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The Impact of Pregnancy on Physical Activity Level

Deshayne B. Fell · K. S. Joseph · B. Anthony Armson · Linda Dodds

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Abstract *Objective* The purpose of this study was to compare women's levels of physical activity during early pregnancy and during the year before pregnancy, and to identify characteristics associated with discontinuing sports and exercise among women previously active during the year before pregnancy. *Methods* Data collected from 1,737 women enrolled in a prospective cohort study and who had no contraindications for exercise were included in this analysis. Measures of physical activity (including household and care-giving activities, active living and sports and exercise activities) during early pregnancy were compared to the year before pregnancy. Log binomial regression was used to identify factors associated with discontinuing sports and exercise during pregnancy. *Results* There was a statistically significant decrease in all summary measures of physical activity during early pregnancy. The largest decreases were observed in sports and exercise activity. Among women active before pregnancy, age <35 years, multiparity, less than university education, pre-pregnancy body mass index (BMI) $\geq$ 30 kg/m^2 and lower levels of pre-pregnancy exercise were associated with discontinuing sports and exercise activities during pregnancy. *Conclusion* Most women reduced their physical activity level during the first 20 weeks of pregnancy compared with their level of activity during the year prior to pregnancy, particularly for sports and exercise, although a small proportion of women in this study actually increased their activity in this area during early pregnancy. Participation in sports and exercise activity during pregnancy is potentially modifiable and could favorably impact perinatal health and maternal post-partum weight. The results of this study suggests that pregnancy is an event that leads to a decrease in physical activity.

Keywords Changes in pregnancy · Exercise · Physical activity · Pregnancy

Introduction

Leisure activity, such as sports and exercise, is recommended for its many health benefits including weight control, and reduced risk of hypertension, cardiovascular disease and Type 2 diabetes [1]. Benefits of participation in sports and exercise activity may also extend to pregnant women. Increasing evidence suggests that exercise plays a role in reducing the risk of pregnancy complications such as preeclampsia [2], gestational diabetes [3, 4] and preterm delivery [5], and may help prevent excess pregnancy weight gain [6] and post-partum weight retention [7]. Currently, healthy women with uncomplicated pregnancies are advised to continue pre-pregnancy sports and exercise activities, or begin a program of regular activity, avoiding activities that could result in loss of balance or fetal trauma [8, 9].

D. B. Fell · K. S. Joseph · L. Dodds (✉)
Perinatal Epidemiology Research Unit, Department of Obstetrics and Gynaecology, Dalhousie University and the IWK Health Centre, 5850/5980 University Avenue, P.O. Box 9700, Halifax, NS, Canada B3K 6R8
e-mail: L.Dodds@dal.ca

B. A. Armson
Department of Obstetrics and Gynaecology, Dalhousie University and the IWK Health Centre, 5850/5980 University Avenue, P.O. Box 9700, Halifax, NS, Canada B3K 6R8

D. B. Fell · K. S. Joseph · L. Dodds
Perinatal Epidemiology Research Unit, Department of Pediatrics, Dalhousie University and the IWK Health Centre, 5850/5980 University Avenue, P.O. Box 9700, Halifax, NS, Canada B3K 6R8

Overall, the literature indicates that participation in sports and exercise is lower among pregnant women than non-pregnant women [7, 10–15], but little information is available on factors associated with continuing exercise during pregnancy. Only a few studies have compared levels of sports and exercise before pregnancy with sports and exercise levels during pregnancy, and identified the determinants of continuing (or stopping) these activities during pregnancy [13–15]. High BMI has been associated with both increased [14, 15] and decreased level of sports and exercise during pregnancy [13], compared to pre-pregnancy levels. Other factors might influence the level of physical activity during pregnancy. For instance, women who perceive physical activity during pregnancy as risky to maternal or fetal health would have a higher propensity to discontinue exercise activity [16]. Also, early pregnancy symptoms, such as nausea and fatigue, might be expected to negatively impact physical activity, although this is not always the case [7]. Moreover, other aspects of physical activity, such as household and care-giving activity have received little attention [17]. More research is needed to quantify and understand the reasons for changes in physical activity levels during pregnancy, compared to pre-pregnancy, among healthy pregnant women, particularly with respect to modifiable factors.

