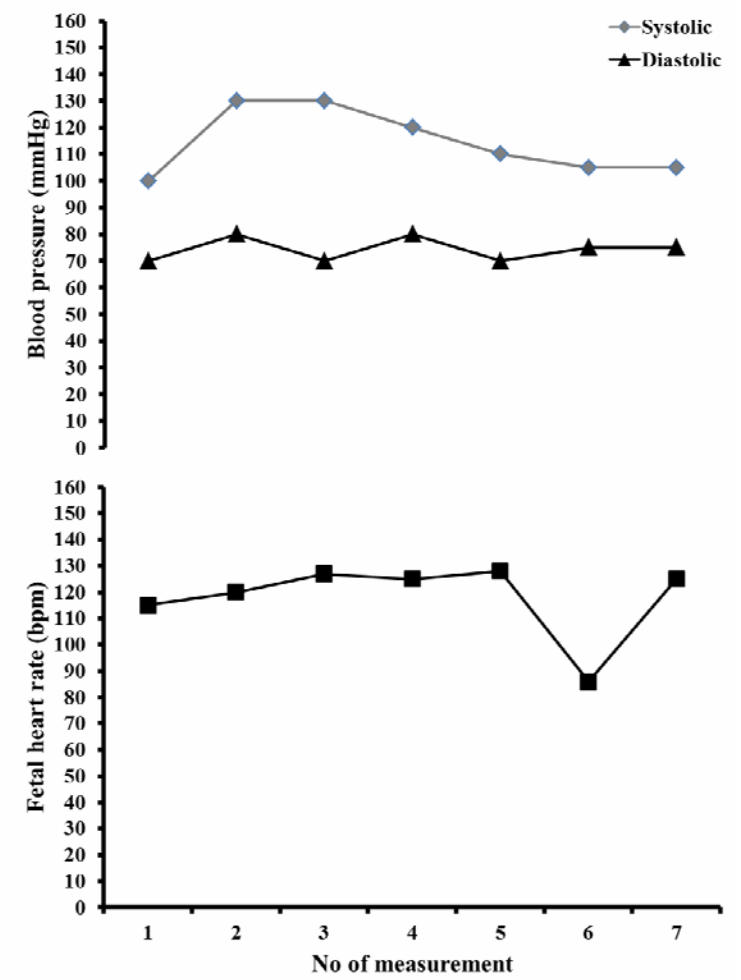

Fig. 2 – Mother′s blood preasure (upper graph) and cardiotocographic (CTG) recording of fetal heart rate (lower graph). (Seventh measurement during the third trimester. Blood preasure measured before CTG recording).

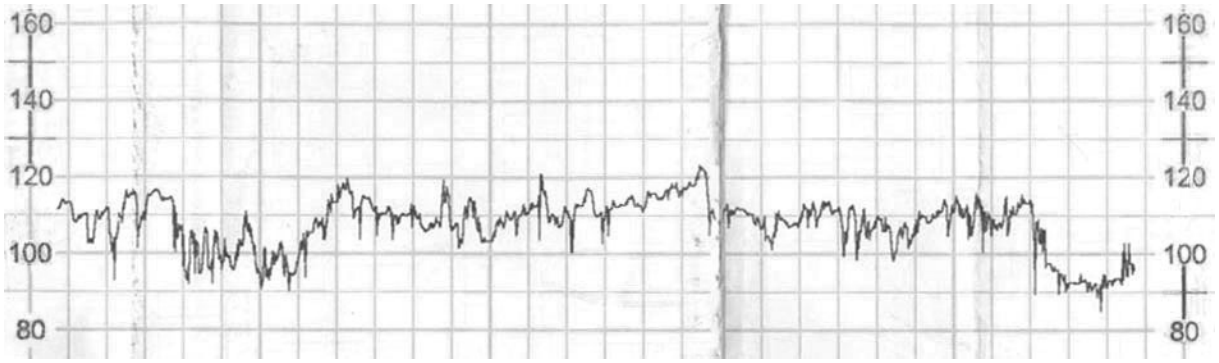

Fig. 3 – Cardiotocographic (CTG) recording of pulse in the foetus in the 39th week of the pregnancy.

Discussion

Low-intensity exercise of a minimum 30 min *per* day reduces the risk of numerous adverse events in pregnant women [1, 2, 8]. The exercise of moderate intensity is defined by the American College of Obstetricians and Gynaecologists' (ACOG) recommendations as 3–4 metabolic equivalent units (METs), i.e. equivalent to fast walking, whereas athletes are recommended a slightly higher intensity of 60–90% of maximum pulse [1]. In light of these recommendations of at least 30 minutes of moderate exercise *per* day, the training load in this study can be considered high, since the running intensity in the first month of the pregnancy was 4:30 min/km and in the last week approximately 6:15 min/km. The length of the runs was reduced from the total 100 km *per* week to 17 km *per* week (Figure 1). If the results are compared to the results of a meta-analysis, in which the subjects trained on average 43 minutes daily, three times per week, with the pulse 144 bpm or lower, the training load in this study is not considered risky [8]. Also, the analysis of the car-

diovascular parameters showed that the subject was very fit and recovered quickly after exercise. Compared to the usual pregnancy problems, reported by physically active and sedentary pregnant women [9], the subject in this study most commonly reported fatigue and lethargy in the afternoon hours during the last two months of the pregnancy.

