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Running Head: FACTORS RELATED TO EXERCISE

Factors related to Exercise over the Course of Pregnancy including Women's Beliefs  
about the Safety of Exercise during Pregnancy

Dianne Duncombe, Eleanor H. Wertheim, Helen Skouteris, Susan J. Paxton, and

Leanne Kelly

School of Psychological Science, La Trobe University

Bundoora (Melbourne), Victoria, Australia

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Correspondence author: Professor E Wertheim, School of Psychological Science, La  
Trobe University, Bundoora, Victoria, 3086, Australia.

Phone: +61 3 9479 2478

Fax: +61 3 9479 1956

E-mail: [e.wertheim@latrobe.edu.au](mailto:e.wertheim@latrobe.edu.au)

**Abstract****Objective**

to explore pregnant women's exercise patterns across pregnancy, reported reasons for exercising or not exercising, beliefs about the safety of exercise during pregnancy and the association of those beliefs with the amount and intensity of exercise that women participated in.

**Design**

a prospective questionnaire-based approach was implemented over three pregnancy time points eight weeks apart, with retrospective pre-pregnancy data obtained at the first time point.

**Setting**

participants were mailed questionnaires at 16-23 weeks pregnancy (T1), 24-31 weeks pregnancy (T2) , and 32-38 weeks pregnancy (T3).

**Participants**

a total of 158 pregnant women participated.

**Measurements**

at 16-23 weeks pregnancy women completed an Exercise Safety Beliefs Questionnaire in which they described their beliefs about the safety of *low to medium exercise, high intensity exercise, gentle exercise, and weight bearing exercise*. At T1, T2 and T3 reasons for exercising and not exercising were described, and participants maintained a one-week exercise diary in which they

recorded amount and intensity of physical activity. Physical symptoms experienced over time were also reported.

### **Findings**

the amount and intensity of exercise decreased over the course of pregnancy, with main reasons for not exercising including feeling tired or unwell, being too busy, and, particularly in late pregnancy, exercise being uncomfortable. Some women also reported safety concerns. Safety concerns predicted amount and/ or intensity of exercise.

### **Key conclusions**

overall, most women had clear beliefs about what forms of exercise were safe or not safe during pregnancy. Women who rated *gentle* and *low to medium exercise* as unsafe reported engaging in less intense and fewer minutes of exercise.

### **Implications for practice**

information and discussion about ways to exercise safely, enjoyably, and comfortably should be offered to pregnant women by health professionals in early pregnancy, when safety beliefs may impact on women's exercise patterns across pregnancy, and throughout pregnancy since the most appropriate forms of exercise may need to be modified over time.

## **Introduction**

Increasing evidence supports the importance of exercise for individual health. Being active can reduce the risk of diseases such as osteoporosis (Welten, Kemper, & Post, 1994), cardiovascular disease (Berlin & Colditz, 1990), type II diabetes (Macdonald, Philp, Harrison, Bone, & Watt, 2006; Manson & Spelsberg, 1994), colon cancer (Slattery, Potter, Caan, et al., 1997), and obesity (Cortright, Sandhoff, Basilo, et al., 2006). Regular exercise has also been shown to be effective in managing stress (Simonsick, 1991), alleviating depression (Bartholomew, Morrison, & Ciccolo, 2005; Galper, Trivedi, Barlow, Dunn, & Kampert, 2006; Morgan, 1994), boosting self-esteem (Simonsick, 1991) and enhancing body image (Suris & Parera, 2005; Williams & Cash, 2001).

An awareness that exercise is important in promoting health and well-being has led to many women wanting to continue exercising during pregnancy (Da Costa, Rippen, Dritsa, & Ring, 2003). Traditionally, pregnant women have been advised to restrict exercise due to concerns for the health of the mother and her foetus, including risks of over heating; impaired delivery of oxygen and nutrients to the foetus; and premature labour (American College of Obstetricians and Gynecologists, 1985). While no study has found any negative effect of moderate intensity aerobic exercise on pregnancy outcome in a normal, healthy pregnancy (Bell, Palma, & Lumley, 1995; Lokey, Tran, Wells, Myers, & Tran, 1991; Sternfeld, Quesenberry, Eskenazi, & Newman, 1995), the safe limits for exercise during pregnancy have not been determined.

