CASE STUDY

Serum creatine-kinase and extended breastfeeding: Case study

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Abstract

The World Health Organization recommends infants should be exclusively breastfed for the first six months of life. Various factors can affect the maintenance of lactation. Increased physical activity and stress are thought to negatively affect breastfeeding success. The aim of this case study was to examine the effect of high serum creatine-kinase (CK) values and the success of breastfeeding after sports competition. It is assumed that continuous aerobic exercise is a stress for the body that can have a negative impact on lactation and extended breastfeeding. Methods. The level of acute muscle damage (AC) was measured before and after the competition in order to confirm continuous exposure to aerobic exercise. Results. After the competition, elevated serum creatine-kinase levels were noted. Prolactin and TSH values remained within optimal values. Conclusion. Several months of preparation for the competition had an impact on increasing acute muscle damage (AC) after the competition. No negative effect of continuous aerobic exercise on breastfeeding success was observed in this case study.

Keywords aerobic physical exercise • prolactin • extended breastfeeding.

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Introduction

The World Health Organization recommends extended breastfeeding for the first six months of a newborn`s life, and even longer (WHO, 2020; Kramer, & Kakuma, 2012). Breastfeeding is considered the healthiest diet and excludes giving infants water (Almroth, Mohale, & Latham, 2000; Dewey, 2001). Although many positive effects of extended breastfeeding are known, it is still a problem for many mothers (Pérez-Escamilla, 2020). Only a small percentage of women manage to maintain lactation during the first months after giving birth (Binns, Lee, & Low, 2016; Yuliarti, 2010). It is believed that stress, increased physical activity, chronic diseases, as well as some other lesser-known factors can cause a low milk supply during breastfeeding. In as many as 80% of cases, due to chronic stress, there is a reduced oxytocin secretion, which is responsible for milk production. (Yuliarti, 2010). There are few studies that have investigated the impact of continuous aerobic exercise during breastfeeding (Bubnjević, Ugarković, and Kovačević, 2020). It has not been sufficiently researched how high-intensity exercise affects the possibility of breastfeeding, especially extended breastfeeding.

There are various ways to describe the training load of physical exercise. One of the indicators is the appearance of creatine kinase in the blood (CK), (Anugweje, & Okonko, 2012). This serum marker indicates acute skeletal muscle fibre damage (Mougios, 2007). According to the experiences of some researchers, there are no unique markers that would be a reliable indicator of transient muscle damage and overtraining. (Marić, 2018). Although researchers recommend

measuring more than one marker, CK can be considered one of the best indicators because it enters the circulation and is the result of muscle metabolism (Brancaccio, Lippi, & Maffulli, 2010; Nigro et al., 1983). Also, one of the markers used as an indirect marker of muscle damage is the aspartate aminotransferase (AST), (Brancaccio, Lippi, & Maffulli, 2010; Paulsen et al., 2012). If the values of AST are increased, chronic muscle injury can be suspected, but then the value of alanine aminotransferase (ALT) is also increased, (Nathwani, Pais, Reynolds, & Kaplowitz, 2005). A number of parameters used to investigate possible stress caused by high training load certainly better describe a possible problem. Also, the analysis of the composition and quality of breast milk would be a reliable indicator of the impact of physical exercise on lactation, but in this case it was not easily feasible. A study on a larger number of female respondents who regularly train some aerobic sport would certainly contribute to the research. However, since few women have the ability to breastfeed successfully, this case study was sufficient to show the individual impact of continuous aerobic exercise on lactation success and extended breastfeeding.

Case study

In this case study, an analysis of data collected before and after a triathlon competition (long triathlon) was performed. The respondent (35 years old; BMI 18.5 kg/m2) competed in several aerobic sports before her first pregnancy. Apart from thyroid disease, she had no other health problems. Two weeks after giving birth, she continued with training (running) of light to moderate intensity. She increased her training load gradually (running - about 5-7 trainings per week / about 60-70 km). After a year, she included swimming (once or twice a week) and cycling (once to three times a week) in her training program. With enough rest and proper nutrition, the respondent continued to breastfeed successfully at the request of the child, and after the sixth month she introduced solid foods into the child`s diet and continued to breastfeed 3-6 times a day. After 15 months of giving birth, she participated in a long triathlon in Austria (St. Pölten, May 22, 2016).

It is believed that taking part in a long triathlon requires several months of training and possible disruption of the conditions for successful breastfeeding. Monitoring and control of parameters before and after the competition will show whether great physical exertion after continuous aerobic physical exercise can affect lactation and thus the possibility of breastfeeding. The following parameters were measured: KKS, prolactin, TSH, FT4, ferritin, AST/OT, CK, direct and indirect bilirubin (3 days before competition). Body composition monitoring was performed for seven days, as well as one day after the competition. Quality control of breast milk was not performed.

Results

The respondent successfully completed the first long triathlon for about 06:00. The air temperature ranged from about 12 degrees (start of the race - 07h) to 25 degrees, which could have caused dehydration. After the competition, the respondent received an infusion for preventive reasons. Breastfeeding was established after one hour.