The purpose of this study was to quantify changes in level of physical activity during early pregnancy (up to 20 weeks' gestation) compared to the year before pregnancy in a cohort of women. We additionally sought to identify characteristics associated with discontinuing participation in sports and exercise activities during pregnancy among women previously active in the year before pregnancy.

Methods

This study was a secondary analysis of data originating from a prospective cohort study of pregnant women, recruited at <20 weeks' gestation between October 2002 and July 2005 at the IWK Health Centre in Halifax, NS, Canada. Detailed methods have been previously described [18]. In summary, women were asked to complete and return a self-administered questionnaire during the 20th week of pregnancy (mean gestational age when questionnaires were returned was 21.4 weeks), which collected information on socioeconomic factors, lifestyle (including physical activity), chronic medical conditions and past pregnancy history. After delivery, additional data were collected from medical records. This analysis included only women whose pregnancy advanced beyond 20 weeks' gestation, who returned their study questionnaires, and who had no contraindications to sports and exercise during pregnancy. Contraindications to exercise during pregnancy were based on Canadian guidelines and included preterm labor or incompetent cervix before 20 weeks requiring hospital admission, onset of hypertension requiring medication prior to 20 weeks, triplets or higher order multiple gestation, 2nd trimester bleeding or other serious medical disorders [8]. These exclusions were based on data obtained from the medical chart after delivery, with the exception of the 2nd trimester bleeding and other serious medical disorders, which additionally used data collected in the study questionnaire.

Questionnaire items pertaining to physical activity were adapted from the Kaiser Physical Activity Survey (KPAS) [19], which has been validated in non-pregnant [17] and pregnant women [20]. The KPAS and details regarding scoring have been published elsewhere [17, 19, 21]. Briefly, the KPAS measures participation in four activity domains: household and family care (e.g., routine cleaning, meal preparation, childcare, etc.), active living (e.g., walking/cycling to work, etc.), sports and exercise, and occupation. There are 11 questions in the KPAS pertaining to the household and family care domain, 4 questions pertaining to active living, 8 questions (or more, depending on the number of sports and exercises the women participated in) pertaining to sports and exercise and 8 questions pertaining to occupation. Each question is assigned a value of 1–5, indicating low to increasingly higher levels of activity or participation. An index score ranging from 1 to 5 is generated for each domain by summing the score for each individual question within a domain and dividing by the number of items. The overall KPAS score is the sum of the index-specific scores.

Women were asked to answer the KPAS questions reflecting the first 20 weeks of pregnancy as well as the year preceding pregnancy with the exception of information on occupation, which was only collected for the first 20 weeks of pregnancy. Thus, the overall KPAS score in this study is a 3-index score that excludes occupational activity [19].

The sports and exercise index of the KPAS contains detailed questions regarding participation in up to three activities such as walking, jogging, conditioning exercise, gardening and organized sports. The sport score, which is the sum of metabolic equivalent level (assigned using a published compendium [22, 23]) by frequency and time across all activities, is one of the items used to calculate the sports and exercise index score. It was also used independently in this study to estimate the level of participation in sports and exercise. A high level of sports and exercise activity was defined using the 75th percentile of the pre-pregnancy sport score.

For both of the time points of interest (the year before pregnancy and during the first 20 weeks of pregnancy)

women were asked whether or not they participated in sports and exercise activity and they were provided with a list of examples of different physical activities. If they reported "yes" they were subsequently asked to complete the details required by the KPAS for up to three specific activities. It was these questions ("During the year before this pregnancy, did you participate in any sports or exercise activities such as…?" and "So far during this pregnancy, did you participate in any sports or exercise activities such as…") that were used to determine whether previously active women continued or discontinued sports and exercise activity during early pregnancy (e.g., an answer of "Yes" in the first question and "No" to the second question would define discontinuing sports and exercise.

