

The association between prenatal yoga and the administration of ritodrine hydrochloride during pregnancy: an adjunct Study of Japan Environment and Children's Study.

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1 **Title: The association between prenatal yoga and the administration of ritodrine**
2 **hydrochloride during pregnancy: an adjunct Study of Japan Environment and**
3 **Children's Study.**

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27 **ABSTRACT**

28 **Background:** While the beneficial effects of prenatal yoga have been reported in recent
29 years, little is known about its effectiveness in pregnant Japanese women. Despite
30 several adverse effects, ritodrine hydrochloride is frequently prescribed to suppress
31 preterm labor in Japan, and its usage may therefore indicate cases of preterm labor. This
32 study aimed to clarify the association between prenatal yoga and ritodrine hydrochloride
33 use during pregnancy.

34 **Methods:** An observational study was conducted as an adjunct study by the Hokkaido
35 unit of the Japan Environment and Children's Study. Information on prenatal yoga
36 practice was collected using a self-questionnaire between March 21, 2012 and July 7,
37 2015 targeting women who had recently delivered. Ritodrine hydrochloride use was
38 identified from medical records. A total of 2,692 women were analyzed using logistic
39 regression models that adjusted for possible confounders.

40 **Results:** There were 567 (21.1%) women who practiced prenatal yoga, which was
41 associated with a lower risk of ritodrine hydrochloride use (adjusted odds ratio [OR]
42 0.77; 95% CI 0.61-0.98). This was especially evident in women with a total practice
43 duration that exceeded 900 minutes throughout their pregnancy (adjusted OR 0.54; 95%
44 CI 0.38-0.76). A sensitivity analysis that excluded patients with threatened abortion

45 during the study period produced similar results.

46 **Conclusions:** Prenatal yoga was associated with a lower risk of ritodrine hydrochloride
47 use, particularly in women with more than 900 minutes of practice time over the course
48 of their pregnancy. Prenatal yoga may be a beneficial option for pregnant women in the
49 selection of alternative therapies.

50

51 **Keywords:** yoga; pregnancy; preterm; ritodrine; JECS

52

53 INTRODUCTION

54 Yoga is a mental and physical practice with origins in ancient Indian philosophy¹.

55 Previous research based on randomized controlled trials (RCTs) have suggested that

56 yoga may reduce low back pain,² improve vitality in breast cancer patients, and reduce

57 inflammatory cytokines³. In recent years, prenatal yoga has also been reported to reduce

58 psychiatric stress and anxiety,^{4, 5} low back pain,⁶ pregnancy complications in high-risk

59 patients (such as those with obesity or advanced age),⁷ and the duration of labor in

60 healthy pregnant women⁸. The beneficial effects of prenatal yoga have been previously

61 summarized elsewhere⁹.

62 Two RCTs have also investigated the effects of yoga on neonatal prematurity: a study

63 from the US reported significantly longer mean gestational durations before delivery in

64 women who practiced yoga (yoga group, mean (SD) 38.6 (1.9) weeks; non-yoga group,

65 36.7 (2.6) weeks)¹⁰. Similarly, a study from India observed a significantly lower

66 prevalence of preterm births (yoga group, 20.7%; control group, 45.7%) among women

67 with high-risk factors such as history of obstetric complications, obesity, or advanced

68 age⁷. However, studies have yet to examine the effects of prenatal yoga on prematurity

69 or tocolytic drug use in pregnant Japanese women,⁹ and there is currently little evidence

70 to support the practice of prenatal yoga in Japan.

71 Preterm birth is a major contributing factor to perinatal morbidity and mortality^{11, 12}.
72 Drugs such as β 2-agonists are frequently administered throughout the world to treat
73 preterm labor,¹³ which if left untreated can lead to spontaneous preterm birth. Despite
74 evidence supporting the effectiveness of betamimetics in reducing the number of
75 women in preterm labor who gave birth within 48 hours, these drugs have not been
76 observed to actually reduce the number of preterm births¹³. Due to the relatively high
77 risk of adverse effects and the lack of effectiveness in preventing preterm births, the
78 usage of betamimetics tends to be avoided, particularly among developed countries^{13, 14}.
79 The proportion of preterm births in Japan is among the lowest in the world¹⁵⁻¹⁷. The
80 key drug for treating preterm labor in Japan is ritodrine hydrochloride, which is a
81 β -agonist¹⁸⁻²⁰. While the Japanese Ministry of Health, Labour and Welfare approved
82 another tocolytic agent (magnesium sulfate) for the treatment of preterm labor in 2008,
83 its use is restricted to cases that are unresponsive to ritodrine hydrochloride. As a result,
84 ritodrine hydrochloride remains the de facto first-line drug for preterm labor in Japan¹⁹.
85 Despite its widespread use, ritodrine hydrochloride places a substantial burden on the
86 cardiovascular system²¹ and may also result in other adverse effects,²²⁻²⁵ indicating that
87 it should only be administered when necessary. Hence, identifying alternative options
88 that may contribute to a decrease in ritodrine hydrochloride use would be beneficial for

89 pregnant women. In this study, we investigated the use of prenatal yoga as a possible
90 alternative to reduce preterm labor in pregnant women.

91 This observational study aimed to clarify the association between prenatal yoga and
92 the use of ritodrine hydrochloride during pregnancy.

93 **METHODS**

94 **Study Participants**

95 The Japan Environment and Children's Study (JECS)²⁶ is an ongoing large-scale
96 prospective birth cohort study, and its protocol has been previously described in detail²⁷.
97 Women are recruited in the early stages of pregnancy, and a total of 103,106 women
98 throughout Japan participated in this study between January 1, 2011 and March 31,
99 2014²⁸. The Hokkaido unit (e Appendix 1) is one of 15 regional centers of the JECS,
100 and had recruited 8,362 pregnant women at the time of the study.

101 This study was conducted as an Adjunct Study outlined in the JECS protocol paper²⁷.
102 The study protocol was approved by the Ministry of the Environment, Japan. This
103 adjunct study on the effects of prenatal yoga was performed on JECS Hokkaido unit
104 participants using self-questionnaires. Participants provided written informed consent
105 before inclusion in the study. Explanatory materials and self-questionnaires regarding
106 prenatal yoga were sent to eligible study participants after delivery, and the
107 questionnaires were collected between March 21, 2012 and July 7, 2015.

108 The sample selection flow diagram is shown in Figure 1. Of the possible 8,362 study
109 participants, we sent the self-questionnaire to 7,571 participants after their delivery. The
110 791 participants who were not sent questionnaires were excluded due to miscarriages,

111 stillbirths, participation withdrawal, or for other reasons. A total of 5,468 agreed to
112 participate in the study, indicating a response rate of 72.2%.

