

Review Article

Exercise During Pregnancy

Effects on Birth Weight and on the Risks of Gestational Diabetes and Preterm Delivery

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Summary

Background: Pregnancy is a good time to motivate women to implement health-promoting behaviors in their everyday lives. There is no official German-language guideline for the counseling of pregnant women by professionals involved in their care. The goal of this review is, therefore, to discuss the links between exercise and gestational diabetes mellitus (GDM), low birth weight, and prematurity.

Methods: This review is based on pertinent articles retrieved by a systematic search of PubMed and the Web of Science. The articles included in the evaluation were reports of randomized controlled trials (RCTs) and meta-analyses of RCTs of exercise interventions in pregnant women that were published from 1 January 2011 to 15 November 2021.

Results: A structured exercise program during pregnancy can lower the risk of gestational diabetes by as much as 49%. A 25% risk reduction for GDM was achieved with 140 minutes of exercise per week. The mean birth weight was not affected but the rate of excessively heavy newborns was lowered by 32–59% in the normal-weight subgroup. This effect was not seen in the overweight subgroup, possibly because of poorer compliance. Exercise did not elevate the risk of preterm delivery.

Conclusion: Regular exercise during pregnancy lessens gestationally induced weight gain and lowers the risk of excessive weight gain, as well as the risk of GDM, without elevating the risk of preterm delivery.

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Pregnancy is a good time to motivate women to implement positive behaviors with regard to exercise and nutrition in their everyday lives as they are more receptive to such advice during pregnancy. The American College of Obstetrics and Gynecology (ACOG) recommends 150 minutes of moderate-intensity exercise per week, such as fast walking (3–4 metabolic equivalent of tasks [MET]) (1–4). However, women tend to avoid exercise because they are pregnant or are forced already early in pregnancy to adopt an attitude of exercise avoidance due to, for example, the fact that they are no longer allowed to work. This in turn often leads to uncertainty among pregnant women about whether they still can engage in recreational activities. In the German-speaking area, unlike in other countries, there are no

official recommendations or guidelines for the counseling of pregnant women available to professionals involved in their care. Consequently, there are also uncertainties about recommendations.

Thus, the goal of this review is to discuss the effects of exercise on some important obstetric issues. Our key questions were: What effects does exercise during pregnancy have on the rates of gestational diabetes (GDM) and preterm birth as well as the risk of abnormal birth weight (*Box*)?

Material and methods

We followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines when writing this review (5). By peer consensus, the three topics with the highest importance for the general population were selected: The links between exercise during pregnancy and GDM, birth weight and potential preterm birth.

Literature search and study selection

Between 1 September 2021 and 15 November 2021, the PubMed and Web of Science database were each systematically searched by two independent reviewers. The

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BOX

Definitions

- **SGA (small for gestational age)**
Birth weight <10th percentile
- **LGA (large for gestational age)**
Birth weight >90th percentile
- **Macrosomia**
Birth weight >4 kg or >4.5 kg

following search strategy was used: (pregnancy) AND (physical activity) AND (macrosomia) OR (gestational diabetes) OR (intrauterine growth retardation) OR (small for gestational age) OR (preterm birth). The articles included in the evaluation were reports of randomized controlled trials (RCTs) and meta-analyses (MA) of RCTs that were published in German or English from 1 January 2011 to 15 November 2021.

Study populations and inclusion/exclusion criteria

Inclusion criteria

- RCTs or MAs of RCTs
- Uncomplicated pregnancy
- Comparison of the intervention group (IG) with a control group of physically inactive pregnant women (CG)
- Exercise intervention (exercise under supervision)

Lifestyle interventions that attempted to both improve the quality of diet and achieve higher levels of daily physical activity by means of motivation and counseling were excluded. First, because the focus of our review was on physical activity, and second, because the advisory nature of these studies resulted in poor study protocol adherence (e1–e15).

Women of any BMI category were included. The retrieved studies were classified based on the respective BMI category (eTable 1 and 2). The term “at-risk subgroup” was used for studies with pregnant women at increased risk of GDM. The list of independent risk factors in the current German-language S3-level clinical practice guideline “Gestational diabetes mellitus (GDM): Diagnosis, Therapy and Follow-up Care” (6) includes, among others: status post GDM in previous pregnancy, body weight >69 kg, age >35 years, and 1st or 2nd degree relatives with diabetes mellitus (DM). Studies on women with normal BMI (18.5–25 kg/m²) were combined under “normal-weight subgroup”, while studies in which the BMI was neither an inclusion nor an exclusion criterion were categorized as “mixed-weight subgroup”.

Exclusion criteria

Studies of women with overt GDM as well as studies investigating postpartum outcomes, such as long-term effects of GDM and postpartum weight retention or

long-term effects in children (obesity, neonatal complications).