Median scores and 25th and 75th percentile scores were computed for pre-pregnancy and early pregnancy for each index (household and family care, active living, sports and exercise). The mean difference in the within-woman score for each index was used to quantify the change in activity between pre-pregnancy and the first 20 weeks of pregnancy. Log binomial regression was used to estimate the relative risk (RR) of discontinuing sports and exercise during early pregnancy among the subset of women who reported participation in sports and exercise prior to pregnancy [24, 25]. Factors that were evaluated included those that had been noted in previous studies (e.g., parity, BMI, education, maternal age, maternal smoking) and factors not previously identified in the literature but were collected as part of the overall cohort study (e.g., previous pregnancy history, bleeding during the current pregnancy). Initially, unadjusted RRs and 95%CI were calculated, followed by a backward stepwise approach to determine the most parsimonious multivariate model. Only those risk factors that were significantly associated ($P < 0.05$) with the outcome, based on the likelihood ratio test, were retained in the final model.

All analyses were performed using SAS Version 8.2 software for Windows (SAS Institute, Inc., Cary, NC, USA). The study received approval from the IWK Health Centre Research Ethics Board and participants provided written informed consent.

Results

Of the 2,314 women invited to participate in the original study, 2,200 (95.1%) agreed and provided consent. Following recruitment, 30 women were excluded: 11 withdrew, 16 terminated their pregnancy and 3 were later determined to have been >20 weeks' gestation at recruitment (using ultrasound dating). We further excluded 94 women with an early pregnancy loss (<20 weeks' gestation) and 233 women who did not return a questionnaire. Finally, 106 women with contraindications to exercise during pregnancy were excluded leaving 1,737 women with low-risk pregnancies available for this analysis. Women were recruited at a mean gestational age of 13.7 weeks (SD 4.1; range 4–20 weeks). Approximately 10% of women returned their questionnaire after 25 weeks' gestation. Basic demographic characteristics of the women in this study are shown in Table 1.

Table 1 Demographic characteristics of sample ($n = 1,737$)[a]

Characteristic	*n*	%
Maternal age		
≥35 years	423	24.4
25–34 years	1,143	65.8
<25 years	171	9.8
Highest level of education		
University	1,069	61.7
Community college/trade school	450	26.0
High school	213	12.3
Parity (number of previous viable pregnancies)		
≥1 (multiparous)	877	50.5
None (nulliparous)	860	49.5
Smoking during pregnancy		
No	1,474	84.9
Yes	263	15.1
Pre-pregnancy body mass index		
<25.0 kg/m^2	1,017	59.3
25.0–29.9 kg/m^2	389	22.7
≥30.0 kg/m^2	310	18.1

[a] Cell counts may not add up to total number of subjects due to missing values

Median scores for KPAS indices, shown in Table 2, generally decreased during pregnancy compared to the year before pregnancy, with the largest decrease observed for the sports and exercise index (mean difference = −0.71, 95%CI = −0.75, −0.70. Seventy-one percent of women (71.3%) reported participation in sports and exercise activity before pregnancy; however, less than half of women (47.4%) reported that they participated in sports and exercise during early pregnancy. Among the women who were active in sports and exercise before pregnancy, 62.2% continued to participate during their pregnancy, with an even higher rate among those women with a pre-pregnancy sport score in the top quartile (76.1%, data not shown). Among the women who did not report participation in sports and exercise activity during the year before pregnancy, 11.1% initiated sports and exercise for the first time during early pregnancy (Fig. 1).

