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# Physical activity during pregnancy and its association with maternal and child health indicators

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## ABSTRACT

**OBJECTIVE:** To analyze factors associated with the practice of physical activity during pregnancy and its relationship to maternal and child health indicators.

**METHODS:** Cross-sectional study carried out with all births that occurred at maternity hospitals in the municipality of Rio Grande (Southern Brazil) during the year of 2007 (N = 2,557). Information was collected through interviews, by means of a pre-coded questionnaire administered to the mothers. The analyzed maternal and child health outcomes were: hospitalization during pregnancy, cesarean delivery, preterm birth (gestational age < 37 weeks), low birth weight (< 2500g), and fetal death.

**RESULTS:** A total of 32.8% of mothers (95%CI 31.0;34.6) reported having practiced physical activity during pregnancy. The factors associated with practice of physical activity during pregnancy, after adjusting for potential confounders, were: maternal age (inverse association), level of schooling (direct association), mother's first pregnancy, having received prenatal care, and having been instructed in physical activity during prenatal care. Women who practiced physical activity during pregnancy were less likely to deliver surgically and to have a stillbirth. There was no association between physical activity and preterm birth, hospitalization, and low birth weight.

**CONCLUSIONS:** Only one third of mothers reported having practiced physical activity during pregnancy. This behavior was more frequent among younger women with higher level of schooling who were advised during prenatal care. Women who practiced physical activity during pregnancy had fewer cesarean sections and lower occurrence of stillbirths.

**DESCRIPTORS:** Pregnant Women. Motor Activity. Exercise. Sports. Maternal and Child Health. Cross-Sectional Studies.

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## INTRODUCTION

The new physical activity guidelines published in 2008 include one section targeted at pregnant and parturient women. The recommendations to this subgroup of the population are the same ones provided for the general population: at least 150 minutes per week of moderate intensity physical activity.<sup>a</sup> However, research carried out up to the decade of 1990 on this matter approached mainly the possible gestational risks deriving from the regular

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Received: 5/19/2011

Approved: 11/12/2011

<sup>a</sup> Department of Health and Human Services (USA). Physical Activity Guidelines Advisory Committee Report 2008. Washington; 2008.

practice of physical activity, both occupational and leisure-time. Nowadays, it has been verified that, among active women, the practice of physical activity at the beginning of pregnancy does not undergo great changes, being similar to the rest of the active population.<sup>4</sup> However, the factors associated with the practice of physical education during pregnancy and the possible benefits to the mother's and fetus' health still lack population-based studies.

The aim of the present study was to analyze factors associated with the practice of physical activity during pregnancy and their relationship with maternal and child health indicators.

## METHODS

The research was carried out in the municipality of Rio Grande, southern Brazil, which has a population of approximately 200 thousand inhabitants. In the year of 2007, the municipality registered approximately 2,500 births, with a child mortality rate of 15 per one thousand and only one maternal death.<sup>b</sup>

In a cross-sectional study, all births that occurred between January 1<sup>st</sup> and December 31<sup>st</sup>, 2007 in the two maternity hospitals of the municipality were analyzed. Only newborns with weight equal to or higher than 500 g or 20 weeks or more of gestational age whose mothers lived in the municipality were included. The participants were approached within a period of up to 24 hours after delivery. More details of the study's methodology can be found in another publication.<sup>1</sup>

The information was collected through a pre-coded questionnaire composed of information regarding the family's place of residence, demographic characteristics, occupation, mother's reproductive history and life habits; socioeconomic level, ownership of house appliances, the family's housing and sanitation conditions and characteristics of the father's job; assistance received during pregnancy and delivery, access and utilization of preventive and curative health services. In addition, a physical examination was performed on the child; the birth weight was written down based on the nursing record book, and the nurses had used a digital pediatric scale with 10 g precision. The gestational age of the live births was evaluated based on the first day of the last menstrual period, written down on the pregnant woman's card. This variable had a large number of ignored values and was available for 77% of the sample. In case of a twin delivery, a specific questionnaire was used for the second newborn so as to avoid the repetition of questions.

The practice of physical activity during pregnancy was collected from the mothers' answer to the question "Did

you practice physical exercises during this pregnancy?". This question referred to physical exercises, excluding school, work or domestic tasks. The variables examined as possible factors associated with the practice of physical activity during gestation were: maternal age, mother's skin color, marital status, mother's level of schooling, family income, parity, whether the pregnancy had been planned, whether the mother received prenatal care, smoking before pregnancy and whether the mother was advised in the prenatal sessions to practice physical activity. The analyzed maternal and child health outcomes were: hospitalization during pregnancy, cesarean delivery, preterm birth (gestational age <37 weeks), low birth weight (< 2500g), and fetal death.

