



Physical Training for Pregnant Women: The Theoretical Knowledge and what is Recommended in Gyms

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Abstract

Background: Physically active pregnant women have better anatomical and physiological conditions to gestate and give birth when compared to sedentary pregnant women. However, poorly planned physical training during pregnancy can become a problem for maternal-fetal health.

Objective: From this point of view, this research was designed to analyze the knowledge of Physical Education professionals about the prescription and supervision of physical training for pregnant women.

Methods: A self-administered questionnaire was answered by 16 Physical Education professionals from different gyms in the city of Mogi das Cruzes, São Paulo, Brazil.

Results: We identified that most participants recommend the practice of flexibility, aerobic, and resistance exercises during pregnancy. Intensity recommendations for aerobic and resistance training for pregnant women ranged from light to moderate. The time of aerobic and resistance exercise recommended by professionals was lower than the internationally recommended (150-300 minutes/week). A significant part of the sample does not recommend resistance exercises that involve the pelvic muscles. No participant knows the six physiological variables that must be controlled in pregnant women who are exercising.

Conclusion: These findings show that the participants have an important theoretical limitation on the practice of physical exercise in pregnant women and, consequently, gyms neglect training for pregnant women.

Keywords: Physical Education; Physical Exercise; Specific Training; Pregnancy; Woman's Health

Abbreviations: ACOG: American College of Obstetricians and Gynecologists; ACSM: American College of Sports Medicine; SMA: Sport Medicine Australia.

Introduction

The gestation period is followed by anatomical and physiological changes in a woman's body, including weight gain, abdominal circumference growth, lumbar lordosis, head protrusion accentuation, reduction in lower members'

venous circulation, and cell response to insulin, and ligament laxity [1]. These are essential changes for fetal accommodation and development and labor. However, when they are associated with harmful-environmental stimuli, like sedentarism, anatomical and physiological changes may be potentiated and become detrimental to mobility, balance, blood circulation, glycolytic and hormonal function of a pregnant woman and, consequently, affect fetal health and well-being [2,3].

It has been observed that pregnant women with lower-recommended physical activity levels are more prone to develop gestational diabetes and hypertension compared to those who achieve exercise level recommendations. Furthermore, physically active pregnant women have better cardiopulmonary, humoral, balance, and strength performance, and low risk to develop cardiovascular diseases, mental disturbs, musculoskeletal injuries, pain, and falls compared to sedentary ones. For this reason, well-planned and supervised physical training before, during, and after the gestational period is considered essential to the maintenance and improvement of maternal-fetal health [4-10]. Physical exercise recommendations for pregnant women are similar to recommendations for the general public (i.e. 300 minutes a week or more of moderate physical activity, divided into daily training sessions lasting 30 to 60 minutes of aerobic, resistance and flexibility exercises). To ensure that the practice of exercise is beneficial to maternal and fetal health, it is important that training be planned and adapted according to the particularities of each pregnant woman and the gestational period [6,7]. If the physical training planning is inadequate, the exercise may trigger events that harm gestational development, like hemorrhages, musculoskeletal injuries, prematurity, and miscarriage [9,11,12].

Although a well oriented exercise practice is important to gestational health like others factors how healthly alimentation, the adherence of pregnant women to it and physical education professionals' knowledge about gestation is still limited [13-15]. So, it is probable that the prescription of physical exercise for pregnant women in gyms is not the most adequate to promote maintenance and improvement of maternal-fetal quality of life. Thinking about that and considering exercise benefits to pregnant women, the goal of this study was to analyze how the practice of flexibility, aerobic, and strength exercises are prescribed to pregnant women in gyms.

Material and Methods

This cross-sectional, quantitative, and descriptive survey was carried out under the ethical and legal precepts of the Declaration of Helsinki and the resolutions 466/12 and 510/16 from National Health Council of Brazil and was approved by Ethics and Research Committee from Universidade de Mogi das Cruzes, Mogi das Cruzes, São Paulo, Brazil (CEP/UMC #2.248.130).

