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Physical Exercise, Type of Delivery and Related Outcomes: Systematic Review and Meta-Analysis of Randomized and Non-Randomized Trials.

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ABSTRACT

Background: Studies have shown that pre-conditioned women had lower incidence of abdominal delivery and reduced risk of cesarean delivery. However, data about this issue are controversial and still lack to investigate the effect of exercise on other pregnancy outcomes such as type of delivery. **Objective:** Systematically review the effect of physical exercise on the type of delivery and related outcomes. **Results:** The initial search identified 2,055 articles, of which 21 articles were used for contextual analysis. Finally, nine articles were included in the systematic review and three on meta-analysis. We included only a few number of articles in the meta-analysis because many of the papers were lacking mean and standard deviation information about final primary outcomes analysis. Meta-analysis showed that aerobic training induced shorter first stages labor ranging from – 31 (95% CI, [- 56.04] - [- 5.96]) to – 79 (95% CI, [- 149.01] - [8.99]) minutes**. Conclusion:** It was not possible to conclude whether exercise, regardless of its types, is able of change the type of delivery and related outcomes due to the absence of better statistical data management and well defined methodologies.

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INTRODUCTION

For many years, women have been encouraged to reduce or discontinue physical exercise during gestation process through believing it to be harmful. However, many studies have shown several positive effects of physical exercise on maternal, fetal and placental wellbeing (Bergmann *et al*., 2004; Clapp 3rd, 2008; Clapp, 2006).

Some years ago, the American College of Obstetrics and Gynecology (ACOG, 2002) published a guideline on the benefits of exercise on maternal and fetal health. However, literature still lack sufficient information to help both doctors and physical education professionals to orient better physical practice of pregnant women. According to Clapp 3rd *et al*. (2002), for many years professionals have sought to know if the type, volume and intensity of exercise could modulate the effect on the maternal compartment and the growth of the fetal-placental complex. Much about this issue is already known.

Studies have shown that pre-conditioned women had lower incidence of abdominal delivery and reduced risk of cesarean delivery (Bungum *et al*., 2000; Clapp 3rd, 1990). Despite these data, other studies failed to demonstrate the association between exercise, type and time of delivery (Barakat *et al*., 2009a; Portela *et al*., 2014).

This study aimed to systematically review the literature about the effect of physical exercise on the type of delivery and related outcomes.

MATERIALS AND METHODS

This systematic review was developed based on the PRISMA guide [preferred reporting items for systematic reviews and meta-analysis] (Liberati *et al*., 2009).

A systematic search of articles for this review was made on October 22th, 2014 in the PubMed, Scielo, Lilacs, Google Scholar, Web of Science and Science direct databases using the following *Mesh* and *Entry terms*: (Randomized controlled trial[pt] OR controlled clinical trial[pt] OR randomized

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controlled trials[mh] OR random allocation[mh] OR double-blind method[mh] OR single-blind method[mh] OR clinical trial[pt] OR clinical trials[mh] OR ("clinical trial"[tw]) OR ((singl*[tw] OR doubl*[tw] OR trebl*[tw] OR tripl*[tw]) AND (mask*[tw] OR blind*[tw])) OR ("latin square"[tw]) OR placebos[mh] OR placebo*[tw] OR random*[tw] OR research design[mh:noexp] OR follow-up studies[mh] OR prospective studies[mh] OR cross-over studies[mh] OR control*[tw] OR prospectiv*[tw] OR volunteer*[tw] OR non-randomized controlled Trial AND Exercises OR Exercise Physical OR Exercises Physical OR Physical Exercise OR Physical Exercises OR Exercise Isometric OR Exercises Isometric OR Isometric Exercises OR Isometric Exercise OR Exercise Aerobic OR Aerobic Exercises OR Exercises Aerobic OR Aerobic Exercise OR Exertion OR Physical Fitness OR Exercise Therapy OR Physical Endurance OR Physical Exertion OR Exertion Physical OR Exertions Physical OR Physical Exertions OR Physical Effort OR Effort Physical OR Efforts Physical OR Physical Efforts OR Resistance Training OR Training Resistance OR Strength Training OR Training, Strength OR Weight-Lifting Strengthening Program OR Strengthening Program, Weight-Lifting OR Strengthening Programs, Weight-Lifting OR Weight Lifting Strengthening Program OR Weight-Lifting Strengthening Programs OR Weight-Lifting Exercise Program OR Exercise Program, Weight-Lifting OR Exercise Programs, Weight-Lifting OR Weight Lifting Exercise Program OR Weight-Lifting Exercise Programs OR Weight-Bearing Strengthening Program OR Strengthening Program, Weight-Bearing OR Strengthening Programs, Weight-Bearing OR Weight Bearing Strengthening Program OR Weight-Bearing Strengthening Programs OR Weight-Bearing Exercise Program OR Exercise Program, Weight-Bearing OR Exercise Programs, Weight-Bearing OR Weight Bearing Exercise Program OR Weight Bearing Exercise Programs OR Running OR Jogging OR Swimming OR Walking AND Parturition OR Parturitions OR Birth OR Births OR Childbirth OR Childbirths OR Labor Onset OR Labor Onsets OR Onset, Labor OR Onsets, Labor OR delivery.

