

Effect of exercise modality on markers of insulin sensitivity and blood glucose control in pregnancies complicated with gestational diabetes mellitus: A systematic review

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Introduction

- During gestational diabetes mellitus (GDM), small degrees of hyperglycaemia have significant effects on pregnancy and neonatal outcomes (1).
- Exercise may be an effective strategy to optimize glucose homeostasis as it lowers blood glucose levels via 2 distinct pathways: contraction-mediated & insulin stimulated pathways (2).
- Despite multiple interventions over the last decade, the most effective form of lifestyle management composed of dietary and physical activity behaviours for the prevention of GDM remains undetermined (3).
- To maximise the use of exercise for clinical management, the most effective modality should be identified.

The purpose of this review is to elucidate the most effective modality of exercise on insulin sensitivity and blood glucose control in pregnant woman with or at risk of GDM.

Methods

Types of studies

Prospective randomized control trials (RCT) & case-controlled studies

Types of participants

The target population were pregnant women at risk or diagnosed with GDM

Types of interventions

Exercise intervention only (no nutrition intervention), performed during pregnancy, which examined the insulin and glycaemic effects of exercise intervention

Search strategy

‘gestational diabetes’ AND ‘exercise’ AND ‘intervention’ AND ‘glycaemic control’ NOT ‘type II diabetes’

Searched databases

MEDLINE (Ebsco), PUBMED (NCBI), Scopus, CINAHL, Cochrane library, EMBASE and Maternity & Infant Healthcare Database (Ovid).

Assessment of risk of bias

Cochrane assessment of risk of bias tool was used.

Data synthesis & analysis

Eligible studies did not have combinable outcomes for meta-analysis, a narrative review was thus undertaken. The eligible articles were summarized and discussed.

Results

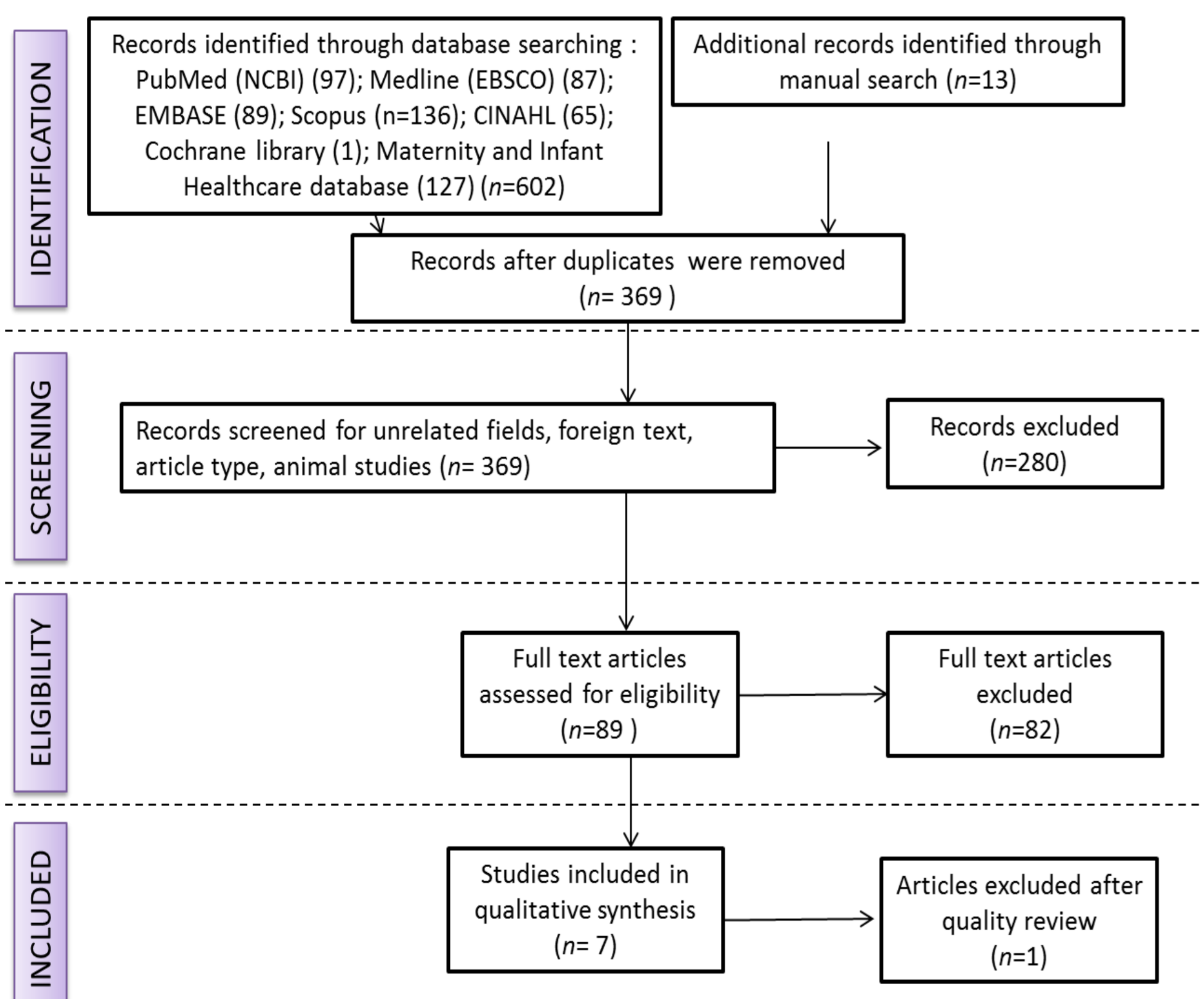


Figure 1 (left) – PRISMA showing inclusion/exclusion of journal articles throughout screening procedures