The American College of Obstetricians and Gynecologists (ACOG) guidelines for exercise during pregnancy aim to assist practitioners involved in the management of pregnant women, and the women themselves, in considering risks and benefits of exercise

during pregnancy and deciding about participation. The 1985 ACOG guidelines recommended against vigorous exercise during pregnancy for previously sedentary women and those with adverse symptoms during pregnancy. Other women were advised to limit high impact activity, exercise intensity ( $\leq 140$  beats per minute), and exercise duration ( $\leq 15$  minute sessions). More recent ACOG guidelines (2002) acknowledged that participation in a range of exercise and recreational activities appeared to be safe during pregnancy. However, pregnant women were advised that each activity should be reviewed individually for its potential risk. If no medical or obstetric complications were present the guidelines recommended 30 minutes or more of moderate exercise on most, if not all, days. The guidelines acknowledged that there was little information available regarding vigorous exercise and women were advised to consult their health practitioners if considering strenuous exercise during pregnancy.

It has been suggested that uncertainty surrounding the safety of exercise during pregnancy leads women to stop or reduce exercising because of concerns for their unborn child (Clarke & Gross, 2004; Ezmerli, 2000) and increased risk of maternal falls and injury (Clarke & Gross). However we are not aware of research that has examined whether there is an association between pregnant women's beliefs about the safety of exercise and their levels of exercise participation during pregnancy.

Therefore, this prospective study followed women across pregnancy, to examine their beliefs about the safety of exercise during pregnancy and whether these beliefs were associated with the amount or the intensity of exercise engaged in over time. The study also explored the amount and intensity of exercise that women participated in across pregnancy and reasons women reported for exercising or not exercising during pregnancy.

## **Method**

In this study, women in the early phases of their pregnancy were recruited from the general population and completed questionnaires and a one-week exercise diary at 16-23 weeks gestation (T1), 24-31 weeks gestation (T2), and 32-38 weeks gestation (T3).

Approval for this study was obtained from the La Trobe University Human Ethics Committee. The study reported here was part of a larger project on women's experiences across pregnancy – only measures relevant to this study are described here.

### *Recruitment and participants*

Advertisements were placed in local newspapers and community newsletters (such as pregnancy exercise providers and mothers groups) and on pregnancy websites requesting volunteers for pregnancy research. Private obstetricians and gynaecologists were also contacted and if they consented, flyers were sent to their rooms to be placed in their waiting rooms. The advertisements invited women who were in the early phases of pregnancy to participate in a longitudinal study investigating 'a range of life style factors during pregnancy.' In the ads, women interested in participating were directed to contact the researchers by telephone or email and study requirements were then explained. Active written consent was obtained.

A total of 158 pregnant women were recruited with 45% obtained from the ads in newspapers, newsletters, magazines and websites; 24% from flyers in obstetrician/gynaecologist waiting rooms; 26% from flyers sent to three different pregnancy exercise class providers; and 5% from word of mouth. Mean gestation on first completing questionnaires was 18.5 weeks (range = 16-23 weeks). Retention of the 158 women across time points was good, with 152 and 144 completing data at T2 and T3

respectively. Of the non-completers, five had moved and were not contactable, three stated lack of time, two had medical complications, two had deaths in the family and two stated they did not wish to answer questions in another part of the study.

### *Measures*

*Demographics.* At T1, participants reported their occupation, employment, income, ethnicity, age, weight, marital status, height, parity and weeks gestation.

*Beliefs about exercise safety.* An *Exercise Safety Beliefs Questionnaire* (ESBQ) initially comprising 15 items was developed by the researchers. At T1 women rated how safe they felt each of a range of physical activities was to do during pregnancy. Five of the items asked women to rate the safety of: *non weight bearing exercise* (e.g., *swimming, cycling, water aerobics*), *weight bearing exercise* (e.g., *walking running, jogging, weight training*), *high impact exercise* (e.g., *running, jogging, high impact aerobics*), *low impact exercise* (e.g., *walking, swimming, low impact exercising*), and *exercise specifically designed for pregnancy*; and one item referred simply to *exercise being unsafe*. An additional nine items asked about *low intensity exercise* (*very comfortable*), *moderate exercise* (*lightly puffing, still able to talk*), and *vigourous exercise* (*puffing, can hardly talk*), each of which were rated three times with the frequency of the activity varying between *less than three times weekly, three to five times weekly, and more than five days weekly*. Ratings for all items included *very safe* (1), *somewhat safe* (2), *Neither safe nor unsafe* (3), *Somewhat unsafe* (4), and *Very unsafe* (5); scores were reversed so higher scores reflected greater belief in safety of exercise.