Table 3 shows the unadjusted and adjusted analysis for characteristics associated with discontinuing sports and exercise activities during early pregnancy among a subgroup

Table 2 Median KPAS index scores and within-woman difference in scores before and during pregnancy

KPAS index	Pre-pregnancy		First 20 weeks of pregnancy		Mean within-woman difference in score (95% CI)
	Median	25th–75th Percentile	Median	25th–75th Percentile	
Household and family care	2.67	2.22–3.11	2.44	2.11–2.89	−0.20 (−0.21 to −0.18)
Active living	3.00	2.50–3.25	2.75	2.25–3.00	−0.30 (−0.33 to −0.28)
Sports and exercise	3.00	2.00–3.75	2.00	1.25–3.00	−0.71 (−0.75 to −0.70)
3-Index score	8.61	7.19–9.72	7.17	6.14–8.47	−1.21 (−1.27 to −1.15)

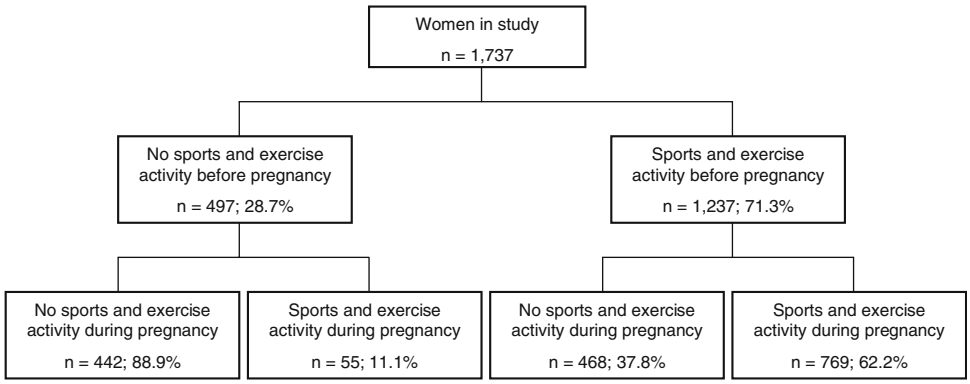

Fig. 1 Rates of participation in sports and exercise activity in the year before pregnancy and during the first 20 weeks of pregnancy. *Note*: cell counts do not add up to total number of subjects due to three missing responses for sports and exercise activity before pregnancy

of women who participated in sports and exercise activity during the year before pregnancy. Discontinuing sports and exercise activities during pregnancy was significantly associated with maternal age <35 years, no university education, BMI ≥30 kg/m^2, multiparity (≥1 previous viable pregnancy) and a pre-pregnancy sport score <75th percentile.

Discussion

The results of this study suggest that pregnancy is an event that leads to a decrease in physical activity. Although women reduced their levels of activity related to household tasks, care-giving and active living, the decrease in overall physical activity was chiefly realized through reduced participation in sports and exercise.

Although we observed that younger women, with lower education, and a higher pre-pregnancy BMI were significantly more likely to discontinue sports and exercise during pregnancy, the strongest predictor of this behavior change was the level of pre-pregnancy activity. Despite very different study populations, this result is consistent with the findings of another recent study (with a focus on Latino women) that used the KPAS to measure women's physical activity before pregnancy and in early and mid-pregnancy [15]. Our analysis was based on a cross-sectional analysis of data collected at about 20 weeks' gestation, which potentially limits the conclusions regarding a temporal relationship between the factors we identified as associated with discontinuing sports and exercise.

Pregnancy typically motivates women to make changes toward healthier lifestyles [26]. However, while getting a good night's sleep, abstaining from alcohol consumption and reducing smoking are lifestyle changes with high perceived importance in pregnant women, it seems that fewer women attribute the same level of importance to regular exercise [16]. Nevertheless, we did not uniformly observe reduced activity during pregnancy. A small proportion of women in this study initiated exercise activity for the first time during pregnancy. Although this change in behavior did not greatly impact activity scores due to participation in less intense types of exercise, it is noteworthy that some previously inactive women were motivated by pregnancy to increase their level of activity. One possible reason for initiating a more active lifestyle during pregnancy is for weight loss, which has been reported among overweight women [27]. This may be supported by our results since the subgroup of women who initiated sports and exercise in pregnancy had the highest rate of moderate/extreme obesity (BMI ≥ 35 kg/m^2, 16.1%) of all women.

