
REVIEW ARTICLE**EFFECT OF AEROBIC EXERCISE TRAINING ON MATERNAL WEIGHT GAIN IN PREGNANCY: A META-ANALYSIS OF RANDOMIZED CONTROLLED TRIALS**Lamina S¹, Agbanusi EC²**ABSTRACT**

BACKGROUND: Weight gains in pregnancy within the recommended guidelines are associated with healthy fetal and maternal outcomes; higher weight gains are associated with fetal macrosomia. This study was a systemic review of randomized controlled trials on the effect of aerobic training on maternal weight in pregnancy.

METHODS: The study data source was publications through May 2012 in the MEDLINE (PubMed) database. The citation lists of randomized controlled trials on the effect of aerobic training and maternal weight were extracted. Data on participants' characteristics, study quality, population, intervention, treatment outcome (maternal weight gain) were collected and analyzed.

RESULTS: There were 11 randomized controlled studies using body weight (kg) as measure of treatment outcome. A total of 1177 subjects were recruited in the 11 studies. The mean \pm SD weight gain (kg) for the exercise (11.31 ± 7.44 kg) and control (14.42 ± 6.60 kg) groups; Meta-analysis result indicated significant effect of aerobic training on maternal weight ($t = -7.580, p = .000$) at $p < 0.05$.

CONCLUSION: It was concluded that aerobic training is an effective tool in maternal weight gain control in pregnancy. More randomized controlled trials are warranted.

KEYWORDS: Aerobic exercise, Pregnancy, Maternal weight, Meta-analysis

INTRODUCTION

In 1985, the American College of Obstetricians and Gynecologists (ACOG) published its first exercise-during-pregnancy guidelines, which stated that active pregnant women should stringently limit the type, duration, and intensity of their exercise to minimize both fetal and maternal risk (1). In 1994, the ACOG modified these recommendations to state that "during pregnancy, women can continue to exercise and derive health benefits even from mild to moderate exercise routines. Regular exercise (at least three times per week) is preferable to intermittent activity (2). However, the guidelines did not include any recommendations for inactive women. The most recent recommendations published in

2002 by the ACOG state that pregnant women without contraindications should exercise, and women who were inactive prior to becoming pregnant can start an exercise program (2). These recommendations are based on research indicating that exercise during pregnancy may be associated with reduced rates of preeclampsia, gestational diabetes, cesarean sections, low back pain, anxiety, nausea, heartburn, insomnia, leg cramps, and possibly control of excessive weight gain (3). Despite the new ACOG recommendations encouraging pregnant women to exercise, pregnant women have been slow to take up exercise, and many physicians have been slow to deliver these recommendations to their patients (4).

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The Institute of Medicine (IOM) recommends that normal-weight women should gain an extra weight of between 11.4 and 15.9 kg during pregnancy, while overweight pregnant women should gain extra weight of between 6.8 and 11.4 kg. Weight gains within these guidelines are associated with healthy fetal and maternal outcomes; weight gains below these goals are associated with low infant birth-weight and higher weight gains are associated with fetal macrosomia (5, 6). Macrosomia also known as “big baby syndrome”, is sometimes used synonymously with large for gestational age, or is otherwise defined as a fetus or infant that weighs above 4000grams or 4500grams. It is associated with increased risks of cesarean section, trauma to the birth canal and the fetus and risk of other pregnancy complications (7, 8). Moreover, women who gain more than recommended retain twice as much weight after pregnancy as women who gain within the recommendations (7, 9). Weight gain during pregnancy may thus contribute to the development of obesity in young women (10).

Several studies (11-14) have been conducted on the effect of aerobic exercise on maternal weight in pregnancy; their results have been controversial and equivocal. Unfortunately, much of the research examining exercise during pregnancy is observational, and the few randomized controlled trials that do exist are small and inadequately powered (14). However, randomized controlled trials (RCTs) are generally accepted as the most valid method for determining the efficacy of a therapeutic intervention, because the biases associated with other experimental designs can be avoided (16). Therefore, the purpose of the present review was therefore to present the best available evidence on the effect of aerobic exercise training on maternal weight gain during pregnancy.

MATERIALS AND METHODS

Search Methods: The Medline (Pubmed) electronic databases were searched (from February 1976 to May 2012) for systematic reviews that evaluated the effects of low to moderate aerobic exercise on maternal weight. The key words and search terms used to develop the search strategy for each of these databases included: aerobic exercise, pregnancy and randomized controlled

trials. The electronic searches were supplemented by checking the reference lists of any relevant identified articles.

