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Journal article

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1 **Impact of heavy resistance training on pregnancy and postpartum health outcomes**

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29 **Abstract**

30 **Introduction:** Participation in Olympic weightlifting, the Valsalva maneuver, and acute or
31 prolonged supine weightlifting during pregnancy are cautioned against, however, these
32 recommendations are based on expert opinions as opposed to empirical evidence. The aim of this
33 study was to examine the training and health outcomes of individuals who engaged in heavy
34 resistance training during pregnancy. **Methods:** 679 individuals who lifted at least 80% 1-
35 repetition maximum during pregnancy participated in an online survey. **Results:** Participants
36 were primarily recreational athletes (88%, n = 332/673) engaged in CrossFit™ (61%, n =
37 410/675) and/or weightlifting (49%, n = 332/675) during pregnancy. Most participants reported
38 no complications during pregnancy or delivery (66%, n = 388/589), while 57% (n = 241/426)
39 reported urinary incontinence following pregnancy. Participants who maintained pre-pregnancy
40 training levels until delivery reported significantly less reproductive complications compared to
41 those who ceased training levels prior-to delivery ($p = 0.006$). Most respondents engaged in
42 Olympic lifting (72%, n = 311/432) and lifting in a supine position (71%, n = 306/437), while
43 fewer reported use of the Valsalva maneuver during pregnancy (34%, n = 142/412). Most
44 returned to weightlifting following delivery (89%, n = 400/447, average: 3.2 ± 3.0 months),
45 including Olympic lifting (81%, n = 300/372, average: 4.0 ± 3.4 months) and Valsalva (62%, n =
46 213/341, average: 4.5 ± 3.6 months). **Conclusions:** Individuals who engaged in heavy prenatal
47 resistance training had typical perinatal and pelvic floor health outcomes that were not altered
48 whether they engaged in, or avoided Olympic lifting, Valsalva or supine weightlifting.
49 **Key words:** weightlifting, prenatal, postnatal, Valsalva, Olympic weightlifting, supine
50 weightlifting.

51 **Brief Summary:**

52 Women who engaged in heavy prenatal resistance training, including contraindicated activities
53 such as Olympic lifting, Valsalva or supine weightlifting, reported typical perinatal health
54 outcomes.

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72 **Introduction**

73 Female participation in strength-focused sports such as CrossFitTM, weightlifting and
74 powerlifting has risen dramatically over the last decade.(1, 2) Due to a lack of data supporting

75 safe participation in heavy/strenuous weightlifting, prenatal physical activity guidelines
76 discourage Olympic lifting, Valsalva maneuver and acute and/or prolonged weightlifting in the
77 supine position.(3-6) However, these recommendations are largely based on expert opinion as
78 opposed to empirical evidence.

79 Traditionally pregnant individuals were discouraged from engaging in heavy lifting based
80 on evidence in an occupational setting where repetitive lifting more than 11kg was associated
81 with an increased risk of having a miscarriage, developing preeclampsia or having a preterm
82 delivery.(3, 7) However, occupational lifting and heavy weightlifting in a recreational setting are
83 vastly different and cannot be equated to establish the potential for adverse pregnancy outcomes.
84 Under recreational settings, dynamic movements at intensities to improve metabolism typically
85 occur over a short period of time (<60 minutes), and allow sufficient time to recover. In contrast,
86 chronic physically demanding activities in an occupational setting generally do not include
87 sufficient rest or recovery may induce physiological “overtraining”, fatigue, psychological stress
88 and detrimental health effects.(8) Further, concerns of excessive stress on the pelvic floor from
89 heavy weightlifting also inspire recommendations to avoid these activities during pregnancy.
90 Evidence demonstrates non-pregnant female athletes who participate in powerlifting, CrossFit™,
91 and weightlifting have a higher incidence of stress urinary incontinence (UI) during heavy lifting
92 and high-impact activities.(9-12) During pregnancy up to 75% of pregnant individuals
93 experience UI prior to delivery,(13) and the combination of heavy weightlifting and pregnancy
94 could exacerbate the risk of UI. However, the combined impact of pregnancy and heavy
95 weightlifting on UI is unknown.