Participants

Sixteen physical education professionals, of both genders (female = 50%), with a mean age of 33±7 years, acting as technical responsible (n=11), and/or training instructors (n=5) from different gyms, which provide exercise services to

pregnant women in the municipality of Mogi das Cruzes, São Paulo, Brazil, were included. Eleven professionals had only completed higher education, 4 were specialists and 1 had a master's degree. In this study, professionals who attended to their clients individually (personal trainers), or those who did not have a fixed space to assist pregnant women in their exercise program were not included.

The sample size is a great limitation of this study. To minimize this limitation, statistical corrections were used, as described in the data analysis

Procedures

Each participant received a self-administered questionnaire, that was structured based on the information contained in the training protocols for pregnant women from American College of Obstetricians and Gynecologists (ACOG) [6], American College of Sports Medicine (ACSM) [16], and Sport Medicine Australia (SMA) [17]. This assessment instrument consisted of two headings that were intended to identify the sample characteristics and 30 questions (8 semi-open and 22 closed) related to i) medical formalization and documentation of services provided to pregnant women; ii) the existing, elaboration, and applying of a specific training protocol, and; iii) specificity about flexibility, aerobic and resistance exercise to gestational period. The questionnaires filled out were made in the presence of a trained collaborator for the applying instrument. The participant took a mean time of 22 minutes to answer all questions.

All professionals included in this study agreed to participate voluntarily in data collection and expressed this will by signing an informed consent form.

Data Analysis

The collected data were tabulated in JAMOVİ (v. 2.2.3, Jamovi Project) statistic program, and analyzed by chi-square test (X^2), with a significant level of 5% ($p < 0.05$). To minimize type-I error, in questions that present a variable with a frequency lower than 5, Yates's correction was applied. The result interpretation of variables with 3 or more categories was made by adjusted residue (values $>+ 1.96$ or < -1.96 indicate that the observed frequency was higher or lower than the expected frequency, respectively.) The outcomes were presented in simple relative frequency. The blank answer was not considered in the statistical analysis.

Results

Service recommendations for pregnant women in the researched gyms are described in Table 1.

Questions / Answer Categories	n
Can pregnant women enroll in the gym?	
Yes, any pregnant women	8
Only pregnant women without a risk gestation	8
Is a medical certificate of physical activity required for pregnant clients?*	
Yes, for all pregnant women	16
Is the medical certificate of release of physical activity of the enrolled pregnant woman filed?*	
No, any pregnant women	2
Yes, for all pregnant women	14
Does the gym have a standardized protocol on physical exercise for pregnant women?	
No	11
Yes, for all pregnant women	5
If the gym has an exercise protocol for pregnant women, how was it created?	
Own guidelines	3
Protocol already described in the literature	2
If the gym uses an existing exercise protocol for pregnant women, what protocol is used?	
American College of Obstetrician and Gynecologist	1
Did not answer	1
The prescription of physical exercise for pregnant women is performed on the recommendation of which professional? *	
Only medical	1
Only physical education professionals	3
Physical Education Professionals associated with Medical Recommendations	12

* Statistical difference observed between the declared answers (χ^2 test; $p < 0,050$).

Table 1: Distribution of characteristics and service recommendations for pregnant women in gyms.

All professionals that participated in this study worked in gyms that allowed pregnant women's enrolment. However, 50% of the gyms do not attend risk pregnant women. In those, the medical certificate to physical activity practice was required for all gravid women and, in most places, this document was filed ($\chi^2 = 9,00$, $p = 0,003$).

No significant difference was observed in the number of gyms that had a protocol for exercise prescription for pregnant women compared to gyms that had one ($\chi^2 = 2,25$, $p = 0,134$). Among gyms that had a protocol for this population, three used their own guidelines, and two were

based on the protocol described in the literature ($\chi^2 = 0,20$, $p > 0,999$). Only one participant revealed what pre-existing protocol was used (i.e. American College of Obstetrician and Gynecologist).

Most evaluated professionals reported that the exercise prescription for pregnant women was based on medical recommendations and from physical education professionals ($\chi^2 = 12,88$, $p = 0,002$).

Physical education professionals' recommendations related to exercise for gravid women can be seen in Table 2.