Studies Selection:

First, we sought randomized controlled trials. However, the amount of this evidence was very small. Therefore, we have included randomized and non-randomized studies with control group, which aimed to investigate the effect of the physical exercise (water, aerobic and resistance) on the type of delivery and related variables (time dilation, expulsion and birth and/or first and second stages of labor).

Outcomes:

The primary outcome of this study was the type of delivery (vaginal or cesarean). The secondary outcomes analyzed were time dilation, expulsion and birth. A third outcome was included for delivery stage (first and second).

Extraction and analysis of data quality:

We extracted important items such as, number of patients included in each trial, age, study outcomes, protocol applied to each group (exercise and control) and primary results. The authors independently assessed the methodological quality of each article using the Jadad, Oxford and Delphi quality scales (Jadad *et al*., 1996; Verhagen *et al*., 1998; Zangh *et al*., 2011).

Data synthesis and analysis:

Review manager software 5.2 was used to calculate heterogeneity by the I^2, Chi^2 and Tau^2 values. We used I^2 to assess heterogeneity between trials, using fixed effect models where there was high heterogeneity. We also used inverse variance method and 95% total confidence interval.

This study was an analysis of published data, which did not require ethics committee approval.

RESULTS

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Studies Selected:

The initial search identified 2,055 articles, of which 21 articles were used for contextual analysis. Finally, nine articles were included in the systematic review and three on meta-analysis. We included only a few number of articles in the meta-analysis because many of the papers were lacking mean and standard deviation information about final primary outcomes analysis. In addition, we decided to include in the systematic review table even those papers that received Delphi quality assessment grade under five. This decision was taken because of the few articles included. The selection process is shown in Figure 1.
A total of 1,062 patients were included in the systematic review analysis (569 patients in exercising group and 493 in control group). We found several type of exercise application such as aerobic training, water aerobics and resistance training, with a predominance of aerobic type exercise. Table 1 described the information extracted from each selected trial.

Quality Assessment:

We applied Jadad, Oxford and Delphi quality scale as tools to verify the quality assessment of randomized and non-randomized trials. These scales were developed with the objective to help the researchers to rapidly identify if these studies contain enough internal and statistical information, and further quality. Our results demonstrated Jadad scores that ranged from 0 to 3, which did not

demonstrated enough internal and statistical information presented by the trials. Oxford scale showed a wider score (ranged from 1 to 6).Delphi list scored from 4 to 7 (Table 1).