Results

Study selection and characteristics

The primary keyword search identified a total of 2398 studies (eFigure). Notably, GDM and/or weight gain during pregnancy, in particular, are frequently studied topics. Without eliminating duplicates, the numerical ratio was: 1126 papers on GDM, 319 on preterm delivery and 204 articles focusing on birth weight. Among these 2398 studies, there were 523 RCTs and meta-analyses. After the exclusion of duplicates, 347 papers remained (266 RCTs, 81 MAs). Finally, full-text screening of 55 RCTs and 30 MAs was performed and further 34 RCTs and 11 MAs were excluded. Two meta-analyses and one RCT identified by manual search were also added, bringing the total of papers included after completed literature search to 22 RCTs and 21 MAs.

Overall, the study populations of the RCTs were small. The number of subjects ranged from 62 to 1348. The majority of interventions were initiated at the transition from the first to the second trimester and ended in the third trimester. While there were differences between the various interventions (eTable 1), their basic structure was similar. Most of the interventions (19/22) consisted of one to three one-hour supervised classes per week, involving a combination of endurance, strength, pelvic floor, and stretching exercises. Two interventions involved stationary cycling programs (3×/week, 30–60 minutes each session) and one intervention only offered free access to classes at a gym. In most studies, the exercise intensities were in the low to moderate exercise intensity range. For intensity monitoring, some studies used a pulsometer (target intensity: 55–80% HR_{max}), while others used the Borg scale (target intensity: 12–14/20, “somewhat hard”).

Gestational diabetes and weight gain during pregnancy

Normal-weight and mixed-weight subgroups

A total of 14 RCTs (7–20) evaluating exercise interventions in normal-weight or mixed-weight subgroups were identified. Study protocol adherence was ensured, resulting in 11 studies (7–13, 15–17, 21) achieving a participant rate greater than 70%.

Six of the 11 randomized studies showed a significant reduction in gestational weight gain (GWG) as the result of the intervention (8, 9, 11, 15, 18, 19). All included meta-analyses (e16–e22) found a positive effect on GWG. Significant reductions in GWG (e16–e18, e20–e22) by 0.61 kg (e21) to 1.61 kg (e17) were demonstrated. One meta-analysis (e19) reported a 32% reduction in the risk of excessive gestational weight gain (eGWG, gestational weight gain above the recommendations)(Table 1). As little as 105 minutes of moderate exercise per week resulted in an eGWG risk reduction of 25% (e19).

TABLE 1

Recommended weight gain during pregnancy (29)

BMI category	BMI	Recommended weight gain (total)	Recommended weekly weight gain in the 2nd and 3rd trimester
Underweight	<18.5 kg/m ²	12.5–18 kg	0.44–0.58 kg
Normal weight	18.5–24.9 kg/m ²	11.5–16 kg	0.35–0.5 kg
Overweight	25–29.9 kg/m ²	7–11.5 kg	0.23–0.33 kg
Obesity	>30 kg/m ²	5–9 kg	0.17–0.27 kg

BMI, body mass index

Of 11 RCTs, only 3 studies (11, 13, 17) demonstrated a GDM risk reduction of 40% (11) to 50% (17). However, these results were confirmed in the meta-analyses: 8 (e16, e17, e20, e23–e27) of 10 (e16, e17, e20, e23–e29) studies showed that exercise interventions reduced the risk of GDM by 28% (e26) to 38% (e24, e27) in the subgroup without BMI restrictions and even by 40% (e17) to 49% (e23) in the normal-weight subgroup.

To accomplish a GDM risk reduction of 25%, an exercise duration of 140 min/week would have to be achieved (e24, e25). If the duration were to be increased to 180 minutes, this reduction in risk could be as high as 35% (e25).

One meta-analysis (e20) found a larger effect when women were physically active throughout the entire pregnancy. In addition, one RCT demonstrated that exercise interventions were protective against GDM when excessive weight gain was also present (Table 1).

At-risk subgroup

A total of 5 (22–26) RCTs evaluating exercise interventions in the at-risk subgroup were included. The inclusion criterion was an increased BMI (>25 kg/m², (26) >24 kg/m²) in all studies (22, 23, 25, 26), except for one (24). The only inclusion criterion in the study by Guelfi et al. (24) was a history of GDM; in consequence, the mean BMI in this study was normal. Unlike in the normal-weight and mixed-weight subgroups, the participation rates achieved in this subgroup were highly variable and, in some cases, poor (for example, 16% achieved 50% of the target [25]).

Only the randomized study by Wang et al. (26) (poorest participation rate: 73%) found that the intervention achieved a significant reduction in GDM (22% [intervention group] versus 40.6% [control group]; p = 0.001 [26]). Furthermore, this RCT (26) was the only study with a significantly lower GWG in the intervention group (8.4 vs. 10.5 kg; p<0.001). In only one further RCT (22), a reduction in the eGWG proportion was achieved by the exercise intervention (22% in IG vs. 43% in CG; p<0.05). However, the included meta-analyses confirmed these findings: 3 meta-analyses (e30–e32) found significant reductions

in the relative GDM risk by 29% (e30) to 39% (e31) in the overweight subgroup. In addition, a significant reduction in GWG by approximately one kilogram was demonstrated (e30, e32).