Questions / Answer Categories	n
Flexibility	
Is the practice of flexibility exercises recommended for pregnant women?*	
No, for any pregnant women	0
Yes, for all pregnant women	9
Only for pregnant women without gestational risks	4

Indifferent		2
Did not answer		1
In flexibility training, should any joint be prioritized?		
Yes		3
No		10
Did not answer		3
In flexibility training, are there any restrictions on the use of any joint? *		
No, all joints are worked		12
Only for pregnant women at risk of pregnancy		1
Yes, for all pregnant women		2
Did not answer		1
Aerobic Exercise		
Is aerobic exercise recommended for pregnant women? *		
Yes, for all pregnant women		10
Only for pregnant women at risk of pregnancy		6
In general, what is the recommended weekly frequency for pregnant women to perform aerobic training?	Healthy Pregnant Women	Risk Pregnant Women
1 day a week	15	2
2 days a week	0	4
3 days a week	0	2
Indifferent	0	1
Did not answer	1	7
In general, what is the recommended intensity for pregnant women to perform aerobic training?		
Only light	0	6
Light to moderate	10	3
Moderate to high	6	0
Did not answer	0	7
During the performance of aerobic exercise, which physiological variables are controlled in pregnant women without risk? (more than one alternative may be marked in this question)		
Heart rate	15	11
Blood pressure	14	11
Breathing	8	10
Blood Glucose	2	2
Sweating	0	2
Temperature	2	2
Lactate	1	1
Did not answer	1	5
Resistance Exercise		
Is the practice of resistance exercises recommended for pregnant women?*		

Yes, for all pregnant women		9
Only for pregnant women without gestational risks		5
Indifferent		2
In general, what is the recommended weekly frequency for pregnant women to perform resistance training?	Healthy Pregnant Women	Risk Pregnant Women
1 day a week	0	1
2 days a week	2	5
3 days a week	7	3
4 days a week	2	1
5 days a week	3	0
Indifferent	1	0
In general, what is the recommended intensity for pregnant women to perform resistance training? #		
Only light	0	6
Only moderate	10	3
Light to moderate	6	0
Can any region of the body of pregnant women described below NOT be exercised during resistance training? (in this question can more than one alternative be marked)? &		
Lower members	0	1
Anterior trunk	0	1
Hip	0	4
Abdomen	10	8
Other	0	0
All regions of the body can be exercised	5	0
Is it recommended for pregnant women to perform resistance exercises that involve the pelvic muscles?		
Yes, for all pregnant women		6
Indifferent		2
No, for no pregnant women		2
Only for pregnant women without gestational risk		6
Is it recommended for pregnant women to perform resistance exercises in the supine position (abdomen facing up)?		
Yes, for all pregnant women		5
Indifferent		2
No, for no pregnant women		5
Only for pregnant women without gestational risk		4
Is it recommended for pregnant women to perform resistance exercises in the prone position (abdomen facing down)? *		
No, for no pregnant women		14
Only for pregnant women without gestational risk		2

Is it recommended that pregnant women hold breathing at the end of inspiration and in the negative phase of the exercise (Valsalva maneuver)?: *		
Yes, for all pregnant women		1
Indifferent		3
No, for no pregnant women		11
Only for pregnant women without gestational risk		1
During resistance exercise, which physiological variables are controlled in pregnant women without risk? (more than one alternative may be marked in this question) #&	Healthy Pregnant Women	Risk Pregnant Women
Heart rate	15	10
Blood pressure	14	10
Breathing	9	8
Blood Glucose	1	1
Sweating	1	2
Temperature	2	2
Did not answer	1	6

*Statistical difference observed between the declared answers; # statistical difference between the declared answers for pregnant women without gestational risk (healthy); & significant difference between the declared answers for pregnant women with gestational risk (χ^2 test; $p < 0,050$).

Table 2: Distribution of participants in relation to opinion on flexibility, aerobic and resistance training recommendations for pregnant women.

There is a consensus among evaluated professionals that flexibility ($\chi^2 = 8,07$, $p = 0,007$), aerobic (all of them recommended) and resistance exercises ($\chi^2 = 9,00$, $p = 0,004$) must be prescribed along gestational period. No significant difference was found in the frequency that professionals recommended these types of exercise to all pregnant women, only if there were at risk (aerobic: $\chi^2 = 1,00$, $p = 0,317$), healthy ones or those that judged this recommendation indifferently (flexibility: $\chi^2 = 5,20$, $p = 0,093$; resistance: $\chi^2 = 4,63$, $p = 0,109$).