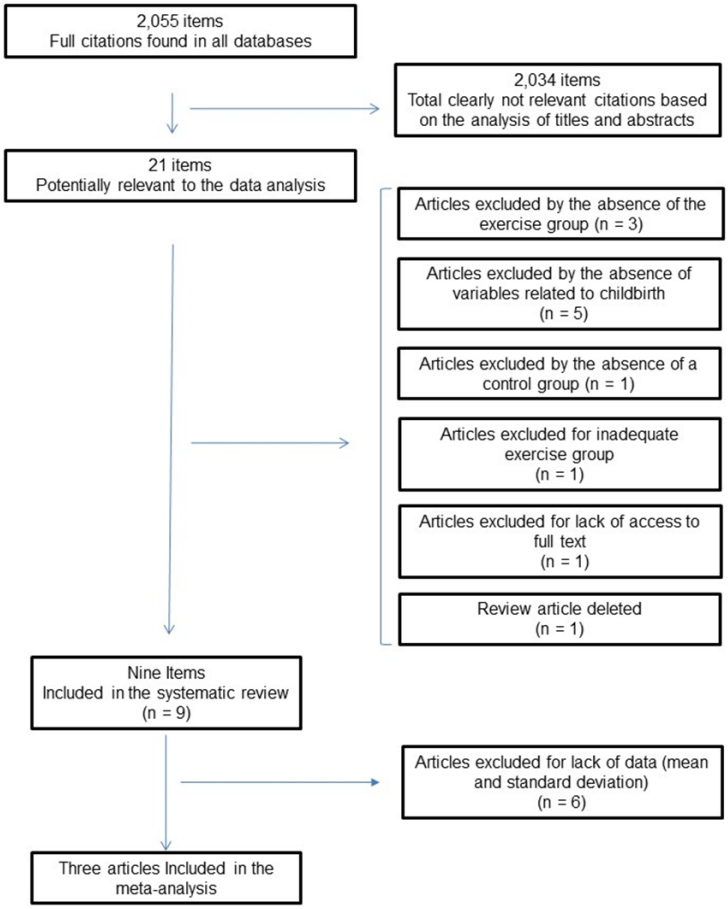

Fig. 1: Flux gram of the articles selection process and exclusion criteria.

Table 1: Description of the studies included in the systematic review analysis.

Reference	*Patients (number)*	*Randomization*	*Outcome*	*Exercise type*	*Control*	*Results*	*Jadad (0-5)*	*Oxford (0-7)*	*Delphi (0-10)*
Portella *et al.*, 2014	56	No	Labor type	Not described	Not described	Natural birth: Active = 89.1% and Sedentary = 68.4%	0	1	4
Ghodsi *et al.*, 2012	174	No	Labor duration	Aerobic training	Not described	Shorter first stage duration in training group	1	1	4
Price *et al.*, 2012	62	Yes	Labor type	Aerobic training	Every day task	Exercise: 87% vaginal and 6% cesarean/ Control: 61% vaginal and 32% cesarean *Exercise group had longer second stage labor	3	4	6
Tomic *et al.*, 2012	334	Yes	Labor type	Aerobic training	Every day task	Not statistical difference between groups	0	2	6
Silveira and Segre, 2012	66	No	Labor type	Resistance training (strengthening exercise)	Every day task	Higher percentage of vaginal birth in exercise group	1	1	4
Melzer *et al.*, 2010	44	no	Labor type and stages duration	Aerobic training	Not described	Exercise group had shorter second stage labor duration	1	1	5
Barakat *et al.*, 2009	142	Yes	Labor type and time of dilation, expulsion and birth	Resistance training	Every day task	Not statistical difference between groups	2	6	7
Cavalcante *et al.*, 2009	71	Yes	Vaginal birth number	Wateraerobic training	Every day task	Not statistical difference between groups	2	5	6
Clapp, 1990	113	No	Labor type and duration	Aerobic training	Women who discontinued exercise	Exercise group had lower incidence of abdominal and vaginal operative delivery and shorter active vaginally duration	0	2	4

Meta-analysis:

Three articles with enough interval and statistical information were included in the meta-analysis. A total about 429 women were included (241 and 188 patients in exercising and control groups, respectively). Meta-analysis was applied only on the third outcome category (first and second labor stages) because other data missed enough

statistical information such as mean and standard deviation data.

Data Synthesis:
General exercise effect on First Stage Labor:

Forest plot demonstrated a great heterogeneity (I^2= 96%) between studies and exercise did not effected first stage labor duration (95% CI, 38.27-49.04). Figure 2 presented data and forest plot.