Since this was a new measure, a separate sample of 24 pregnant women sourced from a parallel prospective study with the same recruitment methods were asked to answer

the items and then rate how easy the language was to understand; 91.7% rated the language as *easy*, 8.3% rated it *somewhat easy*, and no participants indicated the language was *not easy* to understand.

*Exercise participation questions.* Participants reported their reasons for currently engaging in exercise at T1, T2, and T3 and also at three months prior to the pregnancy (completed retrospectively at T1). First, participants chose one category that best described their exercise activity from choices of *regular*, *sporadic*, *none* or *very little* and *new to exercise*. Second, they chose reasons (any that applied) for participating in *any* physical activity in the past four weeks from choices of *fitness; tone and strength; weight loss; relieve stress; enjoyment; have a regular activity routine; and other (describe)*. Finally, participants indicated all reasons why they did no or little physical activity in the past four weeks, including: *too tired; dislike exercise; too busy; not safe to exercise during pregnancy; unsure of what exercise is safe during pregnancy; felt too unwell; exercise is too uncomfortable during pregnancy; and other (describe)*.

*Physical symptoms questions.* Women reported whether they experienced physical symptoms at pre-pregnancy, T1, T2 and T3, including *body soreness, shortness of breath, fatigue, leg cramps, heartburn, groin pain, and nausea*.

*Seven-day exercise diary.* At T1, T2, and T3 for seven consecutive days, participants maintained an exercise diary (instructions were provided). Each time they exercised women monitored the types of exercise they participated in. On one occasion for each different type of exercise, women recorded the length of the main exercise activity, warm-up and warm-down minutes, before and after exercise stretching minutes and pulse rate (a heart rate monitor was provided) after completing the main exercise activity. On

one occasion for each different exercise type, women rated from 0 to 4 their puffing during exercise, body heat during exercise, and tiredness after exercise. On one of the seven mornings, participants monitored their resting heart rate.

*Retrospective Exercise Diary.* At T1, women recalled the types and number of minutes of exercise participated in during a retrospective three-month time period before pregnancy including warm-up, warm-down, and stretching minutes (flexibility exercise) done in each session.

#### *Procedure*

At 7-to 8-week intervals women were mailed questionnaires with the measures indicated above, plus a Polar 'Beat' heart rate monitor and reply-paid envelopes. Heart rate monitors have a transmitter (an elastic electrode belt worn around the chest) and a receiver (worn on the wrist like a watch) that shows the user's heart rate in beats per minute and have been shown to correlate 0.97 with ECG measurements (Lewis, 1992). Participants were given instructions over the phone and in writing on how to use the monitor.

#### *Data Analysis*

Analyses were conducted using the SPSS package. Frequencies were run on exercise participation responses, followed by Friedman tests to assess changes in exercise patterns and pregnancy related symptoms across time points. Information from the exercise diaries was used to calculate amount and intensity of exercise (described below) and analysis of variance (ANOVA) assessed changes in these scores over time. Exercise Safety Beliefs items were examined using frequencies of responses and a Principal

Components Analysis (PCA) was used to explore the factor structure of the questionnaire. PCA with varimax rotation was used to extract the smallest number of components out of multiple variables while accounting for the maximum amount of variance from the original variables. The highest loading items on each factor were summed to create safety beliefs subscales, which were then correlated with exercise patterns across pregnancy.