Related to flexibility training, most professionals believe that all joints should be exercised in these women ($\chi^2 = 14,80$; $p < 0,001$). The number of participants that judged be necessary to prioritize some joint does not differ statistically from those who believe that this conduct is not essential ($\chi^2 = 3,77$, $p = 0,092$). Among the structures to be prioritized in flexibility training were mentioned hip joint, lumbar region, lower members, and vertebral column.

All participants advised a weekly aerobic training, with a mean duration between 32,7 (minimum time) and 79,58 minutes (maximum time), in a light to moderate intensity to healthy pregnant women ($\chi^2 = 6,50$; $p = 0,039$). Those with a risk gestation, the recommendation varied from 1 to 3 weekly trainings and indifferent ($\chi^2 = 2,11$; $p = 0,654$), with a mean duration between 15 (minimum time) to 37,14

minutes (maximum time), in a light and light-to-moderate intensity ($\chi^2 = 1,00$; $p = 0,508$).

For resistance training, the answers about weekly frequency, volume, and intensity varied from indifferent to 2 to 5 trainings in a week ($\chi^2 = 7,33$; $p = 0,139$), with a total mean of 57,5 (minimum time) to 84,4 minutes (maximum time) of practice in a light to moderate intensity ($\chi^2 = 6,50$; $p = 0,039$) and rest of 1 minute and 24 seconds between sets to healthy pregnant women. Risk pregnancy, the varied between 1 to 4 trainings per week ($\chi^2 = 4,00$; $p = 0,261$), accumulating 21,4 (minimum time) to 35 minutes (maximum time) of activity practiced in light or light-to-moderated intensity ($\chi^2 = 1,00$; $p = 0,508$) with a rest of 1 minute and 47 seconds between sets of each exercise. No statistical difference was observed in contraindications and recommendation stimulus in a body region of healthy women (i.e., abdominal, hip, body, and lower member) ($\chi^2 = 1,67$; $p = 0,197$). Risk pregnant women, it was noted a significant number of professionals that contraindicate stimulus in abdominal region ($\chi^2 = 9,43$; $p = 0,024$). Recommendation and restrictions of exercises executed in supine position ($\chi^2 = 1,500$; $p = 0,682$) or those that stimulate pelvic musculature ($\chi^2 = 4,000$; $p = 0,260$) during gestational period do not differ significantly among participants. However, resistance exercise practiced in prone position ($\chi^2 = 9,00$; $p = 0,004$), and the presence of apnea in the concentric phase ($\chi^2 = 17,00$; $p = 0,001$) were not

recommended to all gravid for most of professionals.

All participants advised the monitoring physiological responses of pregnant women along aerobic ($\chi^2 = 21,125$; $p < 0,001$) and resistance training ($\chi^2 = 10,286$; $p = 0,002$). Heart rate and blood pressure were the most cited variables in both types of training and gestational condition (aerobic/healthy pregnancy: $\chi^2 = 28,6$; $p < 0,001$; aerobic/risk pregnancy: $\chi^2 = 23,9$; $p < 0,001$; resistance/healthy pregnancy: $\chi^2 = 32,9$; $p < 0,001$; resistance/risk pregnancy: $\chi^2 = 18,6$; $p = 0,002$). In both situations, any participant got the six recommended variable (i.e., blood pressure, sweating, breathing, temperature, heart rate, and blood glucose) right to be controlled during an aerobic training.

Discussion

This study verified how physical education professionals who act in gyms recommend flexibility, aerobic, and resistance exercises for pregnant women. Our results showed that the requirement for a medical certificate to practice and prescribe exercise in this population is routinely conducted in gyms where participants worked. However, this document was not always archived in the clients' register. Besides that, few gyms had a physical training protocol specific to the gestational period. The multidisciplinary approach adopted (i.e., medical information related to pregnant women's health) propitiates more safety and effectiveness to physical training prescription in special groups, like pregnant women [6,16,17]. The lack of registration of clients' health status and training guidelines may interfere in the exercise prescription for this population. This way, the physical training exercise may no longer be beneficial and become a risk to gestation, mainly in places in which most physical education professionals do not have experience to act with pregnant women, like in Brazil [15,18-21]. These issues may be a predictor of mistakes in the physical exercise planning for special groups, including pregnant women [15].