Birth weight and SGA, LGA and macrosomia rates

Normal-weight and mixed-weight subgroups

Sixteen RCTs (7–21, 27, 28) evaluated the effect of an exercise intervention on birth weight in the mixed-weight subgroup. None of these studies found a difference for birth weight (7–14, 16–21, 27, 28). This finding was confirmed by 7 included meta-analyses (e16–e18, e23, e27, e33, e34). Only one meta-analysis detected a clinically relevant reduction in birth weight by 28 g (e34). Furthermore, neither the RCTs (8, 11–15, 17–21, 27, 28) nor the meta-analyses (e16, e23, e33, e34) showed an effect on the incidence of underweight fetuses (SGA or <2.5 kg).

However, findings were not consistent for the rate of very large newborns (LGA or macrosomia): While 9 RCTs (11, 13, 14, 18–21, 27, 28) showed no change by the intervention, 2 studies (8, 15) confirmed a lower rate of macrosomia (0% in intervention group vs. 5% in control group; p = 0.02 [15]). It should be noted, however, that the macrosomia rate in the intervention group was 0% in both studies, which was very low compared with the other studies. Yet, in contrast, the meta-analyses clearly showed a positive effect on macrosomia/LGA rates (e16, e33, e34). Risk reductions ranged from 32% (odds ratio [OR]: 0.68; [95% confidence interval: 0.54; 0.87]; I² = 4% [e34]) und 59% (relative risk [RR]: 0.41; [0.25; 0.68], p<0.001, I² = 16.3% [e33]).

In specific subgroups, in particular, exercise during pregnancy reduced the risk of macrosomia: The RCT by Perales et al. (17) showed that among previously inactive women in the intervention group the risk of fetal macrosomia was significantly reduced compared to previously inactive women in the control group (adjusted OR: 0.33 (0.18–0.62); p = 0.005 [17]). A further randomized study (15) confirmed that especially women with excessive gestational weight gain (eGWG) benefit from exercise during pregnancy, because the risk of macrosomia was significantly higher in each of these control group subgroups

compared to the intervention group (control group: 13% (with eGWG) versus 0.8% (without eGWG), $p < 0.001$).

At-risk subgroup

A total of four randomized trials (22, 24–26) investigated the effect of exercise intervention on birth weight in the at-risk subgroup. Here, only the study by Wang et al. (26) found a small reduction in birth weight (3345 g (intervention group) vs. 3460 g (control group); $p = 0.049$). No RCT showed an effect of the intervention on the SGA, LGA and macrosomia rates (22, 24–26). Three meta-analyses (e30, e31, e34) confirmed these results: Neither the birth weight, nor the LGA, SGA and macrosomia rates were impacted by the interventions.

Preterm birth rate and gestational age at birth

Almost all RCTs (7–20, 22, 24, 26) of our literature search looked at the gestational age at birth or the preterm birth rate (PTB). No study demonstrated a significant effect of exercise on gestational age or preterm birth rate. Whether physical activity results in a reduction in the rate of preterm birth has yet to be determined. Ten meta-analyses (e16, e17, e23, e24, e26, e27, e29–e31, e34) showed inconsistent findings: While in the normal-weight and mixed-weight subgroups the meta-analyses found no negative effect of exercise on preterm birth rate or gestational age at birth (e16, e17, e23, e24, e26, e27, e34), one (e31) of 3 meta-analyses (e30, e31, e34) in the overweight subgroup found a reduction in the risk of preterm birth (RR: 0.62; 95% CI: [0.41–0.95]) (e31).

Discussion

Our review of the literature found that physical activity during pregnancy may be protective against excessive gestational weight gain, GDM and macrosomia without increasing the risk of prematurity. However, there are some issues worthy of discussion: First, all RCTs primarily harbor a bias, since only motivated pregnant women consent to such a study. Second, the comparability of the different studies is limited because the interventions were not standardized. In addition, exercise intensities also varied widely. The studies that used heart rate ranges for exercising had targets between 50% and 80% of HRmax, which is in line with generally accepted international recommendations (29, 30).

Some RCTs did not have any explicit intensity information, so in this case a lack of effect on the targets could also be related to a rather low exercise intensity. Furthermore, some of the participant rates in the at-risk subgroup were poor which may explain why frequently no significant results were achieved in the intervention groups.

None of the RCTs or MAs found an exercise-related increase in the risk of prematurity. One meta-analysis even showed a risk reduction. The question of whether physical activity actually leads to a reduc-

tion in the risk of preterm birth should be the subject of further studies; in particular in the light of the recommendations for women with premature rupture of the membranes or imminent preterm delivery (31, 32).

Furthermore, the interventions had no clinically relevant effect on birth weight. Exercise interventions had a positive effect on the macrosomia rates in the normal-weight and mixed-weight subgroups, but not in the at-risk subgroup, except for the study by Wang et al. (26). Here again, poorer compliance in the at-risk group may be the reason for the lack of effectiveness.

Furthermore, convincing overweight women to be more physically active is apparently rather difficult. At the same time, it is all the more important to motivate this subgroup, as they tend to develop eGWG more frequently, also because the recommended weight gain (Table 1) is significantly lower compared to women with normal BMI. eGWG, in turn, increases the risk of GDM and macrosomia (15). The positive effect on the GDM rate is greater if women exercise during the entire pregnancy (e20).