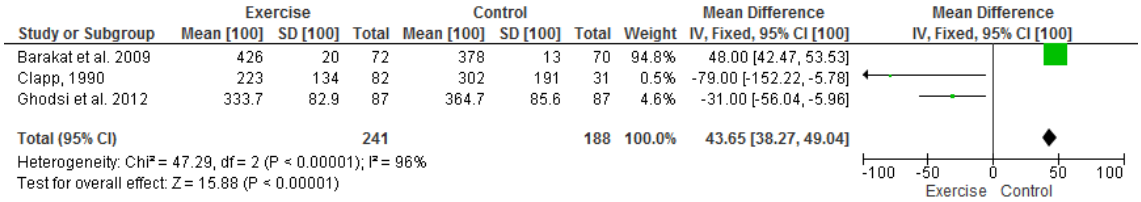

Fig. 2: Forest plot presented information about overall exercise effect on first stage labor.

General exercise effect on Second Stage Labor:

Meta-analysis showed also a great heterogeneity (I^2=79%) between studies and not exercise effect on second stage labor duration was demonstrated (95% CI, [- 4.13]-1.18). Figure 3 presented data and forest plot.

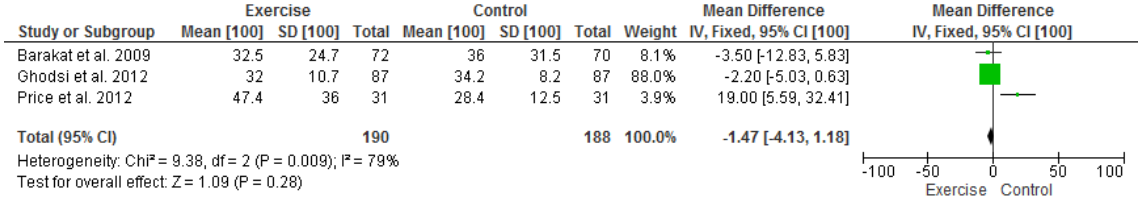

Fig. 3: Forest plot presented information about overall exercise effect on second stage labor.

Sensitivity Assessment:

As meta-analysis revealed a great heterogeneity between trials, we applied a sensitivity analysis to understand this fact. Therefore, we applied meta-analysis only on trials that used aerobic exercise intervention. In addition and for this occasion, meta-analysis was done only on non-randomized trials and first stage labor duration.

Aerobic training Effect on First Stage labor Duration:

Aerobic exercise demonstrated to induce shorter first stages labor ranging from – 31 (95% CI, [-56.04] - [- 5.96]) to – 79 (95% CI, [-149.01] - [-8.99]) minutes. The forest plot (Figure 4) showed a low to moderate heterogeneity level (I^2=38%). Effect estimated was – 36.44 (95% CI, [-60.02] – [-12.87]). In addition, aerobic training demonstrated a significant overall effect (Z=3.03 [p=0.002]). Figure 4 presented data and forest plot.

Aerobic training Effect on Second Stage labor Duration:

Aerobic exercise did not altered second stage labor duration. This analysis showed a high level of heterogeneity (I^2=89%). Data is presented in Figure 5.

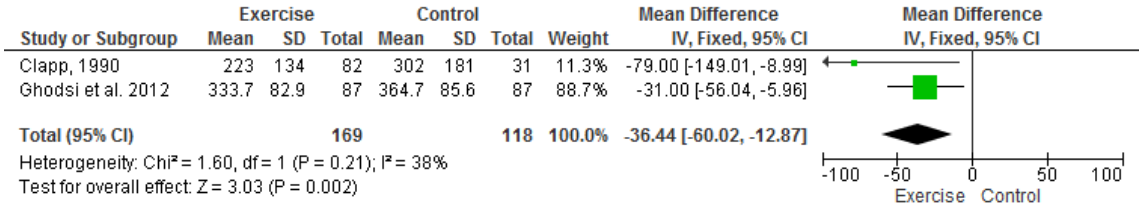

Fig. 4: Forest plot presented information about aerobic effect on first stage labor duration.