MEDLINE is the U.S. National Library of Medicine's (NLM) premier bibliographic database that contains over 18 million references to journal articles in life sciences with a concentration on biomedicine. A distinctive feature of MEDLINE is that the records are indexed with NLM Medical Subject Headings (MeSH). The great majority of journals are selected for MEDLINE based on the recommendation of the Literature Selection Technical Review Committee (LSTRC), a National Institute of Health (NIH)-chartered advisory committee of external experts analogous to the committees that review NIH grant applications. MEDLINE is the primary component of PubMed, part of the Entrez series of databases provided by the NLM National Center for Biotechnology Information (NCBI). MEDLINE may also be searched via the NLM Gateway (17).

Inclusion Criteria: Clinical trials were included if they met all of the following inclusion criteria: Only articles published in English were selected for the review. The study population defined; maternal weight with aerobic training were considered; the primary intervention that this review was concerned with was aerobic exercise of moderate intensity (40-60 VO₂max or 60-79% HRmax), at least 3 times per week and control group (sedentary group). Randomized controlled trials on this topic were selected for review; the main outcome measure was body weight. For the purpose of the present study, only studies that had successfully undergone rigorous peer review (i.e., published peer-reviewed journals) were included.

Review Methods: The literature search results were screened, and relevant articles were retrieved. Data was extracted from each identified paper and included information on study design, participants and outcome measures. Only randomized trials were identified, when the study fulfilled the inclusion criteria, data concerning methods of the trial, participant characteristics, intervention details, and outcome measures were independently extracted using a standard extraction form. The identified articles were selected for inclusion in the review on the basis of appropriateness as determined the author. Some studies had multiple publications; these were treated as a single source of data.

Data Extraction: The study characteristics, patient demographic information, enrollment criteria, therapy allocation, outcomes, and reasons for dropout were extracted independently by two reviewers. The main outcome was the efficacy of aerobic exercise on maternal weight was compared with placebo, sham, or inactive control.

Quality assessment: The authors independently evaluated methodological quality of trials in relation to our inclusion criteria. Authors did not assess trials blindly, as we knew the names of trial authors and institutions, as well as the source of publication. Differences highlighted here were resolved through consultation with the other authors, and a judgment was made based on consensus.

Data synthesis: Statistical analysis for mean and SD was performed using the Statistical Package for the Social Science (SPSS), version 15.0,

(Chicago IL, USA). Meta-analysis was performed using Clin Tools Software (Effect size generator; Version 4 Computer Programme) by Psytek Ltd, USA 19 (18). The probability level for all the above tests was set at 0.05 to indicate significance.

RESULTS

The search criteria identified 201 studies from 1976 to 2012 on inserting maternal weight only 45 studies were identified out of which only 11 met the inclusion criteria's and 34 studies did not meet the inclusion criteria and were excluded. The 11 randomized controlled trials (RCTs) satisfied the inclusion criteria they involved pregnant women who had undergone aerobic exercise training and sedentary.

Table 1: Characteristics of included studies

Authors (reference number)	Study groups	Recruitment	Mean weight gain± SD (kg)
Korpi-Hyovalti et al (23)	exercise (n= 27) control (n= 27)	Weeks 8-12 of gestation	11.40± 6.00 13.90± 5.10
Huang et al (21)	exercise (n= 60) control (n= 64)	Week 16 of gestation	14.02± 2.38* 16.22± 3.26
Barakat et (14)	exercise (n= 40) control (n= 40)	Entire pregnancy	11.89± 3.15* 13.90± 2.11
Haakstad & Bo (28)	exercise (n= 52) control (n= 53)	Week 24 of pregnancy.	3.90± 0.00 4.30± 0.30
Claesson et al (20)	exercise (n= 40) control (n= 30)	<15 week of gestational	8.70± 1.85* 11.30± 1.49
Phelan et al (24)	N/W-exercise (n= 92) N/W-control (n= 94) O/W-exercise (n= 87) O/W-control (n= 90)	Week 10-16 of gestation	15.30± 4.40 16.20± 4.60 14.70± 6.90 15.10± 7.50
Nascimento et al (22)	exercise (n= 40) control (n= 42)	Week 14-24 of gestation	5.90± 4.30 11.90± 1.50
Asbee et al (25)	exercise (n= 57) control (n= 43)	Week 6-16 of gestation	13.02± 5.67* 16.15± 7.03
Clapp (26)	exercise (n= 20) control (n= 19)	Entire pregnancy	3.40± 0.90* 9.90± 3.00
Wolff et al (27)	exercise (n= 23) control (n= 27)	Week 15-18 of gestation	6.60± 01 * 13.30± 03
Polley et al (29)	exercise (n= 57) control (n= 53)	> 20 week of gestation	15.40± 7.10 16.40± 4.80