This is why content related to physical activity during pregnancy and recommended weight gain should be discussed during prenatal counseling. The exercise limits for already very athletic women should be determined by further investigations. A coordinated, national guideline would be desirable to ensure that professionals working in obstetrics are able to act with confidence.

Conclusion

In the absence of contraindications, exercise and physical activity during pregnancy do not involve any particular risks, but have great benefits and should thus be actively encouraged. Exercising for 100 to 140 minutes per week in total reduces both the gestational weight gain and the excessive gestational weight gain as well as the risk of developing GDM. As little as 140 minutes of moderate exercise per week can reduce the GDM risk by 25% and 180 min/week even by 35%.

Furthermore, physical activity had no clinically relevant negative effect on birth weight in any of the studies. Likewise, no exercise-related increase in the risk of fetal growth restriction was observed. In contrast to the subgroup at risk of GDM, the rates of macrosomic and LGA fetuses were reduced in the mixed-weight and normal-weight subgroups. The lack of a positive effect of exercise on LGA and macrosomia rates, particularly in the at-risk population, could be attributable to poorer study protocol adherence. Studies have shown that women with excessive gestational weight gain as well as previously inactive women could reduce their macrosomia risk by exercising.

Moreover, none of the studies provided evidence of an exercise-related increase in the preterm birth rate.

Conflict of interest statement

The authors declare no conflict of interest.

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► **Supplementary material**

eReferences, eTables, eFigure:
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Supplementary material to:

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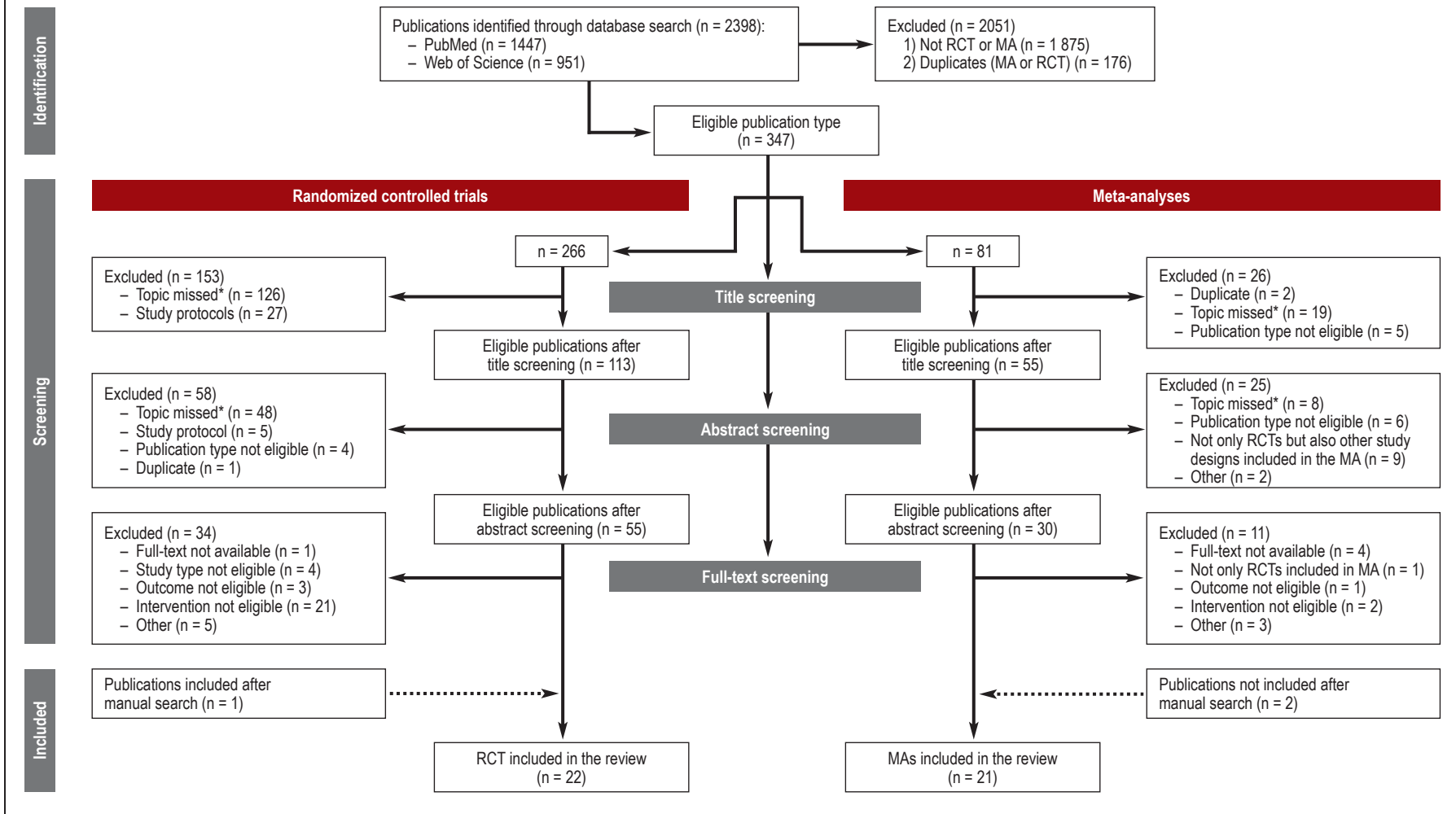
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eFIGURE