*Coding amount of exercise.* At each time point, from the seven-day and retrospective diaries, the total number of minutes of three types of exercise were summed: (1) an *aerobic* minutes total comprised minutes of walking, running, cycling, swimming, aerobic classes and the aerobic components of pregnancy exercise classes, circuit classes, basketball, water aerobics, dance and tennis; (2) an *anaerobic* minutes total comprised weight training, martial arts, pump classes, body tone classes and the anaerobic components of circuit classes, water aerobics, basketball, dance and tennis; and (3) a *flexibility* training minutes total included yoga, pilates, warm-up and warm-down exercise and stretching before and after participants' main exercise activity. Finally, the *total* number of minutes of exercise across the three types of activities was calculated at each time point, including pre-pregnancy (PP), T1, T2, and T3.

*Coding exercise intensity.* From the diaries, at each time point, for each type of exercise scores for puffing, heat, fatigue, and heart rate (highest rate during the activity minus resting rate) were transformed into standard scores, then summed and divided by the number of different activities engaged in. Higher scores represented greater average intensity of exercise over the period.

## **Findings**

### *Sample characteristics*

Table 1 depicts demographic characteristics of participants. At T1 the 158 women had an age range from 21 to 42 years and were from 16 to 23 weeks gestation with a mean of 18.5 weeks. Most participants were from Melbourne and regional Victoria, Australia, with several residing in other states. At T2 152 women returned the questionnaires; mean gestation was 26.6 weeks (range = 24-31 weeks). At T3 144 women returned questionnaires; mean gestation was 34.5 weeks (32-38 weeks).

(insert Table 1 here)

### *Internal consistency of intensity measure*

Internal consistency of the intensity measure at the three time points was assessed by Cronbach's alphas in which the items included were the final scores for puffing, heat, fatigue and heart rate. The alphas were excellent for a 4-item measure: alpha at T1 = .84, T2 = .78, T3 = .80.

### *Regularity of exercise*

Prior to pregnancy 57.9% of the sample described themselves as *regular exercisers*, 27.6% as *sporadic exercisers* and 14.5% reported doing *none or very little exercise*. At T1 46.3% described *regular*, 28.9% *sporadic*, and 24.8% *none or very little exercise*. At T2 46.4% reported *regular*, 24.8% *sporadic* and 28.8% *none or little exercise*. At T3 34.3% reported *regular*, 21.7% *sporadic* and 44% *none or very little exercise*. Only two previously inactive participants started to exercise during pregnancy.

### *Changes in exercise from early to late pregnancy*

Differences in *exercise minutes* engaged in at pre-pregnancy, T1, T2 and T3 were analysed using repeated measures one-way ANOVAs (with Huynh-Feldt Epsilon adjustments applied). A significant Time effect was found for *exercise minutes*,  $F(1.69, 231.31) = 99.83, p < .0005, \eta^2 = .42$ . Least Significant Difference (LSD) post hoc comparisons revealed that women participated in progressively less exercise ( $p < .0005$ ) at each time point: pre-pregnancy (PP) versus T1  $\eta^2 = .42$ ; T1 vs. T2  $\eta^2 = .03$ ; T2 vs. T3  $\eta^2 = .17$ ; PP vs. T3  $\eta^2 = .54$ .

A significant effect for Time (T1, T2, T3) was found for *exercise intensity*,  $F(1.75, 108.81) = 8.97, p < .0005, \eta^2 = .13$ . Women's aerobic exercise intensity was significantly higher at T1 than T3 ( $p = .002, \eta^2 = .14$ ) and T2 than T3 ( $p < .0005, \eta^2 = .28$ ); with T1 and T2 not different ( $p = .81$ ). See Table 2 for means.

(Insert Table 2 here)

#### *Reasons for participating in exercise in the past month*

As shown in Table 3, the most frequently reported reasons for participating in exercise were for *fitness* and *enjoyment*, with over half the sample citing those reasons. Other reasons were for *tone and strength* and to *relieve stress*. While 42% reported *weight loss* as a reason for exercising before pregnancy, very few women reported it as a reason during pregnancy. Friedman tests resulted in significant changes in reasons for exercising from pre- to late pregnancy; decreases were found for exercising for *fitness* ( $p < .0005$ ); *tone and strength* ( $p = .004$ ); *weight loss* ( $p < .0005$ ); *enjoyment* ( $p < .0005$ ); and to *relieve stress* ( $p = .013$ ). In contrast, small increases were reported in maintenance of a *regular exercise routine* ( $p = .04$ ) at T1 and T2.