Most evaluated professionals recommended the practice of flexibility, aerobic, and resistance exercises for this population. It was also observed a consensus in the advisement for training that stimulate the flexibility of all joints and that required an aerobic and resistance effort in a light-to-moderate intensity. For aerobic practices, it was recommended a mean time for weekly training of 55 minutes for healthy pregnant women and 26 minutes for risk gestations, distributed between 1 to 3 days a week. For resistance training, the mean time was 71 minutes for healthy ones and 28 minutes for those at risk, distributed between 1 to 5 days a week. The mean time for resting among the resistance exercise sets was 1.5 minutes. These results partially differ from international and scientific recommendations about physical activity practice during gestation. According to

previous studies, mixed training (aerobic, resistance, and flexibility) reduces health complications during pregnancy. However, this effect was observed in daily practice with 50 minutes of duration, realized 3 times a week [2,22-24]. Price, Amini, et al. [24] research has shown that 45 to 60 minutes of daily mixed training performed 4 times a week decreases the incidence of overweight, obesity, hypertension, and preterm birth. Barakat, et al. [2] have identified that 50 to 55 minutes of aerobic, resistance, flexibility training, and dance realized 3 times a week during gestation reduces the incidence of pre-eclampsia, hypertension, gestational diabetes, and excessive weight gain in both mother and fetus. A metanalysis realized by Sanabria-Martínez, et al. [23] showed that performing combined exercises (aerobic, resistance, and flexibility) improves the newborn's immediate adjustment scale score to extrauterine life (Apgar). In addition, Marín-Jiménez, et al. [22] identified that pregnant women with higher performance in velocity and agility tests, better cardiorespiratory conditions, and higher physical fitness feel less pain during gestation. According to ACOG [6], ACSM [16] e SMA [17] guidelines, flexibility is considered an essential practice for the maintenance and improvement of pregnant women's health. However, these guidelines do not describe how this type of training should be conducted. Although the beneficial effects of flexibility training (i.e., muscle elasticity, postural adaptation, and pain prevention, especially in lumbar and pelvic regions) can be observed in diversified practices performed 3 to 5 times a week [1], it is recommended to avoid extreme stretching exercises from the tenth week of gestation. During this period, pregnant women get susceptible to musculoskeletal injuries due to the increase of relaxin, a stimulating hormone for the flexibility of joint tissues and ligaments [6,25]. For aerobic and resistance exercise, the ACOG [6], ACSM [16], SMA [17] e World Health Organization [3,7] recommend that training should be performed in moderate intensity, for a period of 150 to 300 minutes a week, distributed between 3 to 5 sessions with 30 to 60 minutes duration. This way, it is possible for a practice involving 4 to 8 differentiated exercises, realized in 3 sets with 12 to 15 repetitions each. From another perspective, the SMA [17] described that resistance training for pregnant women should be elaborated with daily sessions with 8 to 10 exercises, twice a week, in which, each one should be performed in one set with 12 to 15 repetitions. In this guidance, it is not declared the time the pregnant women should spend during one training day. However, considering classical resistance training, where it is spent 3 seconds to perform the concentric and eccentric phases with 90 seconds of rest between the sets, the duration of a unique session of resistance training by SMA [17] guidance can vary between 15 to 21 minutes. Consequently, the weekly time used will be 30 to 42 minutes. It is essential to highlight that in sedentarism cases or risk gestational, in which gravid women may practice exercise, the desired physical activity level, and

the training intensity should be achieved gradually, followed by a training prescription elaborated by medical information related to pregnant women's health [3,6,7,16,17]. These appointments indicate that physical education professionals, who were evaluated in this study, do not prioritize the joints in the flexibility training and underestimate the weekly frequency and volume of aerobic and resistance exercises in pregnant women due to the lack of technical and scientific knowledge about physical and physiological modifications of gestation and the benefits of physical exercise for maternal-fetal health.