Ten female interviewers (eight medicine students and two social work students) were trained, and a pilot-study was conducted for the administration of the questionnaire and calculation of anthropometric measures.

The identification of the pregnant women was performed directly with the parturient and confirmed in the birth registration book of each maternity hospital. If she lived in the municipality of Rio Grande, the parturient was invited to participate in the study.

The questionnaires were double-entered by different professionals. Fortnightly, the typed questionnaires were compared and mistakes were listed and corrected. Then, data consistency was verified, with immediate correction of possible differences. Data input was performed through the use of the software EpiInfo 6.04. Subsequently, the data were transferred to the Stata statistical package, version 11.0, for data analysis.

The descriptive analysis was conducted by means of prevalence. For the crude and adjusted analysis of the practice of physical activity during pregnancy with the independent variables, Poisson regression was employed, with robust variance adjustment. For ordinal categorical variables (maternal age, level of schooling and family income), the p-value of the linear trend test was reported, while for the other variables the Wald test was used for heterogeneity.

For the adjusted analysis of the factors associated with practice of physical activity during pregnancy, a three-level conceptual model was employed to adjust for possible confounding factors. The first level included demographic and socioeconomic variables, the second, reproductive and behavioral variables, and the third level, whether the mother was advised during the prenatal sessions to practice physical activity. In this regression model (backwards), the variables were controlled for those of the same or of the superior levels, and a p-value of up to 0.20 was established to the maintenance of the variables in the analysis model.

<sup>b</sup> DATASUS. Informações de Saúde. Estatísticas Vitais. [cited 2012 Jan 13] Available from: <http://www2.datasus.gov.br/DATASUS/index.php?area=0205>

For the association of practice of physical activity in pregnancy with the maternal and child health outcomes, Poisson regression was also employed, and the following factors were considered as possible confounders: maternal age in years, marital status, mother's level of schooling in years, family income in reais, parity, prenatal consultation (yes or no), and twin delivery. The statistical level of significance that was adopted was 5% for two-tailed tests.

The research was approved by the Health Research Ethics Committee of *Universidade Federal do Rio Grande* (Process no. 23116.5369/6.58, opinion no. 12/2007). Besides, data secrecy was guaranteed, as well as voluntary participation and the possibility of leaving the study at any time, with no need to present a justification.

## RESULTS

Of the 2,584 births that occurred in the municipality in 2007, information was obtained for 2,557 children (1.1% of losses), of whom 34 (1.3%) came from twin pregnancies. The mean age of the mothers was 25.7 years (SD = 6.6 years), varying from 13 to 46 years. The median of level of schooling, income and number of children was, respectively, nine years of study, R\$ 800, and two children (including the current pregnancy). One fifth were children of adolescent mothers (< 20 years), two thirds of the mothers rated themselves as having white skin color, and 83% lived with a partner. Half of the women had nine or more years of schooling, 40% were primiparous, only 37% had planned the pregnancy, almost all of them (96%) attended at least one prenatal consultation, more than one fourth (28%) used to smoke before the pregnancy, and 61% were advised during prenatal assistance to practice physical activity (Table 1).

A total of 32.8% of the mothers (95%CI 31.0;34.6) reported having practiced physical activity during pregnancy. The factors associated with practice of physical activity during pregnancy were: maternal age (inverse association), level of schooling and income (direct association), being primiparous, having planned the pregnancy, having received prenatal care, not having smoked during pregnancy, and having been instructed in physical activity during prenatal care. (Table 2). In the adjusted analysis, the following variables lost association: family income, planned gestation and pre-gestational smoking. The variables skin color and marital status were not significantly associated with the practice of physical activity during pregnancy, neither in the adjusted, nor in the crude analysis.

Two thirds of the women reported that they believe that practicing exercises during pregnancy improves the baby's health and that it makes the delivery easier. The women who think like this were 50% more likely to

**Table 1.** Distribution of the sample according to demographic, socioeconomic and maternal characteristics. Rio Grande, Southern Brazil, 2007.

Variable	n	%
Maternal age (years)		
< 20	516	20.2
20 to 29	1346	52.6
30 to 34	394	15.4
≥ 35	301	11.8
Mother's skin color		
White	1678	66.5
Mixed-ethnicity (black and white)	511	20.2
Black	337	13.3
Lives with husband/partner		
No	440	17.2
Yes	2117	82.8
Maternal level of schooling (years)		
0 to 4	322	12.6
5 to 8	923	36.1
9 to 11	1071	41.9
≥ 12	241	9.4
Family income (quartile)		
1 (lowest)	679	26.6
2	675	26.4
3	584	22.8
4 (highest)	619	24.2
Parity		
None	1012	39.6
1 or 2	898	35.1
3 or more	647	25.3
Planned the pregnancy		
No	1611	63.0
Yes	946	37.0
Received prenatal care		
No	108	4.2
Yes	2449	95.8
Smoked before the pregnancy		
No	1846	72.2
Yes	711	27.8
Was advised during prenatal care to practice exercises		
No	996	39.0
Yes	1561	61.0
Total	2557	100.0

practice physical activity during pregnancy, even after adjusting for possible confounders (data not presented).