Strengths of this study include the availability of physical activity data that were collected during mid-pregnancy, when the outcome of the pregnancy was unknown. Using the comprehensive KPAS instrument, this study collected detailed information on several domains of physical activity for women.

Table 3 Relative risks (RR) and 95% confidence intervals (CI) for participation in sports and exercise activity during pregnancy among women reporting participation in sports and exercise activity in the year before pregnancy ($n = 1,237$)[a]

Characteristic	Participation in sports and exercise activity during the first 20 weeks of pregnancy				Unadjusted RR (95% CI)	Adjusted RR[d] (95% CI)
	Discontinued ($N = 468$)		Continued ($N = 769$)			
	n	%	*n*	%		
Maternal age						
≥35 years	100	21.4	218	28.4	1.0 Reference	1.0 Reference
25–34 years	316	67.5	495	64.4	1.5 (1.2–2.0)	1.2 (1.0–1.5)
<25 years	52	11.1	56	7.3	1.2 (1.0–1.5)	1.3 (1.0–1.8)
Highest level of education						
University	262	56.0	569	74.3	1.0 Reference	1.0 Reference
Community college/trade school	153	32.7	137	17.9	1.7 (1.4–1.9)	1.5 (1.3–1.8)
High school	53	11.3	60	7.8	1.5 (1.2–1.9)	1.2 (1.0–1.6)
Marital status						
Married/common law	434	92.7	716	93.1	1.0 Reference	n/a
Single	34	7.3	53	6.9	1.0 (0.8–1.4)	
Annual family income (Canadian dollars)						
≥$60,000	272	61.1	504	68.3	1.0 Reference	n/a
<$60,000	173	38.9	234	31.7	1.2 (1.0–1.4)	
Household index score during the year before pregnancy						
≤3	330	70.5	572	74.4	1.0 Reference	n/a
>3	138	29.5	197	25.6	1.1 (1.0–1.3)	
Employment status during pregnancy						
Employed	404	86.3	680	88.7	1.0 Reference	n/a
Unemployed	64	13.7	87	11.3	1.1 (0.9–1.4)	
Occupational index score during pregnancy[b]						
≤3	340	72.7	558	72.7	1.0 Reference	n/a
>3	128	27.3	209	27.3	1.0 (0.9–1.2)	
Pre-pregnancy body mass index						
<25.0 kg/m^2	249	53.7	505	66.2	1.0 Reference	1.0 Reference
25.0–29.9 kg/m^2	107	23.1	160	21.0	1.2 (1.0–1.4)	1.1 (0.9–1.3)
≥30.0 kg/m^2	108	23.3	98	12.8	1.6 (1.3–1.9)	1.3 (1.1–1.6)
Smoking during pregnancy						
No	404	86.3	683	88.8	1.0 Reference	n/a
Yes	64	13.7	86	11.2	1.1 (0.9–1.4)	
Parity (number of previous viable pregnancies)						
None (nulliparous)	216	46.2	430	55.9	1.0 Reference	1.0 Reference
≥1 (Multiparous)	252	53.8	339	44.1	1.3 (1.1–1.5)	1.2 (1.1–1.4)
Multiple gestation						
No	462	98.7	760	99.0	1.0 Reference	n/a
Yes	6	1.3	8	1.0	1.1 (0.6–2.1)	
History of early pregnancy loss, stillbirth or preterm delivery						
No	324	70.0	562	73.7	1.0 Reference	n/a
Yes	139	30.0	201	26.3	1.1 (0.9–1.3)	
Bleeding during the first trimester						
No	350	75.0	596	77.7	1.0 Reference	n/a
Yes	117	25.0	171	22.3	1.1 (0.9–1.3)	
Sport score during the year before pregnancy[c]						