The KKS analysis showed the good health condition of the respondent before and after the competition. The measured biochemical values (in two measurements) were within the reference values. Blood analysis showed that there were no indications of possible anaemia, infection or dehydration. Prolactin, which is primarily related to lactation, but can also indicate the existence of stress, was within the reference values. AST values that were within the reference values (up to 40 U/I) before the competition increased significantly after the competition. CK values also ranged within pre-competition reference values (26-140 U/I). After the competition, the results of the measured CK values showed that there was severe acute muscle damage (115 U/I in the first measurement; 1445 U/I in the second measurement). No major changes in thyroid hormone (TSH) were observed (Table 1). Biochemical results were measured by SPFT laboratory method in the same laboratory. The body composition values in both measurements showed slight differences. The muscle mass values were within the reference values, while the percentage of adipose tissue was slightly reduced (9.6% - 9.4%).

Table 1. Blood biochemistry

Parameters	First measurement	Second measurement	Reference values	Reference value	Measurement method
Metabolites					
Bilirubin total	14.4	14.3	up to 20.1	μmol/L	SPFT
Bilirubin direct	4.6	5.2	up to 7	μmol/L	SPFT
Enzymes					
AST/OT	23	79	up to 40	U/I	SPFT
CK	115	1445	M (38-174); F (26-140)	U/I	SPFT
Hormones					
TSH	6.03	6.04	0.27-4.20 mU/I	mU/I	ECLIA
Prolactin	384	274	M (86-324); F (102-496)	μmol/L	ECLIA
*Free T4	14.21		12.0-22.0	pmol/L	ECLIA
Ferritin	26.5	15.1	M (10.6-28.3); F (6.6-26)	μmol/L	SPFT

* Missed the second measurement.

Discussion

Prolonged overtraining can lead to the development of chronic stress. On the other hand, moderate daily aerobic physical activity is recommended to maintain good health (WHO). A study that investigated the effects of yoga during lactation shows a positive effect on prolactin secretion, a calm mom and breastfeeding success (Wildan, & Primasari, 2011). Although continuous aerobic exercise has a positive effect, it can negatively affect the secretion of oxytocin, and thus the possibility of breastfeeding. Also, it is considered that the psychological factor is most responsible for the success of breastfeeding (Yuliarti, 2010). The mother`s commitment proved to be very important (Brew, 2003). During several months of breastfeeding, periods are expected when there may be a loss of interest and cessation of breastfeeding due to the impending crisis (Wildan, & Primasari, 2011). Exercise is thought to reduce stress and the possible development of postpartum depression (Currie, Rich, & McMahon, 2004). Some studies point out that the problem of breastfeeding when it comes to top female athletes has been insufficiently researched. How to maintain lactation during the competition period is something that definitely worries many athletes.

In addition to the necessary commitment of the mother, proper nutrition is also very important, as well as enough rest (Brew, 2003; Nedelec, Mathieu et al., 2018). Breastfeeding women burn an additional 500 kcal per day. After intensive training, it is necessary to get enough protein (Morton, Robert W., et al., 2018). Although the respondent had lower BMI values, a lower percentage of adipose tissue did not negatively affect the possibility of breastfeeding. The success of breastfeeding in this case study can be explained by establishing a proper breastfeeding rhythm and getting adequate rest.

Increased CK marker values, which were recorded after the second measurement, can be explained by the respondent`s physical fitness levels (Brancaccio, Lippi, & Maffulli, 2010). TSH and prolactin values show that there was no chronic stress during several months of training and breastfeeding. The largest changes in serum were observed after the second measurement in the CK and ALT values. Increased CK values indicate the resulting acute damage that is probably proportional to the duration and intensity of muscle contractions, and which also depends on muscle sensitivity. The ALT (alanine aminotransferase) indirect marker confirms the resulting acute muscle damage. The highest CK marker values are recorded about 24 hours after the end of physical activity, and can be maintained from 48 to 72 hours after exercise. CK values measured can be attributed to gender, physical fitness levels, and increased fatigue (Brancaccio, Lippi, & Maffulli, 2010; Anugweje, & Okonko, 2012). In this case study, there was no negative impact of sports competition on establishing lactation and breastfeeding after the triathlon competition. Also, great physical effort did not pose a problem to easier and faster recovery of the organism because the respondent participated in the next competition only 7 days later (long triathlon). Sports and competition

regime did not have a negative impact on extended breastfeeding.

Conclusion

A review of the available scientific literature so far has shown that female athletes are not sufficiently informed about the possibilities of sports training during the period of extended breastfeeding. Also, no data have been reported describing the impact of continuous aerobic exercise on breastfeeding success as measured by confirmation of physical exertion and a measured marker of acute serum muscle damage (CK). Based on the results obtained from this study, it can be assumed that continuous aerobic exercise will not have a negative impact on the success of extended breastfeeding if a healthy diet, enough rest, proper hydration and optimal training load are included in the daily lifestyle. Further research is needed on the different types and intensities of physical exercise on the possibility of breastfeeding during the first six months and after that period.

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