

## Physical activity level and associated factors among pregnant women: a population-based epidemiological study

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**Abstract** *This research aimed to assess the level of physical activity and identify the associated factors in pregnant women assisted in primary health care in the city of Montes Claros, Minas Gerais (Brazil). This was an epidemiological, cross-sectional, analytical study, carried out with 1,279 pregnant women. Socioeconomic, occupational, obstetric, behavioral, social, health, and emotional variables were assessed using a questionnaire. The Physical Activity Questionnaire for Pregnant Women was also applied. Descriptive statistical analysis and multinomial logistic regression with a hierarchical model were performed. The prevalence of physical inactivity in the physical activity and leisure time dimensions was verified. A mild level of physical activity was associated with the variables such as age from 21 to 30 years and up to 20 years old, income above two minimum wages, salaried work, and maternal-fetal attachment at a medium/high level. Income from one to two minimum wages and above two wages, paid work and self-employment, anxiety and stress symptoms, and medium/high maternal-fetal attachment were associated with the moderate/vigorous level. Multifactorial aspects must be considered in health promotion strategies directed to the practice of physical activity by pregnant women.*

**Key words** *Pregnant women, Exercise, Primary health care, Health surveys*

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## Introduction

Pregnancy is a period that involves maternal-fetal health care, such as the adoption of a healthy lifestyle. The practice of physical activity at this stage results in benefits for the pregnant woman and the fetus<sup>1,2</sup>. For the pregnant woman, physical activity ensures the improvement of circulation, respiratory quality, and sleep; strengthening of the endocrine and nervous system, as well as the muscles of the back and legs, helping in weight control and in the prevention or control of various diseases; it also improves quality of life and self-esteem<sup>2-5</sup>. In addition, it stimulates placental growth, provides better conditions for the baby's birth, and faster recovery during the postpartum period. For the fetus, the regular practice of physical activity results in benefits such as greater tolerance to vaginal labor, better neurodevelopment, and lower percentage of body fat<sup>4,3,6,7</sup>.

According to the Physical Activity Guide for the Brazilian Population<sup>8</sup>, this practice also contributes to the human development and well-being of the pregnant women, helping them to enjoy a full life with better quality; it promotes relaxation, fun and disposition. It reduces the risk of depression; helps in social inclusion, in the creation and strengthening of social bonds, links and solidarity; and reduces the risk of prematurity<sup>8</sup>.

However, for a long period, fears regarding the risks of complications for mother and fetus due to the practice of physical activity by pregnant women existed<sup>9,10</sup>. There is a consensus that light or moderate physical activity and regularly during pregnancy presents minimal risks and benefits most women, with improvement in the level of physical fitness of the pregnant woman, provided that she has no medical contraindication for this practice<sup>8-13</sup>. One must consider the need for continued research on the safety of physical activity for the fetus, since the possibility of reaching a consonance remains distant<sup>13</sup>.

International studies have shown the prevalence of insufficient physical activity during pregnancy. Research conducted with pregnant women from South Africa showed that 65.1% did not practice physical activity before pregnancy, and 69.6% never practiced physical activity in any of the trimesters<sup>14</sup>. In Germany, research conducted with pregnant women who had some type of restriction to physical activity found that 80% had less or no exercise during pregnancy<sup>15</sup>. In Singapore, there was a significant reduction in the pattern of physical activity and total energy expenditure from before to during pregnancy<sup>16</sup>. In

Brazil, investigations have shown that the regular practice of physical activity by pregnant women is still low compared to non-pregnant women. Results of national studies show a high rate of insufficiently active pregnant women<sup>17,18</sup>.

There is a need to demystify the incompatibility of the practice of physical activity at this stage of the life cycle and stimulate its regular performance considering the reality in which the pregnant woman is inserted, so to contribute to the improvement of her health conditions, quality of life, minimize the discomforts of pregnancy, and benefit fetal health<sup>17,19-21</sup>.

Therefore, it is important to estimate the prevalence and identify factors related to levels of physical activity during pregnancy. However, investigations that address this issue are still incipient, especially in the northern region of Minas Gerais. Therefore, this research aimed to evaluate the level of physical activity and identify the associated factors in pregnant women assisted in Primary Health Care (PHC) in the city of Montes Claros – Minas Gerais (Brazil).

## Methods

This is an observational, population-based, cross-sectional and analytical epidemiological study. This study is an excerpt from the matrix research entitled “Estudo ALGE – Avaliação das condições de saúde das gestantes de Montes Claros - MG: estudo longitudinal” (ALGE Study – Evaluation of the health conditions of pregnant women in Montes Claros – MG: longitudinal study). Recommendations of the “STROBE – *Strengthening the reporting of observational studies in epidemiology*” were followed<sup>22</sup>.

The population of this research consisted of pregnant women registered in the teams of the Family Health Strategy (FHS), in the urban area of the municipality of Montes Claros, in 2018. Sample size was established to estimate population parameters with a prevalence of 50% (to maximize the sample size and due to the project contemplating several events), 95% confidence interval (95% CI), and precision level of 2.0%. A correction was made for the finite population (N=1,661 pregnant women) and an increase of 20% was also established to compensate for possible non-responses and losses. The calculations showed the need for participation of at least 1,180 pregnant women.

The ALGE study aimed to analyze a series of outcome variables with several independent vari-

ables, and it was not possible to calculate a measure of association previously. The population was 1,661 women and the sample interviewed included 1,279 (higher than the minimum amount indicated in the sample calculation), so most of the population contingent was analyzed.

For sample selection, all the FHS centers of the municipality were considered, which totaled 15 in the period of this research and among which 125 family health teams were distributed. The number of pregnant women sampled in each center was proportional to their representativeness in relation to the total population of registered pregnant women. All those registered at the centers were invited to participate in the project.