96 Prenatal physical guidelines recommend avoiding the Valsalva maneuver due to concerns
97 surrounding the substantial, but transient, increase in maternal blood pressure. Two studies have
98 demonstrated that the Valsalva maneuver during pregnancy is not associated with any adverse

99 acute maternal outcomes; (14, 15) however, both were completed at relatively low training loads
100 (up to maximum of 50 lbs with incline bench press(14) and 40% of 10 repetition maximum [RM]
101 in a seated leg press).(15) Acute and/or prolonged supine exercise, particularly after 16 weeks of
102 gestation, has been cautioned against for decades.(16) Evidence has demonstrated that supine
103 positions during pregnancy compress the maternal inferior vena cava (IVC) and aorta which may
104 result in maternal hypotension and reduced fetal oxygenation.(17-19) A recent review observed
105 that despite compression of the IVC in the supine position, the majority of pregnant individuals
106 do not demonstrate symptoms of hypotension.(20) At this time evidence remains inconclusive if
107 acute or prolonged supine exercise during pregnancy is associated with adverse outcomes.(21,
108 22)

109 Given the distinct lack of empirical evidence supporting (or not) the safety of heavy
110 weightlifting (including supine and Olympic weightlifting) and the Valsalva maneuver, the aim
111 of the present study was to examine whether females who continued to participate in heavy
112 resistance training during pregnancy (>80% 1RM) were at heightened risk for adverse birth
113 outcomes, adverse fetal outcomes or pelvic floor dysfunction.

114 **Methods**

115 **Survey**

116 The questionnaire was developed by pelvic floor physiotherapists (C.P., L.F.), exercise
117 physiologists (M.H.D., M.K.), biokineticist and sports rehabilitator (M.D.), and an elite-level
118 weightlifter (C.P.) from Canada, the United States, Australia and the United Kingdom. The
119 public was not involved in the design of this study. The survey was piloted with a small group of
120 female athletes to assess the feasibility, usability and clarity of the survey. The questionnaire
121 consisted of 60 questions and took 20-30 minutes to complete. Question domains included
122 maternal demographics, sport history, reproductive history, pregnancy health outcomes, and pre-

123 pregnancy/pregnancy/postpartum aerobic and resistance training characteristics. Respondents
124 were asked about any signs or symptoms of pelvic floor dysfunction (leaking, heaviness,
125 symptoms of prolapse, pain) during and following pregnancy. Finally, participants were asked
126 about information sources that they used to make decisions about heavy weightlifting during
127 pregnancy.

128 **Participants**

129 Between June 14 and August 21, 2021, we recruited 679 participants through social
130 media (e.g., Instagram), word of mouth and through the authors' personal networks. Participants
131 had to be over the age of 18 and engaged in heavy weightlifting during pregnancy (>80% 1RM).
132 A threshold of greater than 80% was chosen as this exceeds any current resistance training
133 literature in pregnant individuals and equates to loads higher than published guidelines have
134 recommended due to a paucity of literature.(4-6) Electronic informed consent was provided
135 before completing an online survey. This study was approved by the University of Alberta
136 Health Research Ethics Board (Pro00109302) and was conducted in accordance with the
137 Declaration of Helsinki, apart from registration in a publicly available database. Responses were
138 collected through Research Electronic Data Capture, a web-based software hosted by the Women
139 and Children's Health Research Institute, University of Alberta, Canada.

140 **Statistical Analysis**

141 After all responses were collected, all data were cleaned and verified for accuracy, and
142 impossible (e.g., non-human body weight) data were removed. All exclusions were reviewed by
143 M.K. and M.H.D and discarded following consensus. The mean \pm standard deviation was
144 calculated for continuous variables, and frequency of responses (*n* and %) were calculated for
145 categorical variables. Subgroup analysis comparing training patterns and or pregnancy outcomes
146 of pregnant individuals 1) with and without UI; 2) who performed Valsalva during pregnancy; 3)

147 engaged in supine lifting during pregnancy; and 4) Olympic lifts during pregnancy. To determine
148 differences between groups, Fisher exact tests were used for categorical data, and multiple t-tests
149 using the false discovery rate were used for continuous data. Odds ratios with 95% confidence
150 intervals (95% CI) were calculated for all categorical variables.