**Literature search**

* Topic missed: Example: Only dietary intervention, long-term effects (postpartum), subgroup not eligible, quality of life or psychological, etc.

incl., included

eTable 1

Included randomized controlled trials with exercise intervention

Authors	Subgroup	Specification of subgroup	n (total)	n (IG/CG)	Intervention	Intervention duration	Participation rate
Barakat et al., 2012 (7)	Mixed-weight subgroup	1) Healthy 2) No CI to exercise in pregnancy	83	IG: 40, CG: 43	Exercise under supervision (3 ×/week for 35–45 min): 2 × strength + endurance, 1 × aquatic exercises, 85 sessions	From 10–14 WG – end of 3 rd trimester	85%
Barakat et al., 2013 (8)	Mixed-weight subgroup	1) Uncomplicated singleton pregnancy 2) No CI to exercise in pregnancy 3) No regular physical activity (< 20 min, 3×/week)	510	IG: 255, CG: 255	Exercise under supervision (3 ×/week à 50–55 min): 10 min WU, 30–35 min (strength + endurance), 10 min CD; 85 sessions	8–10 WG to 38–39 WG	> 95%
Barakat et al., 2014 (10)	Mixed-weight subgroup	1) No CI to exercise in pregnancy 2) No regular physical activity (< 4×/week)	200	IG: 107, CG: 93	Exercise under supervision(3 ×/week à 60 min): 5 min WU, 30 min strength + endurance, 10 min balance, 10 min BB, 5 min CD; 85 sessions	From 9–13 WG to 39–40 WG	> 95%
Barakat et al., 2014 (9)	Mixed-weight subgroup	1) Uncomplicated singleton pregnancy 2) No regular physical activity (< 4×/week)	320	IG: 160 CG: 160	Exercise under supervision (3×/week à 50–55 min): 10 min WU, 30–35 min (strength + endurance), 10 min CD; 85 sessions	8–10 WG to 38–39 WG; 28 weeks	87%
Barakat et al., 2019 (11)	Mixed-weight subgroup	1) Uncomplicated singleton pregnancy 2) No contraindications, 3) No DM I/II/GDM 4) No S/P PTB	456	CG: 222 IG: 234	Exercise under supervision(3 ×/week à 55–60 Min: 10 min WU, 30–35 min strength, endurance, balance, pelvic floor, 10 min relaxation; 83–85 sessions	8–10 WG to 38–39 WG	> 80%
Brik et al., 2019 (12)	Mixed-weight subgroup	1) Uncomplicated singleton pregnancy 2) < 16 WG 3) No CI to exercise in pregnancy 4) No regular activity in pregnancy (< 3 × 30 min/week) 5) > 70% participation rate	120	IG: 75 CG: 45	Exercise under supervision(3×/ week à 60 min): 10 min WU, 25 min endurance (55 – 60 % HR _{max}), 10 min strength, 5 min balance, 5 min BB, 5 min CD	9 WG–38 WG	> 70%
Cordero et al., 2015 (13)	Mixed-weight subgroup	1) No CI to exercise in pregnancy 2) WG 12–14 WG	257	IG:101 CG: 156	Exercise under supervision (3 ×/week 50–60 min): 2 × strength + endurance, 1 × aquatic (1h) (under supervision); 85 sessions	From 10–14 WG to end of 3 rd trimester	85%
da Silva et al., 2017 (14)	Mixed-weight subgroup	1) Singleton pregnancy 2) No CI to exercise 3) Age>18 years 4) BMI < 35 kg/m ² 5)No reg. physical activity > 150 min/week	639	IG: 213 CG: 426	Exercise under supervision(3 ×/week à 60 min): WU, aerobic endurance (15 – 25 min), strength (35–25 min), CD	16 weeks (16–20. to 32–36 WG)	On average: 27/48 (56%), 40% had participation rate >70%
de Oliveria Melo et al., 2012 (27)	Mixed-weight subgroup	1) Singleton pregnancy 2) Approx. 13 GW 3) No CI to exercise 4) No regular physical activity (not further defined)	187	(1) IG A (from 13 WG): 62 (2) IG B(from 20 WG): 63 (3) CG: 62	Exercise under supervision(3 ×/week): WU, walking (initially 15 min, and then increase in duration), target = 60–80% HR _{max} .	Group A from 13 WG, Group B from 20 WG for pregnancy duration	> 85%
Haakstad et al., 2011 (28)	Mixed-weight subgroup	1) Nulliparous 2) No regular physical activity (< 60 min/week exercise or <120 min/week walk in the 6 months prior to randomization) 3) No pre-existing conditions	105	IG: 52 CG: 53	Exercise under supervision(3 ×/week à 60 min): 5 min WU, 35 min aerobic dance + CD, 15 min strength training (esp. trunk and PF), 5 min stretching; a total of 25 sessions + additional 30 min activity on other days	12 weeks	> 80%