More than half of the mothers (51.6%) had cesarean deliveries, 13.4% were hospitalized during pregnancy,

**Table 2.** Crude and adjusted analysis of the prevalence of exercise during pregnancy. Rio Grande, Southern Brazil, 2007. (N=2557)

Variable	Prevalence of exercise (%)	Crude analysis % (95%CI)	Adjusted analysis % (95%CI)
Maternal age (years)		p<0.01 <sup>a</sup>	p = 001 <sup>a</sup>
< 20	36.4	1	1
20 to 29	33.1	0.91 (0.79; 1.04)	0.86 (0.75; 0.99)
30 to 34	31.7	0.87 (0.72; 1.05)	0.83 (0.68; 0.99)
≥ 35	26.6	0.73 (0.59; 1.01)	0.73 (0.58; 0.91)
Mother's skin color		p=0.16	p=0.32
White	33.7	1	1
Mixed-ethnicity (black and white)	32.7	0.97 (0.84; 1.12)	1.01 (0.88; 1.17)
Black	28.2	0.84 (0.70; 1.01)	0.87 (0.73; 1.05)
Lives with husband/partner		p=0.10	p=0.28
No	36.1	1	1
Yes	32.1	0.88 (0.77; 1.02)	0.93 (0.80; 1.07)
Maternal level of schooling (years)		p<0.01 <sup>a</sup>	p = 001 <sup>a</sup>
0 to 4	20.8	1	1
5 to 8	31.1	1.49 (1.18; 1.89)	1.42 (1.12; 1.79)
9 to 11	36.7	1.76 (1.40; 2.21)	1.72 (1.37; 2.16)
≥ 12	38.2	1.84 (1.41; 2.40)	1.88 (1.44; 2.45)
Family income (quartile)		p<0.01 <sup>a</sup>	p<0.025 <sup>a</sup>
1 (lowest)	29.3	1	1
2	32.6	1.11 (0.95; 1.30)	1.08 (0.92; 1.27)
3	33.6	1.15 (0.97; 1.35)	1.07 (0.91; 1.27)
4 (highest)	36.2	1.24 (1.06; 1.44)	1.12 (0.79; 1.06)
Parity		p<0.01	p<0.01
None	40.7	1	1
1 or 2	30.5	0.75 (0.66; 0.85)	0.77 (0.67; 0.88)
3 or more	23.7	0.58 (0.50; 0.68)	0.68 (0.56; 0.81)
Planned the pregnancy		p=0.02	p=0.25
No	31.1	1	1
Yes	35.7	1.15 (1.03; 1.29)	1.07 (0.95; 1.20)
Received prenatal care		p<0.01	p<0.01
No	11.1	1	1
Yes	33.8	3.04 (1.78; 5.20)	2.46 (1.43; 4.23)
Smoked before the pregnancy		p=0.01	p=0.47
No	34.5	1	1
Yes	28.6	0.83 (0.73; 0.95)	0.95 (0.83; 1.09)
Was advised to practice exercises		p<0.01	p<0.01
No	20.2	1	1
Yes	40.9	2.03 (1.77; 2.32)	1.83 (1.59; 2.10)

<sup>a</sup> Linear trend test.

16.5% had premature babies, 9.4% of the children were born with low weight, and 1.5% (n=39) were stillbirths (Table 3). Although there were signs that the practice of physical activity protected against hospitalization and low birth weight, such associations were not statistically significant. However, the women who practiced

physical activity during pregnancy were less likely to have a surgical birth and a stillbirth. Among the women who did not practice physical activity during pregnancy, there were 33 stillbirths (1.9%) versus six (0.7%) among those who practiced it. There was no association between physical activity and preterm birth.

**Table 3.** Association between practice of exercises during pregnancy and maternal and child outcomes. Rio Grande, Southern Brazil, 2007. (N=2557)

Variable	%	Crude analysis		Adjusted analysis <sup>a</sup>	
		PR (95%CI)	p	PR (95%CI)	p
Hospitalization during pregnancy	13.4	0.84 (0.68; 1.05)	0.13	0.88 (0.70; 1.09)	0.24
Cesarean delivery	51.6	0.99 (0.96; 1.01)	0.32	0.96 (0.93; 0.99)	<0.01
Preterm birth	16.5	0.91 (0.73; 1.13)	0.39	0.98 (0.79; 1.22)	0.88
Low birth weight	9.4	0.78 (0.59; 1.02)	0.07	0.84 (0.64; 1.09)	0.19
Stillbirth	1.5	0.37 (0.16; 0.89)	0.03	0.43 (0.18; 1.01)	0.05

PR: prevalence ratio; 95% CI: 95% confidence interval.