7 interventions were included: 2 used resistance exercise & 5 used aerobic-exercise were included

Table 1 (below) – Characteristics of studies meeting eligibility criteria

Article	n		Population		Timing of intervention			
	Intervention	Control	Mode (RT, AER)	Diagnose d with GDM	At risk of GDM	Start point	End point	Duration (weeks)
Brankston et al., 2004	16	16	RT	X		From GDM diagnosis (26-32)	Till end of gestation	~5
de Barros et al., 2010	32	32	RT	X		From GDM diagnosis (24-34 weeks)	Till end of gestation	~5
Halse et al., 2014	20	20	AER	X		From GDM diagnosis (week 28.8± week of gestation)	Till week 34 gestation	~5
Ruchat et al., 2012	6	6	AER		X	Between 16-20 weeks	34-36 weeks gestation	14-20
Davenport et al., 2008	10	20	AER	X		From diagnosis (24-28 weeks)	To delivery	≥6 weeks
Ong et al., 2009	6	6	AER		X	From week 18 gestation	28 weeks gestation	10
Callaway et al., 2010	25	25	AER		X	From 12 weeks gestation	36 weeks gestation	24

Results

Article	Intervention	Main outcome measures	Main findings (Intervention group vs. control)
Brankston et al., 2004	Circuit session: 3 rounds of 8 exercises x 15 repetitions	Requirement for insulin	↔ No difference
		Amount of insulin	↓ Improved
		Latency of administration of insulin	↑ improved
		Pooled post meal glucose	↓ improved
de Barros et al., 2010	Circuit session: 3 rounds of 8 exercises x 15 repetitions	Requirement for insulin	↓ Improved
		Amount of insulin	↔ No difference
		Latency of administration of insulin	↔ No difference
		Pooled capillary glucose levels	↔ No difference

Table 2 – Summary table for resistance exercise interventions

The interventions showed consistently that requirement of insulin therapy; dosage & latency to administration, were improved in the exercise groups.

Less consistent results were observed for capillary blood-glucose measurements; however both modalities were effective at improving blood-glucose control.

Article	Intervention	Main outcome measures	Main findings (control vs. Intervention group)
Halse et al., 2014	Cycling 5 x per week. 3 x a week: supervised 45 minutes moderate intensity and short bouts of higher intensity, 2 x a week 30 min moderate cycling unsupervised.	Mean capillary blood glucose pre and post exercise (exercise group only)	↓ Improved
		HbA1c	Increased in both groups, with no difference between groups
		OGTT	↔ No difference
		Insulin sensitivity	↔ No difference
Ruchat et al., 2012	Supervised walking program 3-4 x per week: 40 minutes in total with 30 minutes at target HR of 30 or 70% HRR according to group allocation	Pooled capillary glucose levels	↓ Improved
		Capillary blood glucose pre & post exercise	↓ Improved in all groups and durations. Longer durations of exercise (40min). Improvements in capillary glucose attenuated with longer durations of exercise.
Davenport et al., 2008	3-4 walking sessions a week of 40 minutes at 30% HRR	Capillary blood glucose Requirement for insulin Amount of insulin	↓ Improved ↓ Improved ↓ Improved
Ong et al., 2009	3 x per week 45 min cycling ergometer at 50-60% HRmax	Blood glucose response (OGTT)	↓ Improved OGTT at 1 hour
Callaway et al., 2010	Individualized exercise plan, to reach recommendation of 7.5-12.5 MET-h/week of moderate to vigorous intensity activity.	Insulin sensitivity (OGIS)	↔ No difference
		Fasting glucose	↓ Improved
		Fasting insulin	↓ Improved

Table 3 – Summary table for aerobic exercise interventions

Conclusion & Future work

- Discrepancies in the timing of intervention, GDM diagnostic criteria and the different measures used to assess glucose metabolism make it difficult to draw clear recommendations.
- Further studies looking specifically at the effects of different modalities of exercise on glucose metabolism with combined strategies to enhance insulin sensitivity should be explored to maximise benefits for GDM pregnancies.
- Consistency in design and delivery of exercise-only interventions is required to make recommendation on suitable exercise prescription in this population.
- In practice, adherence to consensus in diagnostic cut-offs for GDM diagnosis is fundamental for standardising future research.

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