113 The questionnaire data on yoga were then merged with a second dataset provided by
114 the JECS Hokkaido unit. This second dataset included participants who gave birth on or
115 before September 30, 2013, and was released in June 2015. After merging the data, the
116 sample included 3,387 women who had corresponding data in both datasets. We
117 excluded those with multiple pregnancies ($n = 55$), missing birth data ($n = 10$), and
118 uncertain gender ($n = 1$). An outlier who experienced weight gain of 30 kg or more
119 during pregnancy ($n = 1$) and participants with errors/missing data in any of the
120 covariates ($n = 628$) were also excluded. The final study sample for analysis comprised
121 2,692 women.

122

123 **Ethical Issues**

124 This adjunct study of the JECS was approved by the Institutional Ethics Boards for
125 Epidemiological Studies at Asahikawa Medical University, the Hokkaido University
126 Center for Environment and Health Sciences, and the Japan Red Cross Hokkaido
127 College of Nursing.

128

129 Exposure Variable

130 The exposure variable analyzed in this study was the practice of prenatal yoga during
131 the index pregnancy period. A self-questionnaire was sent to each participant after
132 delivery. The median period between delivery and response to the questionnaire was
133 approximately 3 months (mean 2.7 months; range 0–26). The main question in the
134 self-questionnaire was “Did you practice prenatal yoga during this pregnancy period?”
135 If the answer was “Yes”, the participant was categorized into the “prenatal yoga group”;
136 if the answer was “No” or “I tried to, but was stopped by the physician”, the participant
137 was categorized into the “non-prenatal yoga group”. Respondents in the prenatal yoga
138 group were then directed to answer additional questions that addressed practice methods
139 (use of instructor or self-study by DVDs or books), practice frequency (duration of
140 practice in gestational weeks, frequency of practice per week, and duration of practice
141 in minutes per exercise session), and the specific components of yoga (inclusion or
142 non-inclusion of physical posture, breathing techniques, and meditation practice).

143

144 Outcome Variable

145 The outcome variable analyzed in this study was the use of ritodrine hydrochloride. The
146 use of ritodrine hydrochloride once or more during the index pregnancy period was

147 ascertained from medical records by physicians, midwives, or JECS research

148 coordinators after delivery.

149

150 **Covariates**

151 We collected information on various potential confounding factors of preterm

152 delivery²⁹⁻³¹ and prenatal yoga. Using a self-questionnaire sent to the participants

153 between 12 and 16 weeks of gestation, we collected data on marital status, employment

154 status, physical activity level before pregnancy (metabolic equivalents

155 [METS]×min/day),^{32, 33} and malformation of uterus, if any.

156 Using another self-questionnaire sent to the participants between 22 and 28 weeks of

157 gestation, we collected data on smoking, alcohol consumption and maternal education.

158 In the post-delivery self-questionnaire that addressed prenatal yoga, we additionally

159 collected data on whether each participant had intended to practice prenatal yoga at

160 approximately 15 weeks of gestation and whether they had undertaken any

161 complementary therapies during pregnancy. These factors were analyzed due to the

162 assumption that people with interest in prenatal yoga may have higher health

163 consciousness and engage in other activities that they perceive to be healthy.

164 The following information were also collected from medical records: maternal age at

165 delivery, prenatal care hospital, parity, pre-pregnancy body mass index (BMI), infertility
166 treatment, history of preterm delivery, history of spontaneous abortion, chronic
167 hypertension, diabetes mellitus, psychiatric illness, hypothyroidism, autoimmune
168 disease, gender of offspring, use of iron preparations during pregnancy, and threatened
169 abortion during pregnancy. In addition, hospitals that offered in-hospital prenatal yoga
170 classes were identified either through their websites or phone calls during the study
171 period.

172

173 **Statistical Analysis**

174 Analyses were performed using IBM SPSS Statistics 23.0 for Windows (SPSS Inc.,
175 Chicago, IL, USA). Baseline characteristics were calculated and presented as numbers
176 and percentages or means and standard deviations, where applicable. Chi-square tests or
177 Fisher's exact tests were performed to assess differences in baseline characteristics for
178 categorical variables and the Mann-Whitney U test was used for continuous variables.

179 Odds ratios (ORs) with 95% confidence intervals (CIs) for ritodrine hydrochloride use
180 according to the practice of prenatal yoga were estimated using logistic regression
181 models. We developed 3 multivariate logistic regression models for conducting
182 adjustments using the forced entry method. Model 1 adjusted for maternal age at

183 delivery, participation area, parity, marital status, smoking, alcohol consumption,
184 maternal education, pre-pregnancy BMI, employment status, physical activity level
185 before pregnancy, intention to practice prenatal yoga at around 15 weeks of gestation,
186 and prenatal yoga classes held at the prenatal care hospital as the baseline covariates.
187 Model 2 adjusted for the same variables in Model 1, as well as infertility treatment,
188 history of preterm delivery, history of spontaneous abortion, malformation of uterus,
189 chronic hypertension, diabetes mellitus, psychiatric illness, hypothyroidism, and
190 autoimmune disease as covariates of complications or medical history. Model 3 adjusted
191 for the same variables in Model 2, as well as practice of alternative therapies other than
192 prenatal yoga, gender of offspring, use of iron preparations during pregnancy, and
193 threatened abortion during pregnancy as covariates of information obtained during
194 pregnancy.

195 In order to further explore the exposure-response relationship, we analyzed the
196 prenatal yoga group based on the following 3 practice frequency factors: number of
197 practice weeks, number of practice sessions, and total practice duration in minutes.
198 Participants in the prenatal yoga group were allocated into 2 groups for each of these
199 factors based on their respective median values. Next, the OR for each of these
200 dichotomous variables was then calculated using a logistic regression model that

201 included the covariates described in Model 3.

202 We also divided the prenatal yoga group into 4 subgroups based on the combination of
203 the start point of yoga in gestational weeks (divided according to the median value in
204 gestational weeks) and total practice duration (divided according to the median value in
205 minutes) to explore the following two possibilities: the first possibility is that
206 participants who had started prenatal yoga earlier may demonstrate the net effect of this
207 practice because they could be interpreted as having physically similar states to the
208 non-prenatal yoga group with regard to experiencing uterine contractions (due to
209 statistical adjustment for threatened abortion in the multivariate analysis). The second
210 possibility is that participants who had started prenatal yoga later were in better
211 condition to practice yoga due to a lack of uterine contractions. Furthermore, we
212 conducted sensitivity analyses and exploratory subanalyses (e Appendix 2). Statistical
213 significance was set at $P < 0.05$ for all analyses.

214

215 RESULTS

216 A total of 567 (21.1%) women in the study sample reported taking part in prenatal yoga
217 during their pregnancy period. The comparison of the baseline characteristics between
218 the prenatal yoga group and the non-prenatal yoga group is shown in Table 1.

219 After adjusting for covariates (Table 2), the practice of prenatal yoga had a
220 significantly lower OR for the use of ritodrine hydrochloride (adjusted OR, 0.77; 95%
221 CI, 0.61–0.98).

222 In an analysis of practice frequency types (Table 3), the ORs for ritodrine
223 hydrochloride use were significantly lower for higher numbers of practice weeks
224 (adjusted OR, 0.67; 95% CI, 0.48–0.93), higher numbers of practice sessions (adjusted
225 OR, 0.62; 95% CI, 0.44–0.86), and higher total practice duration in minutes (adjusted
226 OR, 0.54; 95% CI, 0.38–0.76) relative to the non-prenatal yoga group.