151 **Results**

152 **Participant Characteristics**

153 Participant demographics are provided in Table 1 of the Supplement Digital Content.
154 Most respondents were recreational athletes (88%, $n = 594/673$) that had been engaged in heavy
155 weightlifting for 6.7 ± 4.1 years (range 1-30). Participants reported lifting at least 73% of their
156 pre-pregnancy body weight during pregnancy (snatch, 73%; bench press, 85%; clean and jerk,
157 94%; clean, 97%; squat, 133%; deadlift, 163%).

158 **Reproductive Outcomes**

159 Pregnancy or delivery complications were reported by 34% of respondents during ($n =$
160 $201/589$), and 20% ($n = 112/574$) following pregnancy (see Supplement Digital Content Table 2
161 for the full list of complications). Rates of gestational hypertension ($18/589$, 3%), preeclampsia
162 ($17/589$, 3%) and gestational diabetes mellitus ($4/589$, 1%) were below expected prevalence
163 values for the general obstetrical population. Prevalence of pregnancy and delivery
164 complications were largely not different between respondents who engaged in Olympic lifting,
165 Valsalva maneuver, or supine exercise, compared with those who did not (see Supplement
166 Digital Content Tables 3, 4, and 5). Respondents who maintained pre-pregnancy training levels
167 until delivery reported significantly less pregnancy and delivery complications compared to
168 those who reduced their training level prior-to delivery (OR: 0.49, 95% CI, 0.29 – 0.81, $p =$
169 0.006) (see Supplement Digital Content Table 6).

170 **Training patterns during pregnancy**

171 During pregnancy, eighty-five percent of respondents continued to engage in heavy
172 weightlifting (with or without modification) until delivery, including 24% (n=108/445) who
173 maintained their pre-pregnancy training levels throughout gestation (see Supplement Digital
174 Content Table 7). The majority of participants engaged in Olympic weightlifting (72%, n =
175 311/432) and supine weightlifting (71%, n = 306/437) during pregnancy, while a minority of
176 individuals reported performing Valsalva maneuvers during pregnancy (34%, n = 141/420).

177 ***Urinary Incontinence:***

178 Thirty-seven percent of participants experienced UI during pregnancy. Individuals who
179 experienced prenatal UI had a lower 1RM for squat, bench press, clean, and clean and jerk prior
180 to conception (see Supplement Digital Content Table 8). However, all other variables were
181 including pre-pregnancy and pregnancy training volumes, and engagement in Olympic lifting,
182 Valsalva and supine exercise were not different between individuals who did and did not
183 maintain continence during pregnancy (see Supplement Digital Content Tables 8 and 9).

184 ***Olympic Weightlifting, Valsalva and Supine Exercise:***

185 Respondents who engaged in Olympic weightlifting during pregnancy had significantly
186 higher pre-pregnancy 1RM for all six lifts, as well as duration and frequency of weightlifting
187 sessions (see Supplement Digital Content Table 10). During pregnancy, participants who
188 engaged in Olympic lifts were more likely to perform the Valsalva maneuver (OR: 2.12, 95% CI,
189 1.29 to 3.39, $p = 0.003$), and reported a greater frequency of resistance training (3.09 ± 1.20 vs.
190 2.55 ± 0.97 days/week; $p = 0.0007$). Remaining training outcomes were not different between
191 groups (see Supplement Digital Content Tables 10 and 11).

192 Respondents who engaged in Valsalva during pregnancy had significantly higher pre-
193 pregnancy 1RM for squat, bench, and deadlift, as well as a greater weightlifting training days per

194 week (4.07 ± 1.08 vs. 3.62 ± 1.13 days/week; $p = <0.0001$), duration per session (60.78 ± 23.13
195 vs. 52.29 ± 18.74 minutes; $p = 0.002$), and %1RM (77.92 ± 10.07 vs. 75.32 ± 10.90 %1RM; $p =$
196 0.03) (see Supplement Digital Content Table 12). Individuals who performed the Valsalva
197 maneuver during pregnancy were more likely to participate in Olympic Lifting (OR: 1.98, 95%
198 CI, 1.21 to 3.26, $p = 0.006$), supine weightlifting (OR: 3.00, 95% CI, 1.80 to 5.02, $p = <0.0001$)
199 and use of a weightlifting belt (OR: 4.04, 95% CI, 2.08 to 7.67, $p = <0.0001$). All other
200 outcomes were not different between groups (see Supplement Digital Content Tables 12 and 13).