Pelaez et al., 2019 (15)	Mixed-weight subgroup	1) Healthy, 2) Singleton pregnancy 3) No regular physical activity	345	IG 115 CG: 230	Exercise under supervision(3 ×/week à 60–65 min): 8 min WU, 35 min endurance (aerobic dance), 10 min strength (major muscle groups), 15 min CD (+ PF exercise), 70–78 sessions	24 weeks (12–36 WG)	> 80%
Perales et al., 2016 (16)	Mixed-weight subgroup	1) No gestation-related complications 2) GA<16 WG 3) Inactive (<3 × 30 min exercise/week)	241	IG: 120 CG: 121	Exercise under supervision(3 ×/week à 55–60 min): 5–7 min WU, 25–30 min main part with endurance and strength exercises (intensity 55 – 60% HRR), 10 min CD; 70–7s Sessions	9–11 WG to 38–39 WG	90% on average; all performed at least 80%
Perales et al., 2020 (17)	Mixed-weight subgroup	1) No CI to exercise 2) Singleton pregnancy 3) >18 years	1348	IG: 688 CG: 660	Exercise under supervision(3 ×/week à 50–55 min): Combination of aerobic dance, strength exercises with light weights, stretching exercises, HR target range: <60% HR _{max} ; for sec. analysis divided into 4 groups: 1) Previously active, in IG; 2) previously active, in CG; 3) previously inactive in IG; 4) previously inactive in CG; active* = before pregnancy >3d/week active	9–12 WG to 39 WG	>95%
Price et al., 2012 (21)	Mixed-weight subgroup	1) Uncomplicated singleton pregnancy 2) <1×/week exercise in last 6 months 3) BMI < 39 kg/m ² 4) No CI to exercise	62	IG: 31 CG: 31	Exercise under supervision(4 ×/week à 45–60 min [BORG 12–14/20]): 3 × under supervision: 1× step aerobics, 1 × hiking, 1 × circuit training (endurance & strength), 1 × individual walking (30–60 min)	From 12 WG to 36 WG	93%
Sagedal et al., 2017 (18)	Mixed-weight subgroup	1) Singleton pregnancy 2) Nulliparous 3) No CI to exercise 4) No complications 5) >18 years 6) BMI >19 km/m ² 7) GA < 20 WG	591	IG: 296 CG: 295	(1) 2 × individual dietary counselling (by phone), recommendations for weight gain, (2) Access to exercise program 2 ×/week: 10 min WU, 40 min endurance and strength (Borg 12–14/20), 10 min CD (stretching) + motivating for 3 further activities/week	From approx. 20 WG; 14 weeks	On average 14 classes were attended
Sagedal et al., 2017 (19)	Mixed-weight subgroup	1) Singleton pregnancy 2) Nulliparous 3) No CI to exercise in pregnancy 4) No complications 5) >18 years 6) BMI >19 km/m ² 7) GA<20 WG	606	IG: 303 CG: 303	(1) 2 × phone call with nutritionist (proper food selection) (2) Exercise under supervision: Target: 2 ×/week exercise classes + 3 ×/week 30 min walking	From approx. 20 WG; 14 weeks	36%
Stafne et al., 2012 (20)	Mixed-weight subgroup	1) Singleton pregnancy 2) No complications 3) >18 years	885	IG: 429 CG: 426	(1) Exercise under supervision(1 ×/week à 60 min): 30–35 min aerobic dance, 20–25 min strength (without add. weight, major muscle groups and pelvic floor), 5–10 min stretching + relaxation; (2) Exercise program to do at home (target: at least 2 ×/week each 45 min): 30 min endurance and 15 min strength training	12 weeks (approx. 20–36 WG)	55%
Daly et al., 2017 (22)	At-risk subgroup	BMI > 30 kg/m ²	88	IG: 44 CG: 44	Exercise under supervision (3 ×/week, each 50–60 min): 10 min WU, 15–20 min endurance, 15–20 min strength, 10 min C; in addition Facebook group (motivation, group dynamics)	<17 WG to 6 wks pp	79%; 64% of women participated for at least 1 h/week.

