

An active pregnancy for fetal well-being? The value of active living for most women and their babies

Zachary M Ferraro,^{1,2} Andree Gruslin,^{3,4} Kristi B Adamo^{1,2,5}

Prenatal life is recognised as a critical period where vital physiological processes may be permanently transformed leading to altered susceptibility to disease risk later in life.¹ Accordingly, fetal adaptive responses to the maternal milieu, including the in utero effect of a physically active pregnancy, may influence the long-term health and well-being of the developing child. Is there potentially lifelong significance of maternal exercise on fetal health?

Although the recent study published in *BJSM* by Salvesen *et al*² is timely with respect to the fetal response to extreme levels of maternal exertion in competitive Olympic hopefuls, it has limited applicability to the maternal population at large who are mostly inactive.³ The latter may benefit the most from a physically active, healthful pregnancy. In their study examining fetal response and utero-placental blood flow during strenuous treadmill running in the second trimester, Salvesen *et al*² note that fetal HR was within the normal range as long as maternal exertion was below 90% maternal HR_{max}; an exercise intensity that few women would routinely work at, nor would be encouraged in a typical maternal population. If maternal HR exceeded 90% of maximum value and uterine artery blood flow was simultaneously less than 50% the initial value, fetal

bradycardia occurred. However, despite these concerns, following exercise cessation fetal HR reached baseline values, uterine artery flow volume improved to resting values in most women and all birthweights were within the lower normal range for Norwegian children, which is encouraging.

Salvasen and colleagues acknowledge that adverse fetal effects of less vigorous maternal training are unlikely in uncomplicated pregnancies. If healthcare providers misinterpret these data, there may be a detrimental message for women who represent the large majority pregnancies. For those women, who are largely sedentary and struggling with excess weight, this message may be more harmful to activity participation. Our goal in this editorial is to ensure that care providers do not discourage women from engaging in physically active lifestyles out of an inappropriate fear of fetal compromise.

Recent work from our group suggests that most pregnant women do not receive recommendations pertaining to pregnancy-specific information about kcal intake, appropriate gestational weight gain (GWG) recommendations and receive little advice on how to engage in a physically active pregnancy.⁴

With rising obesity rates in women of childbearing age,⁵ increasing birth weights⁶ and a greater prevalence of youth who display increased fatness and decreased fitness⁷ a very large majority of the population may benefit from engaging in a physically active lifestyle; including pregnant women and their developing fetus. And while participation in physical activity during pregnancy may not be advantageous for all women, especially those who present with contraindications,⁸ the clinical utility of this behaviour should be viewed as advantageous for most mother-infant pairs given the potential health benefits associated with active living.⁹

Interestingly, the precipitous drop in fetal HR following maternal exertion validates previous findings from May *et al*¹⁰ who compared low-risk pregnant women

who exercised regularly throughout pregnancy (30 min of aerobic exercise, 3×/weeks) with healthy non-exercising controls and found, using fetal magnetocardiograms, that the fetal HR at 36 weeks' gestational age was significantly lower, and the variability was significantly increased during maternal physical activity in the exercise group. This studied countered previous work suggesting that a decrease in fetal HR during maternal exertion is a result of chronic fetal hypoxia.¹¹ In fact if this was the case then one would expect decreased HR variability indicative of an adverse stress on fetal autonomic nervous system development if chronic hypoxia were present.¹⁰ And while there are several mechanisms aimed to maintain utero-placental blood flow and oxygen transport capacity to protect the developing child from adverse stressors during maternal physical activity,⁹ May *et al* suggest that maternal exercise may induce an adaptive response in utero that yields cardiovascular health benefits later in life.¹⁰

For women who are unaccustomed to physical exertion and may be less inclined to engage, recent evidence suggests that yoga¹² is a viable exercise modality and that a simple walking programme of both low or vigorous intensity during pregnancy confers an aerobic benefit.¹³ Given the strong association between aerobic fitness and all-cause mortality¹⁴ engaging in non-sedentary pursuits during gestation may be of tremendous value to limit disease and mortality risk later in life. Furthermore, compared with those who were not active during pregnancy, active women showed attenuated decline in bone mineral density¹⁵ and improved psychological symptoms¹⁶ suggesting a protective effect of exercise that goes beyond one's physiology.