201 Respondents who engaged in supine weightlifting during pregnancy had higher pre-
202 pregnancy 1RM for all lifts except snatch and a greater frequency of weightlifting pre-pregnancy
203 (3.90 ± 1.09 vs. 3.58 ± 1.19 days/week; $p = 0.007$) but a lower duration of vigorous intensity
204 aerobic activity prior to pregnancy (32.82 ± 15.63 vs. 36.96 ± 18.57 minutes; $p = 0.04$) (see
205 Supplement Digital Content Table 14). During pregnancy, frequency of weightlifting was higher
206 among those who engaged in supine weightlifting (3.14 ± 1.18 vs. 2.52 ± 1.04 days/week; $p =$
207 <0.0001); however, other training variables were not different between groups. Participants who
208 engaged in supine lifting had a greater prevalence of engagement in Olympic lifting (OR: 2.01,
209 95% CI, 1.31 to 3.12, $p = 0.002$), Valsalva (OR: 3.20, 95% CI, 1.93 to 5.32, $p = <0.0001$) and
210 use of a weightlifting belt (OR: 2.80, 95% CI, 1.27 to 6.65, $p = 0.01$). Other outcomes were not
211 different between groups (see Supplement Digital Content Tables 14 and 15).

212 **Training patterns following delivery**

213 The majority of respondents returned to weightlifting approximately three months
214 following delivery (89%, $n = 400/447$, average: 3.15 ± 3.0 months; see Supplement Digital
215 Content Table 16). Those who did not return to weightlifting in the postpartum period reported
216 needing additional time to recover (40%), not wanting to return (4%) and not having enough
217 time (23%; see Supplement Digital Content Table 15).

218 ***Urinary Incontinence:***

219 Experiencing UI during pregnancy did not influence whether participants returned to
220 weightlifting, or the timing of return to activity (see Supplement Digital Content Table 17).
221 However, being continent following delivery was associated with a 218% increase in the odds of
222 returning to weightlifting following delivery, compared to those who experienced postpartum UI
223 (OR: 2.18, 95% CI, 1.16 to 4.14, $p = 0.02$; see Supplement Digital Content Table 18). All other
224 outcomes were not different between groups (see Supplement Digital Content Tables 17 and 18)

225 ***Olympic Weightlifting, Valsalva and Supine Exercise:***

226 Respondents who participated in Olympic weightlifting were more likely to return to
227 weightlifting (OR: 3.61, 95% CI, 1.80 to 7.03, $p = 0.0004$) faster (2.99 ± 2.83 vs. 3.73 ± 2.55
228 months; $p = 0.03$) than those who refrained from it during pregnancy. Further, those who
229 engaged in Olympic weightlifting during pregnancy were more likely to return to Olympic
230 weightlifting (OR: 3.49 95% CI, 1.96 to 6.11, $p = <0.0001$) and Valsalva maneuver (OR: 3.25,
231 95% CI, 1.91 to 5.55, $p = <0.0001$) postpartum, and returned to these activities more rapidly (p
232 = <0.0001 , $p = 0.01$, respectively) (see Supplement Digital Content Table 19). Participants who
233 engaged in prenatal Valsalva returned to weightlifting sooner after delivery (2.68 ± 2.43 vs. 3.39
234 ± 3.23 months; $p = 0.02$) and were 6.33 times more likely to engage in postpartum Valsalva
235 (95% CI, 3.64 to 10.98, $p = <0.0001$) compared to those who avoided Valsalva during
236 pregnancy (see Supplement Digital Content Table 20). Similarly, participants who engaged in
237 supine weightlifting during pregnancy had increased odds of returning to Olympic weightlifting
238 (OR: 1.86, 95% CI, 1.12 to 3.15, $p = 0.03$) and Valsalva (OR: 2.03, 95% CI, 1.27 to 3.26, $p =$
239 0.005) in the postpartum period (see Supplement Digital Content Table 21). Other outcomes
240 were not different between groups (see Supplement Digital Content Tables 19, 20, 21).

241 **Information Sources about Weightlifting:**

242 Responses revealed that most participants spoke to their healthcare provider about
243 weightlifting during pregnancy (65%, n = 278/425) and were told to continue heavy lifting with
244 modification (61%, n = 169/276) throughout pregnancy (see Supplement Digital Content Table
245 22). Respondents also sought information from pelvic floor physiotherapists (51%, n = 216/426),
246 the internet (39%, n = 166/412) and their coach (27%, n = 112/412; see Supplement Digital
247 Content Table 22).