Garnæs et al., 2016 (23)	At-risk subgroup	1) BMI > 28 kg/m ² 2) Singleton pregnancy 3) No regular exercise (<2 x/week)	91	IG: 46 CG: 45	Exercise under supervision (3 x/week, each 60 min): 35 min endurance (jogging or walking on treadmill), 25 min strength exercises (major muscle groups and pelvic floor exercises) + 1 x/week at home (35 min endurance, 15 min strength)	From 12–18 WG to delivery	Only 50% of women were adherent, but only those were included
Guelfi et al., 2016 (24)	At-risk subgroup	S/P GDM	172	IG: 85 CG: 87	Stationary cycling under supervision (3 x/week, between 30 and max. 60 min): 5 min WU (55–65% HR _{max}), main block: 5 min (65–75% HR _{max}) + 5 min intervals (2 types: increase in RPM (15 sec) or Watt (30 sec), with 2 min break each (75–85% HR _{max}), 5 min CD	14 weeks (From 12–14 WG)	86%
Oostdam et al., 2012 (25)	At-risk subgroup	BMI > 30 kg/m ² OR BMI > 25 kg/m ² AND 1 of the following risk factors: S/P macrosomia, S/P GDM, pos. FH (1°) for DMII	121	IG: 62, CG: 59	Exercise under supervision (2 x/week à 1h): WU: 5–10 min, 35 min strength + endurance, CU: 5–10 min	15 WG to delivery	16% had attended 50% of sessions
Wang et al., 2017 (26)	At-risk subgroup	BMI > 24 kg/m ²	300	IG: 150 CG: 150	Stationary cycling under supervision (3x/week at least for 30 min): 5 min WU (55–65% HR _{max}); 5 min moderate (65–75% HR _{max}), intervals (sprints, high RPM): 3–5 x 30s/2 min (75–85% HR _{max}), 5 min 60–70%, intervals (mountain), 1min/2min (75–85%/60–70%), 5 min CD. No dietary recommendation; CG was allowed to continue usual exercise, general exercise recommendations made	<12 + 6–37 WG	Lowest: 73%

CG, contraindications; CD, cool down; IG, intervention group; CI, contraindications; (G)DM, (gestational) diabetes mellitus; min, minutes; PTB, preterm birth; WG, weeks' gestation; WU, warm-up; S/P, status post

eTABLE 2

Included meta-analyses (MAs)

Authors	Type of intervention	Subgroup	Subgroups relevant to the review	Inclusion criteria of the studies	Number of incl. RCTs (Total MAs)	Period of the included studies	n
Bennett et al., 2019 (e33)	Exercise (under supervision) & lifestyle int.	Mixed-weight and diseased subgroups	1) Mixed-weight subgroup + exercise intervention	1) RCT 2) Singleton pregnancy	77	2000 – 2016	
Bgeginski et al., 2017 (e35)	Exercise (with and without supervision)	Diseased subgroup	–	1) RCT 2) Exercise intervention 3) Int. duration >4 weeks 4) GDM diagnosis	8	?	495
da Silva et al., 2017 (e16)	Exercise (under supervision)	Mixed-weight subgroup	–	1) RCT 2) Exercise intervention	30 RCTs	1999 – 2015 (RCT)	6 092
Davenport et al., 2018 (e24)	Exercise (under supervision) & lifestyle int.	Mixed-weight subgroup	1) Mixed-weight subgroup + exercise intervention	1) RCT 2) No CI to exercise in preg.	106	2008–2016	273 182
Di Mascio et al., 2016 (e23)	Exercise (under supervision)	Normal weight	–	1) RCT 2) Exercise intervention (started before 23 WG) 3) Singleton pregnancy 4) BMI: 18.5 – 24.9 kg/m ² 5) No CI to exercise in preg.	9	1990–2016	2 059
Domenjoz et al., 2014 (e18)	Exercise (under supervision)	Mixed-weight subgroup	–	1) RCT 2) Exercise under supervision 3) Singleton pregnancy 4) No CI to exercise in preg.	16	1996–2013	3 359
Du et al., 2019 (e30)	Exercise (under supervision)	At-risk subgroup	–	1) RCT 2) Exercise intervention 3) Singleton pregnancy 4) No CI to exercise in preg. 5) BMI >25 kg/m ²	13	2009–2017	1 439
Guo et al., 2019 (e25)	Exercise (under supervision) & lifestyle int.	Mixed-weight subgroup	1) Mixed-weight subgroup + exercise intervention	1) RCT 2) Exercise or lifestyle intervention 3) No CI to exercise in preg.	47		15 745
Magro-Malosso et al., 2017 (e31)	Exercise (under supervision)	At-risk subgroup	–	1) RCT 2) Exercise intervention started <25 GW 3) Singleton pregnancy 4) BMI > 25 kg/m ² 5) No CI to exercise in preg.	9	2005–2016	1 502
Ming et al., 2018 (e17)	Exercise (under supervision)	Normal-weight subgroup	–	1) RCT 2) Exercise intervention 3) BMI 18.5 –24.9 kg/m ²	8	2011–2014	2 981
Ruchat et al., 2018 (e19)	Exercise (under supervision) & lifestyle int.	Mixed-weight subgroup	1) Mixed-weight subgroup + exercise intervention	1) RCT 2) Exercise or lifestyle intervention 3) Singleton pregnancy	79	2002–2017	21 530