227 As shown in Table 4, there was a marginally significantly lower risk of ritodrine
228 hydrochloride use in the group that started prenatal yoga at 21 weeks of gestation or
229 earlier and had a total practice duration of more than 900 minutes (adjusted OR, 0.69;
230 95% CI, 0.46–1.03). The group that started prenatal yoga at 22 weeks or later and had a
231 total practice duration time of 900 minutes or less showed no significant relationship
232 with ritodrine hydrochloride use (adjusted OR, 0.94; 95% CI, 0.64–1.38); in contrast,

233 the group that started prenatal yoga at 22 weeks or later and had a total practice duration
234 of more than 900 minutes showed a significantly lower risk for ritodrine hydrochloride
235 use (adjusted OR, 0.34; 95% CI, 0.19–0.62).

236 The sensitivity analysis that excluded cases with threatened abortion during pregnancy
237 produced results that were similar to those of the main analysis (e-Table 1). The other
238 sensitivity analysis (which excluded cases who tried to do prenatal yoga but were
239 stopped by their physician) did not show any significant relationship between prenatal
240 yoga and ritodrine hydrochloride use (e-Table 2); however, the subanalysis stratified by
241 both the start point of prenatal yoga and total practice duration indicated a significant
242 exposure-response relationship between prenatal yoga and ritodrine hydrochloride use,
243 which was similar to the findings of the main analysis. The exploratory analysis of
244 practice methods, breathing technique, and meditation (e-Table 3) showed few
245 differences in ritodrine hydrochloride use among the different practice methods and the
246 use or non-use of meditation. Practice methods, the median values for practice
247 frequency, and components of prenatal yoga are shown in e-Table 4.

248

249 DISCUSSION

250 After adjusting for a diverse range of covariates, the practice of prenatal yoga was found
251 to be significantly associated with reduced ritodrine hydrochloride administration in
252 pregnant women. Furthermore, the stratified analysis showed that a total practice
253 duration of more than 900 minutes had a significantly protective OR with respect to
254 ritodrine hydrochloride use. The group that started prenatal yoga at 21 weeks of
255 gestation or earlier and had a total practice duration of more than 900 minutes also
256 showed a marginally significant relationship with reduced ritodrine hydrochloride use .

257 To the best of our knowledge, there has yet to be a study that reported the effects of
258 prenatal yoga on the use of tocolytic drugs. However, 3 interventional studies have
259 previously analyzed the effects of prenatal yoga on prematurity,^{7, 10, 34} and found that
260 subjects who practiced yoga had significantly lower incidences of preterm births and
261 longer gestational periods when compared with subjects who had not practiced yoga.

262 One of these studies was not an RCT³⁴ and the study subjects were selected for
263 interventions based on the distance of their residence to the hospital, which may have
264 led to the introduction of selection bias. As a result, the differences in the effects of
265 prenatal yoga between that study and our findings could not be directly compared. Of
266 the remaining 2 studies, one was an RCT conducted in the US that focused on pregnant

267 women who also had prenatal depression,¹⁰ and the other was an RCT conducted in
268 India that investigated pregnant women with high-risk factors that included obesity,
269 history of obstetric complications, and advanced age⁷. These characteristics may limit
270 the generalizability of those findings. Although this present analysis was conducted as
271 an observational study, the study subjects were pregnant women from the general
272 population in Japan, thereby providing a relatively higher level of generalizability to our
273 results. In contrast to the previous studies that focused on prematurity, the outcome
274 measure of our study was ritodrine hydrochloride use, which may be indicative of a
275 pregnant woman's experience of any uterine contractions²⁴. On the other hand, a
276 previous observational study³⁵ showed no significant association between yoga and
277 preterm birth, and a non-RCT study³⁶ was similarly unable to detect an association
278 between yoga and the number of gestational weeks before delivery (yoga group, 38.8
279 weeks; control group, 38.8 weeks). While the results are not conclusive, this study
280 conducted a multifaceted analysis that adjusted for many covariates, and our findings
281 indicate that prenatal yoga has possible preventive effects on ritodrine hydrochloride
282 use.

283 Although the mechanism underlying the reduction of ritodrine hydrochloride use
284 through prenatal yoga remains unclear, uterine contractions induced by the

285 inflammatory process may be a possible cause. Bacterial infection has been documented
286 to be one of the main causes of spontaneous preterm delivery³⁷⁻³⁹. Furthermore, the
287 roles for the pro-inflammatory cytokines interleukin (IL)-1 β , IL-6, IL-8, and tumor
288 necrosis factor alpha (TNF- α) are evident in both full-term and preterm delivery, and
289 have been shown to be independent of the presence of infections^{38, 40, 41}. This indicates
290 that the inflammatory process, regardless of bacterial infections, may result in uterine
291 contractions that lead to preterm labor. The beneficial role of yoga has also been
292 demonstrated in non-pregnant women, where an RCT study of breast cancer survivors
293 showed a significant dose-response decrease in serum IL-1 β and IL-6 in those who
294 practiced yoga³. It is possible that a reduction in the inflammatory response in the
295 prenatal yoga group was able to suppress uterine contractions, and as a result, reduce the
296 need for ritodrine hydrochloride prescriptions.

297 The strengths of this study are 1) a substantially large sample size, 2) demonstration of
298 the existence of an exposure-response relationship between prenatal yoga and ritodrine
299 hydrochloride use, 3) the examination of medical records to ascertain ritodrine
300 hydrochloride use and numerous covariates, 4) statistical adjustment of many potential
301 confounders, 5) provision of relatively detailed insight into the benefits of prenatal yoga,
302 and 6) production of comparatively generalizable results for pregnant Japanese women.

303 On the other hand, there were also limitations in this study. First, there is the
304 possibility of reverse causality, where participants in the prenatal yoga group may have
305 been able to exercise only because they were not impeded by uterine contractions. In
306 fact, the OR for ritodrine hydrochloride use was lower in the group that started prenatal
307 yoga at 22 weeks or later and had a total practice duration of more than 900 minutes
308 when compared with the group that started prenatal yoga at 21 weeks of gestation or
309 earlier and had a total practice duration of more than 900 minutes. However, we
310 demonstrated that the latter group had a marginally significant lower risk for ritodrine
311 hydrochloride use, and the sensitivity analysis models also indicated a significant
312 exposure-response relationship. These findings therefore strongly indicate the reduction
313 of ritodrine hydrochloride use by prenatal yoga. Second, the information on prenatal
314 yoga was collected retrospectively after delivery (mean: 2.7 months post-delivery), and
315 the reliability and validity of the original questionnaire were not examined. There may
316 have been some pregnant women who practiced prenatal yoga up until delivery, and
317 information acquisition should therefore have ideally been conducted at the time of
318 admission for delivery. Despite this limitation, we were able to carry out the survey at a
319 relatively close time frame after delivery. Third, some participants in the prenatal yoga
320 group may have practiced yoga after having received ritodrine hydrochloride, which

321 may have led to an underestimation of the potential benefits of yoga and prevented the
322 observation of statistically significant associations in several aspects of the analyses.