The graph representation of mean running length and running intensity shows an expected reduction of training load due to the increased body mass. Considering the BMI during the pregnancy, the increase in body mass of 10 kg is considered optimal [10]. The results of the study in which pregnant women with autoimmune disorders were monitored show a higher incidence of gestational diabetes in subjects with hypothyroidism, suggesting the need to monitor glucoregulation [7]. In comparison with the study where pregnant women were not physically active, in this study exercise can be considered one of the factors for the optimal body mass gain. The OGTT test showed transient hypoglycemia, whereas the blood sugar values were within reference values and absence of gestational diabetes. Since the exercise can increase the absorption of blood glucose, the hypoglycemia in a mother can lead to a reduction of glucose availability in foetus and lower infant body weight [3]. The mother's body mass can also affect the birthweight [8, 10]. Individual studies showed no difference in body mass in physically active and inactive pregnant women, yet the lower birthweight and body fat percentage can be attributed to the exercise in the late pregnancy [1, 8, 11, 12].

Very few studies reported exercise having a negative effect during a healthy pregnancy [8]. Although there are no recorded cases of foetal hyperthermia, caution is advised during exercise in high temperatures [1, 8]. In order to reduce the risk of adverse events, in the summertime training times were limited to morning hours. Higher heat dissipation is directly correlated to the running intensity and hydration [1]. In higher temperatures, the subject wore an appropriate sports outfit and was hydrated.

Consistent with a study in which stress hormones were monitored in healthy physically active pregnant women, [3] in this study higher cortisol levels within a training cycle were also recorded. Another stress indicator is a hormone that regulates lactation after the delivery. The measured high prolactin levels are expected in pregnancy. Since the metabolic function is, among other factors, dependent on the excretion of certain hormones, the elevated cortisol, prolactin and TSH levels are expected in physically active pregnant women.

The changes in the cardiorespiratory system during the third trimester cause an elevation of heart frequency for up to 20% [1]. Mean arterial blood pressure in usually lower by 5–10 mmHg, but later returns to the pre-pregnancy state [1]. The measured pulse and blood pressure levels during the training cycle indicate the subject's level of fitness. Pregnant women's physical activity has a significant effect on the pulse in the foetus [13, 14]. The indicator of the pulse rate in a foetus is the mother's pulse while resting and during exercise [15]. CTG monitoring showed normal pulse values (118.0 ± 14.8 bpm) which were close to the lower range of normal CTG values of 110 to 160 bpm [16]. Oxygen supply in the foetus is dependent on mother's circulation, so the lower recorded value in the sixth measurement could be a result of a transient change in the foetal pulse, the so-called deceleration, or hypoxia [16]. The subject's blood pressure, measured immediately before the CTG imaging, showed the systolic and diastolic blood pressure of 100–130 mmHg and 70–80 mmHg, respectively. Studies show that the foetal pulse in physically active mothers is within the recommended value limits, while the results after a high intensity training show lower values (before training: 138.9 ± 8.1 and after training: 126.8 ± 34.4) [13, 14]. The CTG showed foetal pulse changes within the lower reference value (110–160 bpm) [13, 16]. Increased physical activity leads to changes in levels of thyroid hormones [17]. Studies in which physically active and healthy subjects were monitored show increased TSH values [17, 18]. The data in the literature do not explain how the thyroid hormone levels in physically active pregnant women are affected by Hashimoto's thyroiditis. In early pregnancy, the T4 concentrations are elevated, but in the late pregnancy drop below the pre-pregnancy levels. Due to the unknown baseline T4 value, the reference value for pregnancy, calculated by multiplication of the baseline level by 1.5 could not be determined. TSH values of 2.5 mIU/L in the first trimester and 3 IU/L in the second trimester are considered within normal limits. It has been demonstrated that slow-twitch fibres (used in aerobic sports) are more susceptible to thyroid hormones, and so increased thyroid activity can be related to higher muscle activity [18]. Metabolism, cardiac action, and oxygen consumption are also dependent on the excretion of the thyroid hormones (4). Therefore, training efficacy can be affected by the level of the thyroid hormones and *vice versa* [18].

The musculoskeletal and cardiorespiratory system changes in the third trimester can render training difficult and pose an increased risk of injury [1]. The reviewed literature did not offer an insight into the exercise in women whose pregnancy is complicated by an autoimmune disorder. Parameters that are indicators of stress, physical strain and thyroid function were monitored to determine the significance of aerobic physical exercise within a training cycle, which included the third trimester of pregnancy in the subject with Hashimoto's thyroiditis. The increased L-thyroxine dose in the fifth week of the pregnancy likely had an effect on the thyroid hormone levels and maintaining the complication-free pregnancy.

Conclusion

In this study, there was no negative course or outcome of pregnancy in a subject with Hashimoto's thyroiditis due to continuous light to moderate aerobic exercise. A healthy infant of average weight and height, and with a high Apgar score, was born by normal vaginal delivery.

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