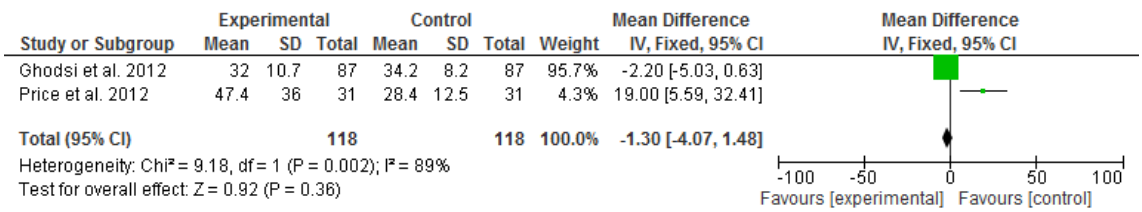

Fig. 5: Forest plot presented information about aerobic effect on second stage labor duration.

Any further analysis was not possible to do because of the absence of enough statistical information.

DISCUSSION

Physical exercise as an inducer of faster and shorter delivery rates is a classical discussion on obstetrics and exercise fields. Nine articles were included for systematic review and three of these were used to meta-analysis. Our strategy showed a huge variability of methodologies and a great heterogeneity results. Much of this fact was due to a lack of exercise pattern and many different exercise type or training protocol. During the first search, we attempted to find only randomized studies however, a meta-analysis was impossible to be achieved. Therefore, we included non-randomized studies and a wider article search inclusion. Even so, evidence published until today showed poor methodology control and lacking internal and statistical information. Perhaps, future research need to manage more accurately and precisely exercise control.

Clapp 3rd (1990) demonstrated that women that continuing to exercise during pregnancy presented shorter first stage and active labor duration in comparison to who stopped. In addition, exercising group had more spontaneous and less cesarean sections deliveries than control group. This study included women that decided to stop exercise during pregnancy as control group. Further, Clapp 3rd (1990) indicated a frequency of three or more times per week and higher training intensity than did Ghodsi and cols (2012). Ghodsi *et al*. (2012) applied the protocol from ACOG (2002) which indicated at least 30 minutes of physical exercise for at least three times per week. ACOG guideline proposed a lighter physical effort. Perhaps, this fact might turned difficult a more precisely comparison. Even so, sensitivity analysis revealed a trend to aerobic exercise inducing a shorter first stage delivery. Silveira and Segre (2012) demonstrated higher percentages of vaginal deliveries and fewer cesarean operations in active women. On the other hand, Portella *et al*. (2014) registered the fact that small women groups could turn less possible to present a more accurately and plausible result at this topic. Using a larger patients group, Tomic *et al*. (2013) did not find any exercise effect on vaginal and cesarean delivery rates. Corroborating, Cavalcante *et al*. (2009) also did not show any significant difference between training and control groups. Sadly, results data on vaginal delivery was presented using percentages rates (%) and could not be included in meta-analysis. On the other hand, a randomized controlled study of Melzer *et al*. (2010) demonstrated shorter second stage labor in active women group. Our sensitivity meta-analysis showed no exercise effects on this labor stage thus high heterogeneity level (I^2=89%) presented. Melzer *et al*. (2010) study lacked standard deviation information and could not be included in meta-analysis.

Through Delphi scale analysis, we identified a more precise training control of Barakat *et al*. (2009a) work. Resistance training (RT) is a non-common exercise modality indicated for pregnant women. Recently, studies demonstrated that RT was effective, safe and had no adverse effects on pregnancy related outcomes (Barakat *et al*., 2009b; Benton *et al*., 2010; O´Connor *et al*., 2011; White *et al*., 2013:. In addition, the authors showed that RT did not altered any delivery outcomes. Probably, aerobic and resistance training might induce different pelvic floor adjustments during pregnancy.

CONCLUSION

In conclusion, it was not possible to conclude whether exercise, regardless of its types, is able of change the type of delivery and related outcomes due to the absence of better statistical data management and well defined methodologies.

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