323 Fourth, the use of ritodrine hydrochloride includes both oral administration and infusion.
324 Despite these differences in administration routes, both these methods are likely to
325 reflect the participants' experience of uterine contractions²⁴, which may be an indicator
326 of preterm labor. Fifth, the use of ritodrine hydrochloride is dependent on the discretion
327 of each obstetrician, which may have introduced a degree of bias into the study.

328 However, this analysis adjusted for variations in participation regions and for prenatal
329 yoga classes that were held in the prenatal care hospital. Sixth, the number of excluded
330 participants from this analysis was 695 from the original 3387 (20.5%) patients, and the
331 majority of these cases were excluded due to missing values. However, a supplementary
332 analysis showed that the proportions of patients who practiced prenatal yoga and were
333 administered ritodrine hydrochloride did not differ between these excluded subjects and
334 subjects who were included in the final analysis (data not shown). Seventh, the outcome
335 in this analysis was not preterm birth or threatened preterm labor, which could not be
336 analyzed due to low statistical power. However, we intend to analyze these outcomes in
337 the future with a larger sample size after improvements have been made to all of the
338 JECS participants' data.

339 The main finding of this study was that prenatal yoga was associated with a lower risk
340 of ritodrine hydrochloride use in pregnant Japanese women, especially those with a total
341 practice duration that exceeded 900 minutes. This result suggests that performing
342 prenatal yoga for a cumulative total of more than 900 minutes during pregnancy may
343 counter the onset of uterine contractions that necessitates the use of ritodrine
344 hydrochloride. Prenatal yoga may therefore be a viable and beneficial option for
345 pregnant women in the selection of alternative therapies.

346

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356

1. Yoga for health [homepage on the Internet]. National Center for Complementary and Integrative Health. [updated 2013 Jun; cited 2015 Aug 11]. Available from: <https://nccih.nih.gov/health/yoga/introduction.htm>
2. Sherman KJ, Cherkin DC, Erro J, Miglioretti DL, Deyo RA. Comparing yoga, exercise, and a self-care book for chronic low back pain: a randomized, controlled trial. *Ann Intern Med.* 2005;143:849-56.
3. Kiecolt-Glaser JK, Bennett JM, Andridge R, Peng J, Shapiro CL, Malarkey WB, et al. Yoga's Impact on Inflammation, Mood, and Fatigue in Breast Cancer Survivors: A Randomized Controlled Trial. *J Clin Oncol.* 2014;32:1040-9.
4. Satyapriya M, Nagendra HR, Nagarathna R, Padmalatha V. Effect of integrated yoga on stress and heart rate variability in pregnant women. *Int J Gynaecol Obstet.* 2009;104:218-22.
5. Satyapriya M, Nagarathna R, Padmalatha V, Nagendra HR. Effect of integrated yoga on anxiety, depression & well being in normal pregnancy. *Complement Ther Clin Pract.* 2013;19:230-6.
6. Martins RF, Pinto ESJL. Treatment of pregnancy-related lumbar and pelvic girdle pain by the yoga method: a randomized controlled study. *J Altern Complement Med.* 2014;20:24-31.
7. Rakhshani A, Nagarathna R, Mhaskar R, Mhaskar A, Thomas A, Gunasheela S. The effects of yoga in prevention of pregnancy complications in high-risk pregnancies: a randomized controlled trial. *Prev Med.* 2012;55:333-40.
8. Chuntharapat S, Petpichetchian W, Hatthakit U. Yoga during pregnancy: effects on maternal comfort, labor pain and birth outcomes. *Complement Ther Clin Pract.* 2008;14:105-15.
9. Kawanishi Y, Hanley SJ, Tabata K, Nakagi Y, Ito T, Yoshioka E, et al. Effects of prenatal yoga: a systematic review of randomized controlled trials. *Nihon Koshu Eisei Zasshi.* 2015;62:221-31. (in Japanese).
10. Field T, Diego M, Hernandez-Reif M, Medina L, Delgado J, Hernandez A. Yoga and massage therapy reduce prenatal depression and prematurity. *J Bodyw Mov Ther.* 2012;16:204-9.
11. Blencowe H, Cousens S, Oestergaard MZ, Chou D, Moller AB, Narwal R, et al. National, regional, and worldwide estimates of preterm birth rates in the year 2010 with time trends since 1990 for selected countries: a systematic analysis and implications. *Lancet.* 2012;379:2162-72.
12. Tucker JM, Goldenberg RL, Davis RO, Copper RL, Winkler CL, Hauth JC. Etiologies of preterm birth in an indigent population: is prevention a logical

- expectation? *Obstet Gynecol.* 1991;77:343-7.
13. Neilson JP, West HM, Dowswell T. Betamimetics for inhibiting preterm labour. *Cochrane Database Syst Rev.* 2014;2:CD004352.
 14. Restrictions on use of short-acting beta-agonists (SABA) in obstetric indications – CMDh endorses PRAC recommendations [homepage on the Internet]; c2013 [updated 2013 October 25; cited 2015 July 22]. Available from: http://www.ema.europa.eu/docs/en_GB/document_library/Press_release/2013/10/WC500153130.pdf
 15. Lawn JE, Gravett MG, Nunes TM, Rubens CE, Stanton C. Global report on preterm birth and stillbirth (1 of 7): definitions, description of the burden and opportunities to improve data. *BMC Pregnancy Childbirth.* 2010;10 Suppl 1:S1.
 16. Birth Statistics [homepage on the Internet]. Ministry of Health, Labour and Welfare, Japan; c2010 [cited 2015 Jul 27]. Available from: <http://www.mhlw.go.jp/toukei/saikin/hw/jinkou/tokusyu/syussyo06/> (in Japanese).
 17. Beck S, Wojdyla D, Say L, Betran AP, Merialdi M, Requejo JH, et al. The worldwide incidence of preterm birth: a systematic review of maternal mortality and morbidity. *Bull World Health Organ.* 2010;88:31-8.
 18. Minakami H, Hiramatsu Y, Koresawa M, Fujii T, Hamada H, Iitsuka Y, et al. Guidelines for obstetrical practice in Japan: Japan Society of Obstetrics and Gynecology (JSOG) and Japan Association of Obstetricians and Gynecologists (JAOG) 2011 edition. *J Obstet Gynaecol Res.* 2011;37:1174-97.
 19. Kawagoe Y, Sameshima H, Ikenoue T, Yasuhi I, Kawarabayashi T. Magnesium sulfate as a second-line tocolytic agent for preterm labor: a randomized controlled trial in Kyushu Island. *J Pregnancy.* 2011;2011:965060.
 20. Minakami H, Maeda T, Fujii T, Hamada H, Iitsuka Y, Itakura A, et al. Guidelines for obstetrical practice in Japan: Japan Society of Obstetrics and Gynecology (JSOG) and Japan Association of Obstetricians and Gynecologists (JAOG) 2014 edition. *J Obstet Gynaecol Res.* 2014;40:1469-99.
 21. Vesalainen RK, Ekholm EM, Jartti TT, Tahvanainen KU, Kaila TJ, Erkkola RU. Effects of tocolytic treatment with ritodrine on cardiovascular autonomic regulation. *Br J Obstet Gynaecol.* 1999;106:238-43.
 22. Lamont RF. The pathophysiology of pulmonary oedema with the use of beta-agonists. *BJOG.* 2000;107:439-44.
 23. Gyetvai K, Hannah ME, Hodnett ED, Ohlsson A. Tocolytics for preterm labor: a systematic review. *Obstet Gynecol.* 1999;94:869-77.