L-I= low intensity;
NW= normal weight;

M-I= moderate intensity;
O/W=Obese & overweight

*significant at p< 0.05

A total of 1177 subjects were involved in 11 randomized controlled trials (19-29). Detailed studies information on table 1. For all the studies, the pre exercise training weight were measured on recruitments (table 1) and post training weight were the last weight measured prior to the commencement of labour. The mean± SD weight gain for the exercise and control groups was

11.31± 7.44kg (n= 595) and 14.42± 6.60kg (n= 582) respectively (table 2). There was a significant groups difference in weight gain (t= -7.037, p= .000) between the exercise group and control group at p< 0.05 (table 2).

Table 2: Effect of aerobic exercise training on maternal weight gain (N= 1177)

Variables	Exercise (n= 595) mean± SD	Control (n= 582) mean± SD	t-value	P-value
Maternal weight gain (kg)	11.31± 7.44	14.42± 6.60	-7.580	.000*

*significant, p< 0.05

DISCUSSION

Evidence for reasonable to good quality randomized studies published between the year 1997 and 2011 on aerobic exercise training on weight gain in pregnancy is controversial. The result of the present review build on and update the evidence based studies that concluded that exercise is beneficial in maternal weight gain reduction in pregnancy. However, the present review also contradicts several other studies that aerobic training has no significant effect on maternal weight gain in pregnancy.

Several randomized controlled studies (14, 20, 21, 25, 26, 29) investigated the effect of moderate physical activity performed by healthy women during pregnancy on their perception of health status and body weight. They reported significant differences between study groups in weight gain and that women in the exercise group gained less weight than those in the control group and concluded that moderate physical activity program that is performed over the first, second, and third trimester of pregnancy result in less weight gain. On the contrary, several others (28, 23, 24, 22, 29) reported no significant aerobic exercise training effect on maternal weight gain in pregnancy.

The inconsistencies across studies could be attributable to several factors, including how the study defined exercise and whether a comprehensive measure of physical activity was attained, the level of exercise achieved and maintained by women during pregnancy, and whether pre-pregnancy exercise level was

controlled. Another methodological constraint is that body weight and not fat has usually been measured; the small number of studies that have addressed this issue have shown a slightly smaller increase in skinfold measures in pregnant women who exercised (32). In addition, the importance of exercise may vary depending on gestational age. For example, Clapp and Little (33) found that compared with women who continued to engage in exercise during pregnancy, those who quit engaging in exercise during pregnancy gained a similar amount of weight in the first trimester but gained significantly more weight during the second and third trimesters.

Limitations of the study

Though, clinical heterogeneity was prominent across trials on the characteristics of the participants in terms of age, physical characteristics, countries of studies (hereditary and environment), diet, daily energy intake and differences in recruitment gestational age. However, homogeneity in statistical analysis and aerobic exercise training characteristics was identified. While the present review reported a beneficial effect of aerobic exercise training on maternal weight gain in pregnancy, however there are limitations, which include varied period of subjects recruitment by the primary investigators also failure to distinguish between normal, overweight and obese pregnant women, this could affect the outcome variable.

Various systemic reviews (34, 35, 36) have been conducted on various interventions to control gestational weight gain. However, to date, the present review is the largest systematic review

including 1177 subjects and basically on aerobic exercise training as the intervention for gestational weight gain control.

In conclusion, the regular practice of aerobic exercise training by active, low risk and previously sedentary expectant mothers do have a favourable and beneficial effect on maternal weight gain in pregnancy.

Implication for practice

Aerobic training is also an important tool in maintaining the recommended weight gain in pregnancy. Aerobic exercise is safe and beneficial in the absence of medical and obstetric complications in pregnancy. Also, more randomized controlled studies are advised

Conflict of interest

No any conflict of interest on this review.

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