<sup>a</sup> Adjusted for maternal age, marital status, maternal level of schooling, family income, parity, prenatal consultation and twin delivery.

Nevertheless, if all the women with absent information for gestational age (more inactive women) had not practiced physical activity during pregnancy, the difference would become significant (p value = 0.03) and physical activity would start to exert a protective effect over preterm birth.

## DISCUSSION

Approximately one third (32.8%) of the investigated sample reported practicing some kind of physical activity during pregnancy. A study conducted in the city of Pelotas (Southern Brazil) in 2004 found that 12.9% of the pregnant women practiced some kind of physical activity in one of the trimesters of the pregnancy.<sup>3</sup> In the United States, approximately two thirds of the pregnant women reported practicing some kind of physical activity in their leisure time.<sup>4</sup> As the previous practice of physical activity was not asked, it is not known whether this percentage was modified due to the pregnancy. However, studies have shown that physical activity before pregnancy is an important predictor of physical activity during pregnancy.<sup>3,7</sup> Anyway, it is considered that a prevalence of 33% of engagement in physical activities during pregnancy corresponds to a low frequency; therefore, incentive and promotion policies targeted at physical activity for this group of the population should be established.

The following factors were associated with higher level of physical activity in pregnancy: less advanced age, higher level of schooling, lower parity, prenatal care, and having been advised to practice physical activity. A study carried out in Pelotas also found a direct association with level of schooling and an inverse association with parity.<sup>3</sup> The prevalence ratio for advice concerning the practice of physical activity during pregnancy was almost identical in both studies (1.85 in Pelotas versus 1.83 in this one). Nonetheless, some differences were observed, like the absence of association with age group and the presence of a direct association with family income.<sup>3</sup>

The factors associated with practice of physical activity found in our study are consistent with

the literature<sup>4,7</sup> and are in accordance with studies conducted with the general population.

Concerning the effect of the practice of physical activity during pregnancy on maternal and child outcomes, the prevalences of cesarean delivery and stillbirth were lower for the women who practiced exercises during pregnancy. These findings are important to public health, since the practice of physical activity during pregnancy is beneficial both to the mother's and to the conceptus' health, reflecting positively on social indicators. However, we did not find any studies that showed physical activity during pregnancy as a protective factor against cesarean section or occurrence of fetal death. Obese women have more cesarean sections,<sup>2,10</sup> although there was no difference in weight gain during gestation according to the practice of physical activity (data not shown). Regarding the protective effect of physical activity during pregnancy against the occurrence of stillbirths, it remained significant even after adjustment for threatened miscarriage. Nonetheless, when controlled for prematurity or low birth weight (mediator variables), the effect disappeared (data not shown). This may derive from the bias of reverse causality, that is, women with high-risk pregnancy (higher probability of stillbirth) may have decided by themselves to avoid doing exercises or due to medical recommendation. Although in the present study the practice of physical activity during pregnancy did not show a protective effect against preterm birth, lower risk of prematurity deriving from the practice of physical activity during pregnancy was recently verified in two birth cohort studies.<sup>3,6</sup> In relation to birth weight, other studies have also not found a significant association with physical activity during pregnancy.<sup>5,8,9</sup>

As positive points of the present study, we highlight: a) the low percentage of losses and refusals; b) the performance of the interviews immediately after delivery; c) the inclusion of all births that occurred in one municipality throughout the whole year; and d) the new approach to the investigation of the factors that lead to the practice of physical activity during pregnancy, as well as the outcomes deriving from this behavior. As for the study's limitations, the questionnaire that was

used did not have its validity and reproducibility tested; in addition, the frequency, type, duration and intensity of the reported physical activities were not evaluated. Although restricting the information on physical activity in a period of nine months to a yes/no answer presents negative points, no validated instrument to collect information on physical activity in pregnant women in a retrospective way was found.

Concerning the external validity of the findings, it is not known whether the associations that were found can be extrapolated to other municipalities, whose sociodemographic and cultural context is different from the one that was studied here. Thus, we suggest that other studies of this type are carried out in other localities of Brazil to confirm if the data can be generalized to other populations of pregnant women.

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Research financed by Fundação de Amparo à Pesquisa do Estado do Rio Grande do Sul (Process No.: 0700090).  
The authors declare no conflicts of interests.