Ruifrok et al., 2014 (e36)	Exercise (under supervision) & lifestyle int.	Mixed-weight subgroup	–	1) RCT 2) Exercise or lifestyle intervention 3) BMI >18.5 kg/m ² 4) No CI to exercise in preg.	23	2000 – 2011	4 490
Russo et al., 2015 (e26)	Exercise (with and without supervision)	Mixed-weight subgroup	–	1) RCT 2) Exercise intervention 3) Singleton pregnancy 4) No CI to exercise in preg. 5) No GDM at baseline	10	2010–2014	3 401
Sanabria-Martínez et al., 2015 (e20)	Exercise (under supervision)	Mixed-weight subgroup	–	1) Singleton pregnancy 2) No regular physical activity (< 3 × 20 min/week) 3) No CI to exercise in preg.	13 (RCT)	1990–2014	2 873
Song et al., 2016 (e28)	Lifestyle int., dietary int. or exercise (under supervision)	Mixed-weight subgroup	1) Mixed-weight subgroup + exercise Intervention	1) RCT 2) Start of intervention on 1st/ 2nd trimester 3) No CI to exercise in preg.	29 (RCT)		11 487
Streuling et al., 2011 (e21)	Exercise (under supervision)	Mixed-weight subgroup		1) RCT 2) Exercise only intervention 3) Healthy women	12	1983–2009	906
Thangaratinam et al., 2012 (e22)	Lifestyle int., dietary int. or exercise (under supervision)	Mixed-weight subgroup	1) Mixed-weight subgroup + exercise Intervention	1) RCT 2) BMI >18.5 kg/m ² 3) No CI to exercise in preg.	44 (RCT)		7 278
Wiebe et al., 2015 (e34)	Exercise (under supervision)	Mixed-weight subgroup	1) Low GDM risk subgroup + exercise intervention 2) GDM + exercise intervention 3) Overweight + exercise intervention	1) RCT 2) Exercise under supervision	28	1997 – 2014	5 322
Xing et al., 2020 (e32)	Exercise (under supervision)	At-risk subgroup	–	1) RCT 2) BMI > 25 kg/m ²	13	2009–2017	1 439
Yin et al., 2014 (e29)	Exercise (under supervision)	Mixed-weight subgroup	–	1) RCT 2) Exercise intervention 3) No GDM	6	2009–2012	1 278
Zheng et al., 2017 (e27)	Exercise (under supervision)	Mixed-weight subgroup	–	1) RCT 2) Exercise intervention started <20 WG 3) Singleton pregnancy	5	2012–2016	1 872

BMI, body mass index; CG, control group; (G)DM, (gestational) diabetes mellitus; IG, intervention group; int, intervention; CI, contraindications; RCT, randomized controlled trial; WG, weeks' gestation; PTB, preterm birth

Questions on the article in issue 46/2022:

Exercise During Pregnancy

cme plus+

Effects on Birth Weight and on the Risks of Gestational Diabetes and Preterm Delivery

The submission deadline is 17 November 2023. Only one answer is possible per question. Please select the answer that is most appropriate.

Question 1

What weight gain is recommended for normal-weight women over the course of the entire pregnancy?

- a) 2–4 kg
- b) 5–9 kg
- c) 7–10 kg
- d) 11.5–16 kg
- e) 15–20 kg

Question 2

For which parameter none of the included studies demonstrated a significant effect of exercise?

- a) Head circumference at birth
- b) Preterm birth rate
- c) Macrosomia rate
- d) Neonatal diabetes
- e) Cesarean section rate

Question 3

What is a valid recommendation for weight gain during pregnancy?

- a) The higher the baseline BMI, the lower the weight gain should be.
- b) The recommended weight gain is the same for all women.
- c) The lower the weight gain the better.
- a) The lower the baseline BMI, the lower the weight gain should be.
- e) The higher the weight gain the better.

Question 4

What does the abbreviation eGWG stand for in the text?

- a) Extreme gestation-independent weight gain
- b) Excessive gestational weight gain
- c) Extreme gestational weight loss
- d) Expected gestational weight gain
- e) Excessive gestation-independent weight loss

Question 5

Moderate exercise can reduce the risk of developing gestational diabetes. One study reported a 25% risk reduction. How much moderate exercise had the participants completed in order to achieve this?

- a) 60 minutes per week
- b) 140 minutes per day
- a) 240 minutes per week
- a) 140 minutes per week
- b) 70 minutes per day

Question 6

In the study by Perales et al., which subgroup of women was able to reduce the macrosomia risk for the fetus by exercising?

- a) Previously inactive women
- b) Previously overweight women
- c) Previously active women
- d) Previously underweight women
- e) Women previously diagnosed with diabetes

Question 7

What does the abbreviation LGA stand for in the text?

- a) Long for gestational age
- b) Late for gestational age
- c) Large for gestational age
- d) Lean for gestational age
- e) Lightweight for gestational age

Question 8

What was the target exercise intensity (according to the Borg scale) for most of the interventions?

- a) 7–9 “really easy”
- b) 10–12 “easy”
- c) 12–14 “somewhat hard”
- d) 14–15 “hard”
- e) 16–17 “really hard”

Question 9

By what percentage—according to meta-analyses—can the risk of developing a gestational diabetes be reduced in a normal-weight subgroup?

- a) 1–5%
- b) 5–10%
- c) 5–25%
- d) 30–35%
- e) 40–50%

Question 10

What is the American College of Obstetrics and Gynecology’s recommendation on physical activity during pregnancy?

- a) Weekly 1.5 hours low-intensity exercise (walking slowly)
- b) Daily 2 hours of moderate-intensity exercise (walking fast)
- c) Weekly 2.5 hours of moderate-intensity exercise (walking fast)
- d) Daily 2 hours high-intensity exercise (jogging)
- e) Weekly 2 hours low-intensity exercise (walking slowly)