24. Ogawa M, Matsuda Y, Kobayashi A, Shimada E, Akizawa Y, Mitani M, et al. Ritodrine Should Be Carefully Administered during Antenatal Glucocorticoid Therapy Even in Nondiabetic Pregnancies. *ISRN Obstet Gynecol.* 2013;120735.
25. Nakajima Y, Masaoka N, Tsuduki Y, Honda N, Sakai M. Rhabdomyolysis caused by tocolytic therapy with oral ritodrine hydrochloride in a pregnant woman with placenta previa. *J Obstet Gynaecol Res.* 2011;37:629-32.
26. Michikawa T, Nitta H, Nakayama SF, Ono M, Yonemoto J, Tamura K, et al. The Japan Environment and Children's Study (JECS): A Preliminary Report on Selected Characteristics of Approximately 10 000 Pregnant Women Recruited During the First Year of the Study. *J Epidemiol.* 2015;25:452-8.
27. Kawamoto T, Nitta H, Murata K, Toda E, Tsukamoto N, Hasegawa M, et al. Rationale and study design of the Japan environment and children's study (JECS). *BMC Public Health.* 2014;14:25.
28. Ministry of the Environment. Japan Environment and Children's Study. [homepage on the Internet] [updated 2015 April 29]. Available from: <http://www.env.go.jp/chemi/ceh/>
29. Goldenberg RL, Culhane JF, Iams JD, Romero R. Epidemiology and causes of preterm birth. *The Lancet.* 371:75-84.
30. Cunningham FG, Williams JW. *Williams obstetrics.* 23rd ed ed. McGraw-Hill Medical; 2010.
31. Robinson JN, Norwitz ER. Risk factors for preterm labor and delivery. In *UpToDate*, Wolters Kluwer; 2015. [updated 2015 Jun 12; cited 2015 Aug 11] Available at: http://www.uptodate.com/contents/risk-factors-for-preterm-labor-and-delivery?source=search_result&search=preterm+birth&selectedTitle=4%7E150
32. Craig CL, Marshall AL, Sjostrom M, Bauman AE, Booth ML, Ainsworth BE, et al. International physical activity questionnaire: 12-country reliability and validity. *Med Sci Sports Exerc.* 2003;35:1381-95.
33. Murase N KT, Ueda C, Inoue S, Shimomitsu T. International standardization of physical activity level: reliability and validity study of the Japanese version of the International Physical Activity Questionnaire (IPAQ). *J Health Welfare Statistics (Kosei no Shihyo).* 2003;46:1-9. (in Japanese).
34. Narendran S, Nagarathna R, Narendran V, Gunasheela S, Nagendra HR. Efficacy of yoga on pregnancy outcome. *J Altern Complement Med.* 2005;11:237-44.
35. Steel A, Adams J, Sibbritt D, Broom A, Frawley J, Gallois C. Relationship

- between complementary and alternative medicine use and incidence of adverse birth outcomes: an examination of a nationally representative sample of 1835 Australian women. *Midwifery*. 2014;30:1157-65.
36. Sun YC, Hung YC, Chang Y, Kuo SC. Effects of a prenatal yoga programme on the discomforts of pregnancy and maternal childbirth self-efficacy in Taiwan. *Midwifery*. 2010;26:e31-6.
 37. Gibbs RS. Chorioamnionitis and bacterial vaginosis. *Am J Obstet Gynecol*. 1993;169:460-2.
 38. Christiaens I, Zaragoza DB, Guilbert L, Robertson SA, Mitchell BF, Olson DM. Inflammatory processes in preterm and term parturition. *J Reprod Immunol*. 2008;79:50-7.
 39. Slattery MM, Morrison JJ. Preterm delivery. *Lancet*. 2002;360:1489-97.
 40. Steinborn A, Niederhut A, Solbach C, Hildenbrand R, Sohn C, Kaufmann M. Cytokine release from placental endothelial cells, a process associated with preterm labour in the absence of intrauterine infection. *Cytokine*. 1999;11:66-73.
 41. Steinborn A, von Gall C, Hildenbrand R, Stutte HJ, Kaufmann M. Identification of placental cytokine-producing cells in term and preterm labor. *Obstet Gynecol*. 1998;91:329-35.