(insert Table 3 here)

*Reasons for doing no or little physical activity in the past month*

The most reported reasons for not exercising during pregnancy were *feeling too tired, too busy, feeling unwell* and *exercise was too uncomfortable* (see Table 3).

Friedman tests indicated significant increases in women reporting that they were *too tired* to exercise during pregnancy when compared with pre-pregnancy ( $p < .0005$ ) and that exercise was *too uncomfortable* from earlier to later pregnancy ( $p < .0005$ ). No significant changes were found for other reasons ( $p > .05$ ). In general, compared to pre-pregnancy and across the various pregnancy time points, women reported significant increases ( $p < .0005$ ) in physical symptoms such as *shortness of breath* (PP = 11%; T1 = 52%, T2 = 68%, T3 = 80%), *heartburn* (7%, 25%, 46%, 55%); *groin pain* (1%, 14%, 31%, 42%), *leg cramps* (7%, 25%, 57%, 63%), and *body soreness* (18%, 40%, 66%, 73%), with *fatigue* being consistently reported across pregnancy (PP = 37%, T1 = 82%, 78%, 81%) and *nausea* peaking earlier in pregnancy (PP = 9%, T1 = 49%, 29%, 29%).

*Percentage responses to exercise safety questions*

As displayed in Table 4, most participants reported that *exercise designed for pregnancy, non-weight bearing exercise, low intensity exercise (very comfortable) 3-5 times a week* and *low impact exercise* were very safe. Types of exercise reported as very unsafe were *vigorous exercise (puffing a lot, could hardly talk) more than 5 times a week, vigorous exercise 3-5 times a week, and high impact exercise*.

(insert Table 4 here)

*Development of Exercise Safety Beliefs Subscales*

None of the participants left any of the items from the Exercise Safety Beliefs Questionnaire blank, suggesting that participants found the items clear to answer.

Principal components analyses (PCA) with varimax rotation were performed on ESBQ items. Five factors with an eigenvalue greater than one were labelled: *low intensity exercise safety* (eigenvalue = 3.80, % variance explained = 24.3), *high intensity exercise safety* (eigenvalue = 2.24, % variance = 14.9), *gentle exercise safety* (eigenvalue = 1.60, 10.7% variance), *weight bearing exercise safety* (eigenvalue = 1.21, % variance = 8.1). A fifth factor that related to non-specified *exercise safety* (eigenvalue 1.14, % variance = 7.6) had only a single high loading item in it and was therefore dropped. Subscales were created by summing items loading  $> .50$  on each retained factor (see Table 4); higher scores indicated greater belief that the form of exercise is safe. Cronbach alphas for three subscales were considered excellent for short scales: *low to medium exercise safety* (7 items) alpha = .81, *high intensity exercise* (3 items) = .78; *gentle exercise* (2 items) = .72. The *weight bearing exercise* subscale alpha was .48, which was considered lower but acceptable for a two-item index.

#### *Relationships between beliefs about exercise safety subscales and exercise variables*

T1 beliefs that *low to medium exercise* was unsafe predicted fewer minutes of exercise concurrently ( $r = .26, p < .01$ ) and prospectively (T1  $r = .18$ , T3  $r = .20, p < .05$ ). Beliefs that *gentle exercise* was unsafe predicted lower exercise intensity at T1 ( $r = .21, p < .05$ ) and T2 ( $r = .24$ ) and believing *weight bearing exercise* was unsafe related to lower exercise intensity at T1 ( $r = .21, p < .05$ ). The *high intensity exercise safety* beliefs and other time points were not predictive of exercise behaviours ( $p > .05$ ).

#### **Discussion**

The aims of this study were to examine women's beliefs about the safety of exercise and reasons for exercising or not exercising during pregnancy. Four factors of

exercise safety beliefs were created: safety beliefs related to *low to medium exercise*, *high intensity exercise*, *gentle exercise*, and *weight bearing exercise*. Overall, most women believed that low intensity exercise and low impact exercise were safe and that high puff vigorous exercise and high impact exercise were unsafe. Women with more belief in the unsafeness of low to medium exercise reported participating in less exercise across pregnancy. Women with greater belief that gentle exercise was unsafe were also more likely to exercise at lower intensities at 24-31 and 32-38 weeks gestation. Finally, those with greater belief in the unsafeness of weight bearing activity exercised at lower intensity in earlier pregnancy. Significant correlations were low ( $r < .30$ ), however, suggesting that other factors, such as fatigue, time pressures, and physical discomfort, were playing a large role in determining exercise patterns during pregnancy.