Table 3 continued

Characteristic	Participation in sports and exercise activity during the first 20 weeks of pregnancy				Unadjusted RR (95% CI)	Adjusted RR[d] (95% CI)
	Discontinued ($N = 468$)		Continued ($N = 769$)			
	n	%	*n*	%		
≥75th Percentile	74	15.8	236	30.7	1.0 Reference	1.0 Reference
<75th Percentile	394	84.2	533	69.3	1.8 (1.4–2.2)	1.6 (1.3–2.0)

[a] Cell counts may not add up to total number of subjects due to missing values

[b] Unemployed subjects are assigned an occupational index score of 1

[c] Based on distribution among all study subjects

[d] Adjusted model only includes statistically significant factors, based on likelihood ratio test, and is adjusted for other factors in the model

This study was limited by our inability to use objective measures of physical activity that did not involve subject recall. Nevertheless, the KPAS has been previously found to be reliable and valid in non-pregnant [17] and pregnant [20] women. When the participants completed the questionnaire, they were simultaneously asked about activity level during pregnancy and activity during the year before pregnancy. Since one time period in question was very recent and other time period was further distant in the past, it is possible that the reliability of correctly recalling activity measures for the two time periods was different. In addition, about 10% of the women returned their questionnaire after 25 weeks' gestation. Although we do not know when these women actually completed their questionnaire (e.g., they could have completed it at 20 weeks, but mailed it later), it is possible that pregnancy complications or other factors arising later in pregnancy could have affected recall pertaining to their activity level.

Another limitation concerns the small proportion of women that did not return the questionnaire. Compared to the women included in this analysis, the non-responders were significantly more likely to be <25 years and to smoke during pregnancy, and less likely to be nulliparous or married. Assuming that some of these factors are associated with participation in sports and exercise activity during pregnancy [11, 12, 15], this may have resulted in an overestimate of our participation rates. We did not collect information on symptoms of early pregnancy, such as nausea or fatigue that may have influenced level of activity [7, 28, 29], nor on occupation during the year before pregnancy, which precluded analysis of change in occupation-related physical activity in early pregnancy. Finally, we used a single measure for physical activity level reflecting the first 20 weeks of pregnancy but there may have been differences in activity levels within this time period. As well, we did not assess women's physical activity at later time points during the pregnancy and it is possible that women increased their physical activity during mid-pregnancy [15].

This study was conducted in the largest city in Nova Scotia in a hospital where half of the deliveries in the province occur each year. The proportion of women in this study who were ≥35 years (24%) was higher than for Halifax County (18%) during the same time period; however, the rates of nulliparity, smoking during pregnancy and pre-pregnancy weight ≥90 kg were almost identical (unpublished data: Reproductive Care Program of Nova Scotia, November 2006) suggesting that these results are generalizable to the population of pregnant women in Halifax County, and possibly to urban populations of pregnant women in the rest of Canada.

Conclusion

In summary, we found that most women altered their physical activity level during the first 20 weeks of pregnancy compared with their level of activity during the year prior to pregnancy. The changes made by most women occurred in the direction of reduced activity, particularly for sports and exercise, although a small proportion of women in this study actually increased their activity in this area during early pregnancy. Further research is needed to understand the public health importance of previously active women who become inactive during pregnancy, versus that of relatively sedentary women who become even more inactive during pregnancy. Although some of the factors we observed that were associated with discontinuing sports and exercise during pregnancy are not readily modifiable, such as education, age and parity, participation itself in sports and exercise activity during pregnancy is potentially modifiable and could favorably impact perinatal health and maternal post-partum weight. Therefore, further research should be directed toward understanding women's reasons for both discontinuing regular sports and exercise activity after becoming pregnant and for initiating sports and exercise during pregnancy.

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