Figure 1. The sample selection flow diagram

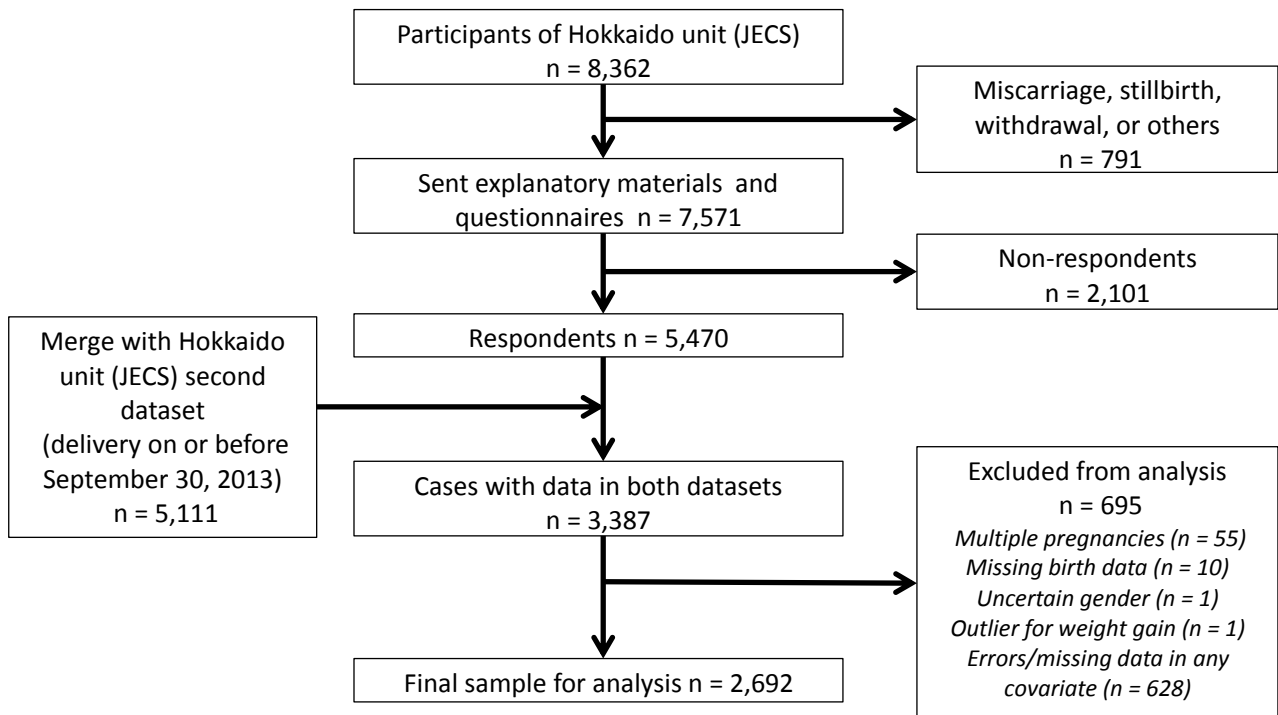


Table 1. Baseline characteristics of study participants according to practice and non-practice of prenatal yoga

Variable	No Prenatal Yoga (n = 2125) N (%)	Prenatal Yoga (n = 567) N (%)	P value
Maternal age at delivery (y)			0.248 ^d
≤24	137 (6.4)	24 (4.2)	
25-29	569 (26.8)	160 (28.2)	
30-34	800 (37.6)	213 (37.6)	
≥35	619 (29.1)	170 (30.0)	
Participation area			0.927 ^d
Sapporo	1155 (54.4)	312 (55.0)	
Asahikawa	496 (23.3)	128 (22.6)	
Kitami	474 (22.3)	127 (22.4)	
Parity			<0.001 ^d
0	819 (38.5)	375 (66.1)	
1	940 (44.2)	148 (26.1)	
2	309 (14.5)	36 (6.3)	
≥3	57 (2.7)	8 (1.4)	
Marital status			0.119 ^d
Married	2039 (96.0)	552 (97.4)	
Single (Unmarried, divorced, or widowed)	86 (4.0)	15 (2.6)	
Smoking at the second trimester			<0.001 ^d
Never smoked	1108 (52.1)	351 (61.9)	
Ex-smokers who quit before pregnancy	623 (29.3)	155 (27.3)	
Ex-smokers who quit after pregnancy	302 (14.2)	56 (9.9)	
Current smokers	92 (4.3)	5 (0.9)	
Alcohol consumption at the second trimester			<0.001 ^d
Never drank	568 (26.7)	107 (18.9)	
Ex-drinkers who quit before pregnancy	343 (16.1)	91 (16.0)	
Ex-drinkers who quit after pregnancy	1134 (53.4)	357 (63.0)	
Current drinkers	80 (3.8)	12 (2.1)	
Maternal education			<0.001 ^d
Junior high school	83 (3.9)	15 (2.6)	
High school	674 (31.7)	112 (19.8)	
Junior college, vocational school, or specialized vocational high school	935 (44.0)	259 (45.7)	
University or graduate school	433 (20.4)	181 (31.9)	
Pre-pregnancy BMI (kg/m ²)			<0.001 ^d
<18.5	352 (16.6)	108 (19.0)	
18.5–24.9	1522 (71.6)	427 (75.3)	
≥25	251 (11.8)	32 (5.6)	
Employment status			0.027 ^d
Housewife	916 (43.1)	217 (38.3)	
Regular employee or self-employed	687 (32.3)	206 (36.3)	
Temporary staff, part-time staff, or commissioned staff	447 (21.0)	113 (19.9)	
Unemployed or others	75 (3.5)	31 (5.5)	
Physical activity level before pregnancy (IPAQ)			0.396 ^f
METs × min/day (Mean [SD])	403.1 (705.0)	374.5 (636.7)	
Intention to do prenatal yoga at around			<0.001 ^d
15 weeks of gestation	1395 (65.6)	539 (95.1)	
Prenatal yoga classes were held in prenatal care hospital	1458 (68.6)	437(77.1)	<0.001 ^d
Infertility treatment			0.131 ^d
None (Spontaneous pregnancy)	1986 (93.5)	521 (91.9)	
Ovulation induction or AIH	100 (4.7)	38 (6.7)	
ART	39 (1.8)	8 (1.4)	
History of preterm delivery ^a	57 (4.4)	7 (3.6)	0.646 ^d
History of spontaneous abortion ^b	417 (27.1)	101 (36.3)	0.002 ^d
Malformation of uterus	10 (0.5)	1 (0.2)	0.476 ^e
Chronic hypertension	38 (1.8)	7 (1.2)	0.361 ^d
Diabetes mellitus	29 (1.4)	5 (0.9)	0.360 ^d
Psychiatric illness	8 (0.4)	1 (0.2)	0.694 ^e
Hypothyroidism	16 (0.8)	12 (2.1)	0.004 ^d
Autoimmune disease	10 (0.5)	2 (0.4)	1.000 ^e
Practice of alternative therapies other than prenatal yoga ^c	383 (18.0)	195 (34.4)	<0.001 ^d
Gender of offspring (Male)	1121 (52.8)	292 (51.5)	0.595 ^d
Use of iron preparations during pregnancy	611 (28.8)	178 (31.4)	0.220 ^d
Threatened abortion during pregnancy	128 (6.0)	22 (3.9)	0.048 ^d
Use of ritodrine hydrochloride	651 (30.6)	139 (24.5)	0.004 ^d

^aOnly among women with parity ≥1 (n = 1,498) ^bOnly among women with gravida ≥1 (n = 1,815).

^cIncludes Lamaze technique, sophrology, aromatherapy, maternity swimming, maternal aerobics, massage, acupuncture, Qigong, Tai Chi, meditation, hypnotherapy, or autogenic training. ^dχ² test. ^eFisher's exact test. ^fMann-Whitney U test.

BMI, Body Mass Index; SD, Standard Deviation; IPAQ, International Physical Activity Questionnaire

AIH, Artificial insemination with husband's sperm; ART, Assisted reproduction technology

Table 2 Adjusted odd ratios for ritodrine hydrochloride use

	OR	95%CI	P value
No prenatal yoga	1 (Ref)		
Prenatal yoga (Crude)	0.74	(0.60 to 0.91)	0.005
(Model 1)	0.77	(0.61 to 0.97)	0.030
(Model 2)	0.78	(0.62 to 0.99)	0.041
(Model 3)	0.77	(0.61 to 0.98)	0.034

Model 1 adjusted for maternal age at delivery, participation area, parity, marital status, smoking, alcohol consumption, maternal education, pre-pregnancy BMI, employment status, physical activity level before pregnancy, intention to do prenatal yoga at around 15 weeks of gestation, and prenatal yoga classes held at the prenatal care hospital.

Model 2 adjusted for the variables in Model 1, as well as infertility treatment, history of preterm delivery, history of spontaneous abortion, malformation of uterus, chronic hypertension, diabetes mellitus, psychiatric illness, hypothyroidism, and autoimmune disease.