248 **Discussion**

249 Our data demonstrate individuals who engaged in heavy resistance training before,
250 during and following pregnancy, including “contraindicated” activities, experience low incidence
251 of adverse reproductive and pelvic floor outcomes. Rather, perinatal health outcomes aligned
252 with, or were lower than, population estimates for key health outcomes. Long-held theoretical
253 concerns about heavy weightlifting, Olympic lifting, supine weightlifting and the Valsalva
254 maneuver have limited the prescription of these movements during pregnancy resulting in a
255 missed opportunity to derive health benefits from strength training during pregnancy. The
256 epidemiological data collected does not support several of the theoretical risks associated with
257 these activities for individuals with uncomplicated pregnancies. Prospective studies are needed to
258 investigate maternal and fetal responses to heavy resistance training and address concerns of
259 prolonged supine exercise and overhead Olympic weightlifting.

260 Contrary to commonly cited theoretical risks of heavy weightlifting, we demonstrate
261 similar, or lower rates of pregnancy complications (e.g., preeclampsia, gestational hypertension)
262 in those who continue to engage in heavy weightlifting during pregnancy compared to
263 population estimates.(23) As a key example, we observed substantially lower rates of postpartum
264 depression and anxiety among this sample (~7%) compared to general population estimates

265 (~14%). Our team has previously demonstrated that engaging in postpartum physical activity
266 (e.g., aerobic exercise or yoga) is associated with a moderate effect size on depressive symptoms
267 (standardized mean difference-0.48, 95% CI -0.73 to -0.22, I=42%).(24) The findings of the
268 current study are the first to illustrate the beneficial impact of heavy weightlifting on perinatal
269 depression. We also identified that individuals engaged in heavy weightlifting during pregnancy
270 were less likely to report a cesarean section compared to global rates (13% compared to global
271 prevalence of 21.1% ,95% confidence interval, 18.8 to 23.3%).(25) Additionally, we observed
272 that respondents who continued their pre-pregnancy training levels until delivery reported
273 significantly lower incidence of reproductive complications compared to those who reduced or
274 ceased their resistance training levels during pregnancy. This suggests that engaging in
275 heavy/strenuous resistance training into late pregnancy does not, or potentially decreases, odds of
276 reproductive and delivery complications. The lower prevalence of these, and other, common
277 perinatal complications in pregnant and postpartum individuals further highlight the urgent need
278 for further research with this population as current recommendations to avoid these movements
279 may conversely increase the risk of these complications.

280 The Valsalva maneuver is a performance aid which increases stiffness across the spine,
281 increases electromyographic activation of the paraspinal musculature and therefore allow for
282 increased loads to be lifted.(26) The Valsalva maneuver has been flagged as a potential area of
283 concern for pregnant people due to the acute and substantial increase in blood pressure. The
284 present study demonstrates that pregnant individuals are largely following this guidance as 66%
285 of the sample avoided participation. Two previous studies failed to demonstrate an adverse effect
286 of acute Valsalva during pregnancy;(14, 15) however, the impact of chronically engaging in the
287 Valsalva maneuver during pregnancy has not been investigated. Our data found no difference in
288 pregnancy, labor or delivery outcomes between those who engaged in the Valsalva maneuver

289 with those who did not. Similarly, acute and prolonged supine exercise during pregnancy is also
290 cautioned against due to concerns of a transient reduction fetal blood flow, and maternal
291 hypotension. In our sample, the incidence of reproductive complications were not different
292 between the 71% of respondents who engaged in supine exercise during pregnancy with those
293 who did not. We also observed no difference in reproductive outcomes between the 72% of
294 respondents who participated in Olympic weightlifting and those who did not. Pregnant
295 individuals may be told to avoid Olympic weightlifting due to concern of injury from falling on
296 the stomach, contact with a barbell or overhead lifting.(27) Among our sample, the odds of
297 obtaining an injury both during and following pregnancy were not different between those who
298 engaged in Olympic weightlifting and those who did not. Pre-pregnancy 1RM and weightlifting
299 volume was significantly higher among this subsample, thus experience and technique may be
300 critical to avoiding injury during pregnancy. These data provide preliminary support for the
301 safety of engaging in Valsalva, supine weightlifting, and Olympic weightlifting during
302 pregnancy.