LIMITING GESTATIONAL WEIGHT GAIN

From a clinical standpoint, modifying one's preconception body mass index (BMI) remains a significant challenge, because of the frequency of unplanned pregnancies and given the high individual recidivism to interventions designed to attain healthy weight.¹⁷ Thus, targeting gestational weight gain (GWG) with physical activity as a potential modifiable risk factor during pregnancy may improve maternal-fetal outcomes.⁹ Recently, a systematic review by Sui *et al*¹⁸ reported that a monitored physical activity intervention appears to be successful in limiting GWG. This is encouraging given the strong association between exceeding the 2009 Institute of

¹School of Human Kinetics, University of Ottawa, Faculty of Health Sciences, Ottawa, Ontario, Canada

²Healthy Active Living and Obesity Research Group, Children's Hospital of Eastern Ontario Research Institute, Ottawa, Ontario, Canada

³The Ottawa Hospital Research Institute, Ottawa, Ontario, Canada

⁴Departments of Obstetrics and Gynecology, Division of Maternal-Fetal Medicine and Cellular and Molecular Medicine, University of Ottawa, Faculty of Medicine, Ottawa, Ontario, Canada

⁵Department of Pediatrics, University of Ottawa, Faculty of Medicine, Ottawa, Ontario, Canada

Correspondence to Dr Zachary M Ferraro, Healthy Active Living and Obesity (HALO) Research Group, Children's Hospital of Eastern Ontario Research Institute, 401 Smyth Road, Ottawa, Ontario, Canada K1H8L1; zferraro@cheo.on.ca

Medicine GWG guidelines and giving birth to a large for gestational age (LGA) neonate (ie, birthweight for gestational age ≥ 90 th percentile); an effect that is independent of pregravid BMI.¹⁹ So while attenuating GWG has the potential to minimise the risk of gestational diabetes,²⁰ hypertension and preeclampsia²¹ as well as postpartum weight retention²² it also serves to benefit the fetus. For example, mothers who exceed recommended GWG targets are more likely to have LGA children who present with increased adiposity and insulin resistance in utero;²³ an effect that may perpetuate the intergenerational cycle of obesity if such aberrant growth trajectory in neonates susceptible to positive energy balance and weight gain throughout their life course if not closely monitored during follow-up.²⁴ So it appears that one way to optimise neonatal birth weight and subsequent growth in the early years may be through maternal lifestyle management during pregnancy. This style of prenatal intervention is advantageous if coupled with dietary support, as low and moderate-intensity exercise have been shown to reduce excessive GWG in normal-weight and overweight pregnant women.^{25 26} Recently, the Jerusalem perinatal family follow-up study noted that excessive GWG, independent of pregravid BMI, is positively associated with adult offspring adiposity and the presence of cardiometabolic risk factors^{27 28} collectively, suggesting that GWG management in all women may have tremendous downstream benefit on child growth, development and chronic disease risk.

Overall, a physically active pregnancy is a safe and effective means of improving fitness and managing GWG in most women (ie, those without contraindications). So while healthcare providers should continue to exercise caution with respect to physical activity prescription and first do no harm, it is important to understand that a physically active lifestyle does not necessarily imply the absence of sedentary behaviours which have their own independent ill-effects on health. Thus, every little movement counts and discouraging excessive sedentary pursuits may provide additional health benefits and be a target for

behaviour intervention above solely meeting physical activity recommendations.²⁹ Therefore, being able to confidently make lifestyle recommendations and troubleshoot barriers to participation in all women that go beyond the simple and ineffective 'eat less and move more' approach may have long-lasting benefits to maternal-fetal and potentially downstream child health.

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