Model 3 adjusted for the variables in Model 2, as well as practice of alternative therapies other than prenatal yoga, gender of offspring, use of iron preparations during pregnancy, and threatened abortion during pregnancy.

OR, odds ratio; CI, confidence intervals

Table 3 Adjusted odd ratios for ritodrine hydrochloride use stratified by the number of yoga practice weeks, number of practice sessions, and total practice duration in minutes

	OR	95%CI	P value	P value for trend
Number of practice weeks				
No prenatal yoga (n = 2125)	1 (Ref)			0.016
Prenatal yoga ≤13 weeks (n = 294)	0.86	(0.63 to 1.17)	0.332	
Prenatal yoga >13 weeks (n = 251)	0.67	(0.48 to 0.93)	0.019	
Number of practice sessions				
No prenatal yoga (n = 2125)	1 (Ref)			0.007
Prenatal yoga ≤17 sessions (n = 279)	0.92	(0.67 to 1.25)	0.581	
Prenatal yoga >17 session (n = 264)	0.62	(0.44 to 0.86)	0.005	
Total practice duration in minutes				
No prenatal yoga (n = 2125)	1 (Ref)			0.002
Prenatal yoga ≤900 min (n = 269)	1.04	(0.76 to 1.42)	0.804	
Prenatal yoga >900 min (n = 267)	0.54	(0.38 to 0.76)	<0.001	

Adjusted for maternal age at delivery, participation area, parity, marital status, smoking, alcohol consumption, maternal education, pre-pregnancy BMI, employment status, physical activity level before pregnancy, intention to do prenatal yoga at around 15 weeks of gestation, prenatal yoga classes held at the prenatal care hospital, infertility treatment, history of preterm delivery, history of spontaneous abortion, malformation of uterus, chronic hypertension, diabetes mellitus, psychiatric illness, hypothyroidism, autoimmune disease, practice of alternative therapies other than prenatal yoga, gender of offspring, use of iron preparations during pregnancy, and threatened abortion during pregnancy.

OR, odds ratio; CI, confidence intervals

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Prenatal yoga >13 weeks (n = 251)	0.67	(0.48 to 0.93)	0.019	
Number of practice sessions				
No prenatal yoga (n = 2125)	1 (Ref)			0.007
Prenatal yoga ≤17 sessions (n = 279)	0.92	(0.67 to 1.25)	0.581	
Prenatal yoga >17 session (n = 264)	0.62	(0.44 to 0.86)	0.005	
Total practice duration in minutes				
No prenatal yoga (n = 2125)	1 (Ref)			0.002
Prenatal yoga ≤900 min (n = 269)	1.04	(0.76 to 1.42)	0.804	
Prenatal yoga >900 min (n = 267)	0.54	(0.38 to 0.76)	<0.001	

Adjusted for maternal age at delivery, participation area, parity, marital status, smoking, alcohol consumption, maternal education, pre-pregnancy BMI, employment status, physical activity level before pregnancy, intention to do prenatal yoga at around 15 weeks of gestation, prenatal yoga classes held at the prenatal care hospital, infertility treatment, history of preterm delivery, history of spontaneous abortion, malformation of uterus, chronic hypertension, diabetes mellitus, psychiatric illness, hypothyroidism, autoimmune disease, practice of alternative therapies other than prenatal yoga, gender of offspring, use of iron preparations during pregnancy, and threatened abortion during pregnancy.

OR, odds ratio; CI, confidence intervals

Table 4 Adjusted odd ratios for ritodrine hydrochloride use stratified by the start of yoga in gestational weeks and total practice duration in minutes

	OR	95%CI	P value	P value for trend
Start of yoga in gestational weeks and total practice duration in minutes				
No prenatal yoga (n = 2125)	1 (Ref)			0.001
Prenatal yoga ≤21 weeks and ≤900 min (n = 102)	1.21	(0.76 to 1.92)	0.413	
Prenatal yoga ≥22 weeks and ≤900 min (n = 167)	0.94	(0.64 to 1.39)	0.770	
Prenatal yoga ≤21 weeks and >900 min (n = 167)	0.69	(0.46 to 1.03)	0.069	
Prenatal yoga ≥22 weeks and >900 min (n = 100)	0.34	(0.19 to 0.62)	<0.001	

Adjusted for maternal age at delivery, participation area, parity, marital status, smoking, alcohol consumption, maternal education, pre-pregnancy BMI, employment status, physical activity level before pregnancy, intention to do prenatal yoga at around 15 weeks of gestation, prenatal yoga classes held at the prenatal care hospital, infertility treatment, history of preterm delivery, history of spontaneous abortion, malformation of uterus, chronic hypertension, diabetes mellitus, psychiatric illness, hypothyroidism, autoimmune disease, practice of alternative therapies other than prenatal yoga, gender of offspring, use of iron preparations during pregnancy, and threatened abortion during pregnancy.

OR, odds ratio; CI, confidence intervals

e Appendix 1

The Hokkaido unit administrates participants from 3 areas: Sapporo area (Kita-ward and Toyohira-ward of Sapporo city; total population, 497,000), Asahikawa area (Asahikawa city; population, 346,000) and Kitami area (Kitami city, Okedo town, Kunneppu town, Tsubetsu town, and Bihoro town; total population, 155,000).

e Appendix 2

We conducted sensitivity analyses using restricted samples comprising 2,542 cases (excluding 150 threatened abortion cases) and 2,632 cases (excluding 60 cases who had attempted to do prenatal yoga but were stopped by their physician). Finally, as an exploratory subanalysis on practice methods and the components of yoga, we divided the prenatal yoga group into 4 subgroups based on combinations of 3 patterns: categorization according to practice methods (instructor or self-study) and the median of total practice duration in minutes, categorization according to breathing technique use and the median of total practice duration in minutes, and categorization according to meditation use and the median of total practice duration in minutes.

e-Table 1. Adjusted odd ratios for ritodrine hydrochloride use among women without threatened abortion

	OR	95%CI	P value	P value for trend
No prenatal yoga (n = 1997)	1 (Ref)			
Prenatal yoga (n = 545)	0.79	(0.62 to 1.01)	0.065	
Number of practice weeks				
No prenatal yoga (n = 1997)	1 (Ref)			0.052
Prenatal yoga ≤13 weeks (n = 282)	0.85	(0.62 to 1.16)	0.295	
Prenatal yoga >13 weeks (n = 244)	0.73	(0.52 to 1.03)	0.072	
Number of practice sessions				
No prenatal yoga (n = 1997)	1 (Ref)			0.024
Prenatal yoga ≤17 sessions (n = 267)	0.90	(0.66 to 1.24)	0.529	
Prenatal yoga >17 sessions (n = 257)	0.67	(0.48 to 0.95)	0.022	
Total practice duration in minutes				
No prenatal yoga (n = 1997)	1 (Ref)			0.010
Prenatal yoga ≤900 min (n = 258)	1.01	(0.74 to 1.39)	0.955	
Prenatal yoga >900 min (n = 259)	0.60	(0.43 to 0.85)	0.004	
Start of yoga in gestational weeks and total practice duration in minutes				
No prenatal yoga (n = 1997)	1 (Ref)			0.003
Prenatal yoga ≤21 weeks and ≤900 min (n = 99)	1.17	(0.73 to 1.88)	0.508	
Prenatal yoga ≥22 weeks and ≤900 min (n = 159)	0.92	(0.62 to 1.37)	0.669	
Prenatal yoga ≤21 weeks and >900 min (n = 161)	0.77	(0.51 to 1.15)	0.201	
Prenatal yoga ≥22 weeks and >900 min (n = 98)	0.39	(0.22 to 0.69)	0.001	