303 Pelvic floor disorders are common in both female athletes and pregnant individuals.(10,
304 13) It has been hypothesized that increased intra-abdominal pressure from lifting heavy weights,
305 combined with the Valsalva maneuver during pregnancy may further strain the potential
306 weakening of the pelvic floor in pregnancy, increasing the risk of developing or worsening
307 pelvic floor issues. Although we saw heightened prevalence of postpartum UI among the sample
308 (57%), compared to the general population (32%),(28) this is expected of active females who
309 participate in high-impact resistance training (41%),(29) . Further, we did not observe any
310 differences in training patterns during or following pregnancy compared to those who remained
311 continent following childbirth. Similarly, participation in Valsalva during pregnancy was not
312 associated with greater odds of UI during or following pregnancy, suggesting that the increased

313 intra-abdominal pressure from Valsalva during pregnancy may not increase risk of UI.
314 However, the development of UI can be impacted by a variety of factors including training age,
315 high impact training (e.g., running), and obesity may have influenced these results. Further
316 research is required to assess the impact of weightlifting prior-to pregnancy and the resultant
317 effects on the pelvic floor during and following pregnancy.

318 Our data demonstrate that the majority of respondents discussed heavy weightlifting
319 during pregnancy with their healthcare provider and were most often told to continue with
320 modification. These results demonstrate pregnant individuals want to know more about heavy
321 weightlifting during pregnancy, aligning with recent requests from elite athletes for more
322 guidance to continue training during pregnancy.(30) More research is critically needed to inform
323 healthcare provider guidance to support individuals who do not wish to cease their training
324 during pregnancy. Approximately half of participants reported seeing a pelvic floor
325 physiotherapist, most commonly in the postpartum period. A review demonstrated that pelvic
326 floor muscle training during pregnancy significantly reduced symptoms and episodes of UI and
327 decreased prevalence in late pregnancy and 3 months postpartum.(31) Increased guidance from
328 pelvic floor physiotherapists may be particularly helpful to this population to help reduce the risk
329 of and treat UI following pregnancy.

330 **Strength and Limitations**

331 Strengths of our study included measurement of reproductive outcomes during and
332 following pregnancy to assess both gestational and postpartum impact of participation in heavy
333 weightlifting. A survey method allowed for the polling of a large sample size of pregnant
334 individuals from around the world who participated in heavy weightlifting improving
335 generalizability of our findings. We also acknowledge important considerations of the present
336 study. Due to the online nature of the study and primary recruitment strategy using social media

337 platforms, random sampling did not occur thus introducing a sampling bias that may have
338 contributed to some of our findings As well, as this was a cross-sectional survey study with self-
339 reported outcomes, recall bias will have been introduced in this study. Thus, results from this
340 survey should be interpreted with consideration of these limitations. Future longitudinal studies
341 assessing the acute and chronic effects of heavy resistance training in those who engaged in these
342 activities prior to pregnancy compared to those who discontinued training are needed.

343 This cross-sectional survey did not identify evidence of adverse pregnancy or delivery
344 outcomes by engaging in heavy weightlifting, Olympic weightlifting, Valsalva maneuver, or
345 supine weightlifting during pregnancy. In fact, lower prevalence of common perinatal
346 complications in pregnant and postpartum individuals was observed, with those who continued
347 participation until delivery experiencing fewer complications than those who did not. Our
348 findings demonstrate incidence of postpartum UI was heightened among our sample compared to
349 general population, however, this is expectant of active females who participate in high-impact
350 resistance training. Collectively, these data challenge numerous theoretical risks of participation
351 in resistance training during pregnancy and establish preliminary safety of Olympic
352 weightlifting, Valsalva maneuver, and supine weightlifting during pregnancy. It is important to
353 note that all survey participants were experienced in heavy resistance training during pregnancy,
354 and the impact of the uninitiated beginning these activities during pregnancy is unknown. These
355 data highlight the critical need for more data to help establish the safety and potential benefit of
356 resistance training during pregnancy to challenge persistent myths and improve prescription of
357 these activities during pregnancy. Additional longitudinal work evaluating the long-term impact
358 of heavy resistance training on pelvic floor health are warranted.

359

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