Could High Volume of Physical Activities in Early Pregnancy Interfere with Deep Placentation?

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Abstract

Background The impact of physical activity (PA) during pregnancy on obstetrical outcomes remains controversial. We followed pregnant women who reported more than 3 hours of sustained PA per week during the first trimester of pregnancy.

Cases Total five eligible women were followed. We observed small placenta from the first trimester (median: 0.68; interquartile [IQ]: 0.62–0.97 multiples of median [MoM]) to delivery (median: 0.82; IQ: 0.71–0.94 MoM), high uterine artery pulsatility index in the first (median: 1.82; IQ: 1.68–1.99 MoM) and second trimesters (median: 1.33; IQ: 1.11–1.56 MoM) of pregnancy. Placenta pathology revealed deep vasculopathy in three (60%) cases. However, all participants delivered at term and none of them experienced preeclampsia.

Conclusion This small case series suggest that high PA volume in first trimester could interfere with deep placentation.

Keywords
- pregnancy
- physical activity
- placenta
- biomarker
- ultrasound
- preeclampsia

Physical activity (PA) has been recommended by the Society of Obstetricians and Gynecologists of Canada for uncomplicated pregnancies as a part of a healthy lifestyle.[1] Moreover, the recent guidelines on hypertension supported the practice of exercise for maintenance of fitness in low-risk patients.[2] It has been suggested that leisure time exercise could have a positive impact on placental growth, endothelial function, as well as oxidative stress reduction.[3–5] A recent meta-analysis highlighted the potential benefit of PA on the prevention of preeclampsia, but the evidences regarding a dose–response relationship with exercise volume are limited.[6] Furthermore, the impact of sustained exercise during the first trimester on placentation and placenta-related complications is still unclear.[7–9] Although regular exercise in early pregnancy has been associated with an increased placental growth in mid-pregnancy,[10] some evidences suggest a potential increase of severe preeclampsia in women of high volume of PA during first trimester.[8] Recently, Ferland et al observed a significant decrease of placental growth factor concentration and a trend toward lower pregnancy-associated plasma protein A and placental volumes in women with higher PA frequency, suggesting a negative impact of sustained exercise on placental growth and function.[7]

With potential preventive measures such as aspirin and low-molecular-weight heparin for placenta-mediated complications,[11–16] there is a growing interest for the study of early placentation. Several tools, including three-dimensional ultrasound[17,18] and biochemical markers have been used to identify women at risk of abnormal placentation and preeclampsia. We aimed to use such tools to evaluate placental

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Table 1 Characteristics of five participants who reported high volume of physical activity during first trimester of pregnancy

Characteristics	Median	Interquartile	Range
Maternal age (y)	33	31–36	29–38
Body mass index (kg/m^2)	21	21–25	21–26
Mean arterial blood pressure (mm Hg)	76	69–81	64–82
Gestational age at recruitment (wk)	12.6	12.4–13.3	12.4–13.4
PAPP-A (MoM)[17]	0.54	0.33–0.72	0.28–0.87
First-trimester placental volume (MoM)	0.68	0.62–0.97	0.62–1.17
First-trimester placental VFI (MoM)	0.27	0.08–1.11	0.07–1.83
First-trimester UtA PI[20] (MoM)	1.82	1.68–1.99	1.65–2.10
Second-trimester UtA PI (MoM, $N = 4$)	1.33	1.11–1.56	1.08–1.60
Third-trimester UtA PI (MoM, $N = 3$)	1.23	–	1.19–1.38
Gestational age at birth (wk)	40.0	39.0–40.6	38.3–40.9
Birth weight (g)	3,220	2,782–3,277	2,608–3,300
Birth weight (MoM)	0.93	0.82–0.94	0.71–0.95
Placenta weight (g)	424	370–489	322–550
Placenta weight (MoM)	0.82	0.71–0.94	0.61–1.05

Abbreviations: MoM, multiple of median adjusted for gestational age; PAPP-A, pregnancy-associated plasma protein A; UtA PI, uterine artery pulsatility index, VFI, vascularization flow index.

development during pregnancy in women who reported high PA volume during the first trimester of pregnancy.

Cases

Five women out of approximately 240 women who participated in a prospective cohort for the study of early biomarkers of preeclampsia reported more than three episodes of more than 1 hour of sustained (e.g., running, cross-country skiing, cross-fit training) PA every week over the first trimester. This volume of PA was selected because it represents twice the minimum recommended levels for Canadian adults. The exact PA volume could not be exactly reported retrospectively but all five participants reported between three and seven episodes of more than 1 hour of sustained PA every week.[19] In comparison, we observed that only 8% of the participants in the entire cohort reported more than three episodes of PA per week, regardless of the intensity. All women signed an informed consent and the ethics committee of the CHU de Québec approved the study. ►**Table 1** reports the characteristics (median, interquartile, and ranges) of the five participants. We observed that most participants showed indices suggesting impaired deep placentation with high resistance of uterine artery pulsatility index, small placenta volume, low placenta vascularization, as well as small birth and placenta weight (►**Table 1**). Of note, none of the participants had preeclampsia, two of them had a small for gestational age neonate, one had a placental abruption, and placenta pathology revealed signs of deep vasculopathy in three of them. All of them delivered at term.

Conclusion

We observed signs of impaired placentation in three to five (60–100%) out of five participants who reported high volume of PA during the first trimester of pregnancy. Our observation suggests that high volume of PA could delay or interfere with physiological placentation and could explain studies that reported a greater risk of severe preeclampsia in women with high volume of PA during pregnancy.[8]

Our conclusions are severely limited by the study design (case series) and the small sample size leading to significant risk of bias. Based on our results, we cannot recommend any maximal level of PA volume and we cannot suggest that high PA volume is a significant risk factor for deep placentation disorder or adverse perinatal outcomes. However, the observation is sufficiently important to warrant a large prospective study that could lead to important change in clinical recommendations regarding optimal PA during pregnancy.

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Conflict of Interest
All authors disclosed no conflict of interest of financial or other nature.

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