Adjusted for maternal age at delivery, participation area, parity, marital status, smoking, alcohol consumption, maternal education, pre-pregnancy BMI, employment status, physical activity level before pregnancy, intention to do prenatal yoga at around 15 weeks of gestation, prenatal yoga classes held at the prenatal care hospital, infertility treatment, history of preterm delivery, history of spontaneous abortion, malformation of uterus, chronic hypertension, diabetes mellitus, psychiatric illness, hypothyroidism, autoimmune disease, practice of alternative therapies other than prenatal yoga, gender of offspring, and use of iron preparations during pregnancy.

OR, odds ratio; CI, confidence intervals

e-Table 2. Adjusted odd ratios for ritodrine hydrochloride use among women with the exclusion of those who attempted to start prenatal yoga but were stopped by their physician

	OR	95%CI	P value	P value for trend
No prenatal yoga (n = 2065)	1 (Ref)			
Prenatal yoga (n = 567)	0.86	(0.67 to 1.09)	0.213	
Number of practice weeks				
No prenatal yoga (n = 2065)	1 (Ref)			0.113
Prenatal yoga ≤13 weeks (n = 294)	0.95	(0.70 to 1.30)	0.754	
Prenatal yoga >13 weeks (n = 251)	0.75	(0.53 to 1.05)	0.093	
Number of practice sessions				
No prenatal yoga (n = 2065)	1 (Ref)			0.058
Prenatal yoga ≤17 sessions (n = 279)	1.02	(0.74 to 1.39)	0.918	
Prenatal yoga >17 sessions (n = 264)	0.69	(0.49 to 0.97)	0.031	
Total practice duration in minutes				
No prenatal yoga (n = 2065)	1 (Ref)			0.021
Prenatal yoga ≤900 weeks (n = 269)	1.16	(0.85 to 1.58)	0.353	
Prenatal yoga >900 weeks (n = 267)	0.60	(0.43 to 0.85)	0.004	
Start of yoga in gestational weeks and total practice duration in minutes				
No prenatal yoga (n = 2065)	1 (Ref)			0.006
Prenatal yoga ≤21 weeks and ≤900 min (n = 102)	1.37	(0.86 to 2.17)	0.186	
Prenatal yoga ≥22 weeks and ≤900 min (n = 167)	1.05	(0.71 to 1.54)	0.819	
Prenatal yoga ≤21 weeks and >900 min (n = 167)	0.77	(0.52 to 1.16)	0.214	
Prenatal yoga ≥22 weeks and >900 min (n = 100)	0.37	(0.21 to 0.67)	0.001	

Adjusted for maternal age at delivery, participation area, parity, marital status, smoking, alcohol consumption, maternal education, pre-pregnancy BMI, employment status, physical activity level before pregnancy, intention to do prenatal yoga at around 15 weeks of gestation, prenatal yoga classes held at the prenatal care hospital, infertility treatment, history of preterm delivery, history of spontaneous abortion, malformation of uterus, chronic hypertension, diabetes mellitus, psychiatric illness, hypothyroidism, autoimmune disease, practice of alternative therapies other than prenatal yoga, gender of offspring, use of iron preparations during pregnancy, and threatened abortion during pregnancy.

OR, odds ratio; CI, confidence intervals

e-Table 3 Adjusted odd ratios for ritodrine hydrochloride use stratified by practice methods, breathing technique use, meditation use, and total practice duration in minutes

	OR	95%CI	P value	P value for trend
Practice methods and total practice duration in minutes				
No prenatal yoga (n = 2125)	1 (Ref)			0.003
Self-study and ≤900 min (n = 108)	1.07	(0.68 to 1.67)	0.777	
Instructor and ≤900 min (n = 160)	1.04	(0.70 to 1.54)	0.861	
Self-study and >900 min (n = 109)	0.45	(0.26 to 0.76)	0.003	
Instructor and >900 min (n = 157)	0.61	(0.40 to 0.93)	0.022	
Breathing technique use and total practice duration in minutes				
No prenatal yoga (n = 2125)	1 (Ref)			0.001
Without breathing techniques and ≤900 min (n = 68)	1.14	(0.66 to 1.99)	0.639	
With breathing techniques and ≤900 min (n = 199)	0.99	(0.69 to 1.42)	0.959	
Without breathing techniques and >900 min (n = 30)	0.76	(0.31 to 1.87)	0.548	
With breathing techniques and >900 min (n = 237)	0.52	(0.36 to 0.74)	<0.001	
Meditation use and total practice duration in minutes				
No prenatal yoga (n = 2125)	1 (Ref)			0.002
Without meditation and ≤900 min (n = 177)	0.99	(0.68 to 1.43)	0.950	
With meditation and ≤900 min (n = 90)	1.13	(0.68 to 1.86)	0.644	
Without meditation and >900 min (n = 134)	0.47	(0.29 to 0.77)	0.002	
With meditation and >900 min (n = 133)	0.61	(0.39 to 0.96)	0.032	

Adjusted for maternal age at delivery, participation area, parity, marital status, smoking, alcohol consumption, maternal education, pre-pregnancy BMI, employment status, physical activity level before pregnancy, intention to do prenatal yoga at around 15 weeks of gestation, prenatal yoga classes held at the prenatal care hospital, infertility treatment, history of preterm delivery, history of spontaneous abortion, malformation of uterus, chronic hypertension, diabetes mellitus, psychiatric illness, hypothyroidism, autoimmune disease, practice of alternative therapies other than prenatal yoga, gender of offspring, use of iron preparations during pregnancy, and threatened abortion during pregnancy.

OR, odds ratio; CI, confidence intervals

e Table 4. Practice methods, practice frequency, and the components of prenatal yoga

Prenatal Yoga Factors	N (%)
Practice methods (n = 565)	
Instructor	341 (60.4)
Self-study using DVDs or books	224 (39.6)
Practice frequency (median [SD])	
Start of yoga in gestational weeks (n = 551)	22.0 (7.1)
End of yoga in gestational weeks (n = 545)	37.0 (5.9)
Frequency per week (n = 561)	1.0 (1.7)
Duration of practice in minutes per session (n = 555)	60.0 (29.9)
Components of prenatal yoga (n = 565)	
Physical posture	553 (97.9)
Breathing technique	465 (82.3)
Meditation	236 (41.8)

SD, Standard Deviation