While most participants (61 to 83%) believed that *low intensity exercise* was very safe during pregnancy, 27% had concerns about the safety of more than five moderate exercise sessions per week. Most women also believed that the individual components of gentle exercise (i.e., *non-weight bearing exercise* and *exercise designed for pregnancy*) were very safe or somewhat safe activities. However, when women believed that *gentle* or *low intensity exercise* was less safe they were likely to engage in less intense, and fewer minutes of exercise.

In relation to *weight bearing exercise*, while most women (57%) believed it was *unsafe*, a third believed it was neutral and 10% believed it was safe, and those women who believed it was safe reported engaging in more intense exercise. Given that *weight bearing exercise* included varied activities including walking (90% participated in walking at T1), running (1.6% of the sample ran at T1), weight training, pump classes, body tone, circuit

classes, and pregnancy and aerobic exercise classes, women should be encouraged to discuss any planned activities with their practitioners to clarify the specific activity's likely safety in their context. The sources and accuracy of women's beliefs about exercise safety during pregnancy were not assessed in this study and would be useful to pursue in future research.

Women reported participating in significantly less exercise during pregnancy than three months pre-pregnancy. As exercise at pre-pregnancy was retrospectively reported the findings need to be interpreted cautiously. However, progressively fewer minutes of exercise were also reported across all pregnancy time points. The decreases (effect sizes) were small between 16-23 weeks and 24-31 weeks pregnancy, but large ( $> .12$ ) in the latter stages of pregnancy (24-31 weeks to 32-38 weeks). Large decreases in exercise *intensity* were also reported at 32-38 weeks of pregnancy.

This study is consistent with others that show decreases in exercise during pregnancy. Decreases in running, aerobic classes, cycling, weight training and sports at different pregnancy time points have been reported (Clapp, 1989; Clapp & Dickstein, 1984; Clarke & Gross, 2004; Da Costa et al., 2003; Dale, Mullinax, & Bryan, 1982; Sternfeld et al., 1995) and decreases in activity from pre-pregnancy to early pregnancy have been found among runners, aerobic dancers and cross-country skiers (Clapp, 1989; Clapp and Dickstein, 1984). The current study builds on the small number of studies undertaken in a general community sample of women.

Two main reasons reported by women in this study for doing no or little exercise during pregnancy included feeling *tired* and feeling *unwell*. These findings are consistent with those of Clapp (1989) and Clapp and Dickstein (1984), whose pregnant women cited

fatigue, gastrointestinal upset and occasional injury as reasons for reducing exercise. In the current study, a substantial proportion also noted being too busy to exercise. Discomfort during exercise was increasingly reported in later stages of pregnancy and there were indeed many women who reported general (non-exercise related) symptoms late in pregnancy, such as *leg cramps* (63%), *body soreness* (73%), and *shortness of breath* (80%). While safety issues were not barriers for most women, at different points in pregnancy 5 to 8% of women did indicate safety concerns prevented them from exercising. In contrast to this finding, Clarke and Gross reported in a small sample that 32% referred to risks or dangers that they believed to be associated with exercise. Whether the two studies' findings differ because of sample variations (36 United Kingdom versus 158 Australian women) or method differences (Clarke and Gross' study was qualitative) remains to be tested.

Reasons for exercising during pregnancy included: to enhance *fitness, tone and strength*, to *relieve stress*, to *have a regular routine*, and *for enjoyment*. Reasons changed across pregnancy, suggesting that some women may reassess their exercise priorities as their pregnancy progresses. In particular, substantially fewer women reported exercising for *weight loss* during pregnancy than at pre-pregnancy, which is likely to be a useful adaptation to pregnancy.