We also noted in our study that there is a concern among the participants in do not indicate resistance training that stimulates the abdominal region in risk pregnant women. For all gravid ones, the supine position and the Valsalva maneuver were widely contraindicated in resistance training. Stimulating all body regions, mainly pelvic muscles, was not a recommendation among participants. About that, it is observed that a resistance training program for pregnant women should stimulate all muscle groups possible to be trained [3,6,7,16,17]. Resistance exercises that active pelvic and abdominal muscles improve physical conditions to labor and assist in the prevention of urinary and fecal incontinence in the pre and postnatal periods [26-28]. Women in the gestational period who practice resistance exercises to upper and lower members ameliorate their peripheral circulation, mobility, strength, and ability to support the child in the arms after the labor [8,10,24]. In normal situations, the contraindications to performing some resistance exercises are punctual and related to some period or specific gestational condition. For example, uterine volume at 20^a pregnancy week propitiates a compression in the abdominal portion of the aorta and vena cava when the woman keeps in the supine position. This compression may generate hypotension and trigger risks to gestation [6]. For this reason, it is recommended that exercises realized in a supine position are adapted to be performed in a leaning or sitting position from the 16th week of gestation. The prone position does not present expressive risks to gestation. However, it should be considered that exercises performed in a prone position may generate physical discomfort for pregnant women in advanced stages of gestation [6,11,24,29]. Regarding the Valsalva maneuver, it is important to highlight that an improvement that the performance improvement observed in the concentric execution of resistance exercises during forced apnea is followed by physiological events (e.g., changes in the blood pressure, reduced oxygenation in the brain, and impairment in the venous return to the heart) that may impair the maternal-fetal health. Therefore, the Valsalva maneuver is a practice that should not be recommended during resistance training for this population [6,16,28,30]. Because of these facts, we believe that evaluated professionals are outdated about some information related to the effect of

strength physical exercise and physiological changes in the pregnancy.

Our study also showed that most physical education professionals agree that is necessary to control some physiological variables during aerobic and resistance training. Nonetheless, no participant pointed out all variables that must be controlled. Among the most cited variables, there was the heart rate, blood pressure, and breathing. Despite being corrected, temperature, blood glucose, and sweating are parameters that can also present significant modifications during exercise practice and cause risk to the gestational health [3,6,28]. For example, the increase in temperature and sweating are indicators of overheating and dehydration and may trigger irritability, hypotension, asthenia, blurred vision, vertigo, confusion, and fainting. Hypoglycemia reduces brain function and may cause similar reactions described in cases of hyperthermia and excessive sweating, except for hypotension. These symptoms enhance the risks of falls and trauma in pregnant women and decrease the supply of oxygen and nutrients to the fetus. The dysregulation of breathing may cause apnea and cardiac arrhythmia in pregnant women. Consequently, the heart rate and oxygen demand may be impaired [3,6,10,28,30]. That is why, physical education professionals must know all physiological parameters that must be assessed in pregnant women who are exercising (i.e., heart rate, blood glucose, blood pressure, breathing, sweating, and temperature). In this context, we believe that evaluated professionals in this study are not prepared to identify risky physiological situations in this population who are practicing exercises.

Besides the facts presented and assumptions made, our study has important limitations, like small sample and lack of observational evidence about the conduct taken in the prescription and supervision of physical training for pregnant women and what are their effects during pregnancy. This way, we assumed that our data should be considered insufficient to be generalized to in populational dimension and to infer any type of causality. It was not possible to increase the sample size due to the lack of interest of professionals in participating in the study. To identify whether the reality we observe is a population characteristic and whether this condition has any impact on maternal-fetal health, more studies are needed to assess both the knowledge and performance of physical education professionals, their prescription, and physical training effects on pregnant women in gyms.

Conclusions

The results of this research with 16 physical education professionals indicate that they ignore technical and scientific essential information related to the prescription and supervision of physical flexibility, aerobic, and resistance

exercises during pregnancy. Despite the studied sample representing a small portion of gyms in the city studied (approximately 10%) and this is a great limitation of our study, our evidence summed with literature data may be an indication that exercise prescription to pregnant women is underestimated and poorly supervised. This may negatively impact the health and safety of pregnant women who use this service.

Declarations

This version of this paper has not been previously published in any peer reviewed journal and is not currently under consideration by any journal. The document was redacted in Microsoft Word software, in the English language and the main text contains 5333 words, including the abstract and keywords.

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Conflicts of Interest

The authors report there are no competing interests to declare.

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