The number of women not exercising regularly or not exercising at all during pregnancy as well as the substantial decrease in women's exercise performance across pregnancy is of some concern. Recent ACOG (2002) guidelines encourage healthy pregnant women to engage in regular, moderate intensity exercise in order to gain the health benefits they received before pregnancy. However, women who become inactive

during pregnancy miss out on benefits of improved cardiovascular, musculoskeletal and general fitness, which have implications preventing and managing gestational diabetes (Dye, Knox, Artal, Aubry, & Wojtowycz, 1997) and other diseases. Therefore, pregnant women need to receive current information and instruction about exercise so they can make informed decisions in consultation with their health practitioners about exercise that will enhance their health and wellbeing. These discussions can include finding ways to address individual women's barriers to exercising, e.g., through scheduling time in a busy week, developing a routine, and finding safe, invigorating, comfortable and enjoyable activities to engage in at different stages in the pregnancy.

Several limitations of the current study should be noted including the self report nature of the study and the fact that pre-pregnancy data was retrospective. Most participants had stable partners and were university educated, therefore, replication in a more diverse sample is required. Future research should also examine whether exercise safety beliefs vary according to socioeconomic status, parity, maternal age, time point in pregnancy, and other factors.

In conclusion, the findings of the study indicated that most pregnant women had clear beliefs about whether exercise was safe or not safe during pregnancy. However, women who rated gentle exercise and low to medium levels of exercise as more unsafe were more likely to report doing fewer minutes of exercise and/or exercising at a lower intensity. Furthermore, women participated in significantly less exercise as their pregnancies progressed and their exercise intensity also decreased. As pregnancy progressed substantially fewer women reported exercising for fitness, tone and strength; for weight loss; to relieve stress and for enjoyment during pregnancy when compared to

before pregnancy. However, the only significant changes in the reasons for women doing *no or little* exercise were that across pregnancy women felt too tired to exercise and in later pregnancy exercise was too uncomfortable. Therefore, it is recommended that health practitioners discuss with women the health benefits of exercise and engage in collaborative discussions about methods for exercising in a comfortable, safe, enjoyable and not too tiring manner. Further research on the impact of structured advice and a collaborative decision-making approach, especially in the early stages of pregnancy when beliefs can affect the course of pregnancy, are recommended.

#### Author Notes

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[e.wertheim@latrobe.edu.au](mailto:e.wertheim@latrobe.edu.au)

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Table 1.

*Demographic Characteristics of the Sample.*

Variables	Sample Characteristics	
Age	Mean = 31.7 years (SD = 3.7)	
Gestation at Time 1	Mean = 18.5 weeks (SD = 1.9)	
Parity	Primiparous	45.1%
	Has one child	35.8%
	Has two or more children	11.8%
Marital status	Married	87.8%
	De facto relationship	11.5%
	Single	0.7%
Annual household income	above A\$70,000	70.9%
	A\$50,000 to A\$69,000	10.1%
	A\$30,000 to A\$49,000	14.9%
	under A\$30,000	2%
Education level	tertiary	81.8%
	secondary	16.9%
	primary	1.4%
Born in	Australia	87.2%
	Europe	6.1%
	Elsewhere	6.7%

Table 2.

*Means (and Standard Deviations in Brackets) for Exercise Measures at Pre-pregnancy, T1, T2 and T3*

Measures	Pre-pregnancy	Time 1	Time 2	Time 3
	Retrospective	16-23 weeks	24-31 weeks	32-38 weeks
Exercise minutes	311.49 (196.08) <sup>a</sup>	139.79 (125.32) <sup>b</sup>	126.56 (130.37) <sup>c</sup>	85.44 (111.99) <sup>d</sup>
Range	0.00-803.00	0.00-584.00	0.00-589.90	0.00-497.40
Exercise Intensity	n/a	60.09 (22.59) <sup>a</sup>	61.95 (19.80) <sup>b</sup>	55.92 (17.71) <sup>c</sup>
Range	n/a	33.69-98.84	28.00-91.51	30.03-84.77

Note: Significant differences were found between variables with different superscript labels (<sup>a</sup> through <sup>d</sup>). No measures of exercise intensity were recorded at pre-pregnancy.

PP minutes  $n = 158$ ; T1 minutes  $n = 158$ ; T2 minutes  $n = 152$ ; T3 aerobic minutes  $n = 144$ ;

T1 exercise intensity  $n = 108$ ; T2 exercise intensity  $n = 106$ ; T3 exercise intensity  $n = 74$ .

Table 3.

*Reasons that Women Reported for Participating and Not Participating in any Physical Activity in the Past Four Weeks at Pre-pregnancy, and at Time 1, Time 2 and Time 3*

	Prepregnancy	Time 1	Time 2	Time 3	Chi-Square
<i>Reasons for exercising</i>	(n =158)	(n =158)	(n =153)	(n =143)	
Fitness	74.3%	74.2%	64.7%	52.8%	27.32, $p < .0005$
Tone and strength	43.4%	45.9%	49.0%	34.5%	13.39, $p = .004$
Weight loss	41.5%	6.3%	3.3%	2.1 %	135.07, $p < .0005$
Relieve Stress	40.9%	34.6%	30.7%	28.2%	10.73, $p = .013$
Enjoyment	56.0%	53.5%	52.3%	38.7%	19.96, $p < .0005$
Have a regular routine	29.6%	40.3%	41.2%	32.7%	8.31, $p = .04$
<i>Reasons for not exercising</i>	(n = 158)	(n =158)	(n =153)	(n =143)	
Too tired	8.8%	34.6%	28.8%	39.2%	45.70, $p < .0005$
Too busy	25.8%	25.2%	19.6%	27.3%	3.88, $p > .05$
Dislike exercise	6.9%	3.1%	5.2%	2.8%	6.75, $p > .05$
Felt too unwell	n/a	18.9%	11.2%	14.1%	3.70, $p > .05$
Exercise not safe	n/a	2.5%	2.6%	2.1%	0.25, $p > .05$
Unsure what exercise is safe	n/a	5.7%	3.9%	2.8%	1.27, $p > .05$
Exercise too uncomfortable	n/a	5.0%	9.8%	18.2%	18.24, $p < .0005$

Note: n/a questions were not asked at pre-pregnancy, therefore,  $\chi^2$  calculated for T1, T2

and T3 during pregnancy only

Table 4.

*Principal Component Analysis (PCA) Loadings and Individual Item Percentages for each Exercise Safety Belief*

Exercise safety beliefs	PCA Loading	Very safe	Somewhat safe	Neither safe nor unsafe	Somewhat unsafe	Very unsafe
<b><i>Low to Medium Exercise</i></b>						
Low intensity exercise < 3 times a week	0.66	77.2%	12.7%	7.0%	3.2%	0
Moderate exercise < 3 times a week	0.72	39.2%	39.9%	13.9%	5.7%	1.3%
Low intensity exercise 3-5 times a week	0.79	82.9%	12.0%	2.5%	1.9%	0.6%
Moderate exercise 3-5 times a week	0.72	34.2%	43.0%	12.0%	9.5%	1.3%
Low intensity exercise > 5 times a week	0.71	61.4%	25.9%	5.7%	4.4%	2.5%
Moderate exercise > 5 times a week	0.65	12.0%	41.1%	20.3%	22.2%	4.4%
Low impact exercise	0.51	63.9%	32.3%	1.9%	1.9%	0
<b><i>High Intensity Exercise</i></b>						
Vigorous (high puffing) exercise < 3 times a week	0.85	0	7.6%	12.7%	39.2%	40.5%
Vigorous exercise 3-5 times a week	0.90	0.6%	5.7%	11.4%	38.6%	43.7%
Vigorous exercise > 5 times a week	0.65	0	2.5%	2.5%	29.1%	65.8%
<b><i>Gentle Exercise</i></b>						
Non-weight bearing exercise	0.84	74.7%	22.8%	1.3%	0.6%	0.6%

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Exercise designed for pregnancy	0.84	89.9%	8.9%	0	0.6%	0.6%
<i>Weight Bearing Exercise</i>						
High impact exercise	0.76	0	4.4%	9.5%	42.4%	43.7%
Weight bearing exercise	0.74	8.9%	57.0%	15.2%	14.6%	4.4%

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Note. A single item factor relating to non-specified exercise safety was dropped. PCA

loadings above .40 are listed. T1  $n = 158$ .