As for the data collection process, initially contact was made with the managers of the PHC coordination of the municipality, to raise awareness and explain the purpose of the research. After their consent, the family health teams were also visited by the researchers for clarification on the study. The professionals of these teams responsible for prenatal care provided a list of pregnant women in their area of coverage containing their names, telephones and addresses. With these lists, a team of interviewers made initial telephone contact with the women, when there was an approach with the invitation and awareness about the study, so that data collection could be scheduled and carried out.

The collection took place between October 2018 and November 2019, in the health units of the FHS or in the homes of the participants, according to their availability. A multidisciplinary team of health professionals and undergraduate students was responsible for the interviews, which took place face-to-face, with an average duration of one hour per interview.

Pregnant women who were registered in a PHC family health team at any gestational age were included. Women who were pregnant with twins and those with cognitive impairment were excluded, according to information from the family member and/or the FHS team.

Prior to data collection, the interviewers were trained, and a pilot study with pregnant women was registered in a FHS unit (who were not included in the analysis of the study), to standardize the research procedures.

For data collection, a questionnaire was used that included socioeconomic (schooling, family income in minimum wages – R\$998.00 at the time of the research, maternal age, marital status), occupational (maternal work), obstetric (number of children), behavioral (smoking and

alcohol consumption), social (family and social support), health (pre-pregnancy nutritional status) and emotional (maternal-fetal attachment, anxiety, stress, self-esteem and body image) characteristics. The Physical Activity Questionnaire for Pregnant Women (QAFG) was adopted to assess physical activity levels in general categories -- household chores, caring for people, sports and exercise, occupation and leisure. Anthropometric data were obtained by copying the records of the Pregnant Women's Booklet (Chart 1).

To observe the pregnant woman's perception about the family function, an instrument named Family APGAR was applied, which signals the fulfillment of basic parameters defined by the acronym APGAR: A – adaptation; P – participation; G – growth; A – affection; R – resolution. The questionnaire presents five questions with three possible answers each, and a score ranging from zero to two points – always (2), sometimes (1) and never (0)<sup>23-25</sup>. Thus, the sum of zero to ten points is given, which, the higher it is, the better the participant's satisfaction. We proceeded to the categorization in “functional family” (score of 7-10) and “dysfunctional family” (< 6)<sup>25</sup>.

To measure the presence of social support, the Brazilian version of the Social Support Scale was used, consisting of 19 questions that comprise five dimensions: material, affective, emotional, positive social interaction, and information. For each item, the participant indicates how often she considers each type of support, using a *Likert*-type scale: never (1), rarely (2), sometimes (3), almost always (4) and always (5). The closer to 100 the final score is, the better the perceived social support<sup>26</sup>. The overall score of the scale was calculated by the total score of the 19 items and results above 66, which corresponds to the second tertile, were considered as high social support<sup>27</sup>.

The QAFG is a questionnaire that evaluates the pregnant woman's energy expenditure in MET (metabolic equivalent), adapted for the Brazilian population in 2009, which is calculated based on the time spent on the 31 activities usually performed as household chores (five activities), caring for other people (six activities), occupation (five activities), sports and exercise (nine activities), locomotion (three activities) and leisure (three activities)<sup>34,35</sup>. The instrument was adapted and validated for use in pregnant women in Brazil by Silva<sup>35</sup>, in which it is available in its complete format.

The estimation of QAFG intensity from mild to vigorous activities results from the average

**Chart 1.** Levels of physical activity and variables investigated, according to measures, categories, and instruments adopted in the study with a sample of pregnant women assisted in primary health care. Montes Claros, MG, Brazil, 2018/2019.

Variables	Measurements	Categories	Instrument
<b>Socioeconomic factors</b>			
Maternal age	Age group	- Over 30 years - 21 to 30 years old - Up to 20 years	Structured questionnaire
Marital Status	- Marital status	- With partner - Without partner	
Education*	- Education level	- Elementary school - High school - Higher education/ graduation	
Family income	- Current minimum wage	- Up to half a wage - Half a wage - One to two wages - Above two wages	
<b>Occupational factors</b>			
Maternal work	- Exercise of professional activity	- Housewife/ moonlighting/none - Salaried - Self-employed	Structured questionnaire
<b>Obstetric factors</b>			
Número de filhos	-Número de filhos que moram com a gestante	- None - 1 child - 2 or more	Structured questionnaire
<b>Behavioral factors</b>			
Smoking	- Current use	- Yes - No	Structured questionnaire
Alcohol consumption	- Ingestion	- Yes - No	
<b>Social aspects</b>			
Family APGAR	- Family Functionality	- Functional family - Dysfunctional family	Family APGAR SCALE <sup>23-25</sup>
Social Support	- Level of social support	- High - Low	Medical Outcome Studies (MOS) Social Support Scale <sup>26,27</sup>
<b>Health conditions</b>			
Body Mass Index (BMI)	- Nutritional status	- Underweightness - Adequate - Overweight/obesity	Records of the Pregnant Women's Booklet

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MET/hour per week for the total activity. Each activity was classified by its intensity: physically inactive (< 1.5 METs), mild (1.5-< 3.0 METs), moderate (3.0-6.0 METs) or vigorous (> 6.0 METs). These questions come from the work of Chasan-Taber *et al.*<sup>36,37</sup>, based on the *compendium* by Roberts *et al.*<sup>38</sup> to represent physical activities, walking, and household chores, and on Ainsworth *et al.*<sup>39</sup> to find the intensity of the other activities (for the general population) of the

questionnaire. The number of minutes spent on each activity was multiplied by its intensity, in MET, and added to be presented in the form of weekly energy expenditure (MET-hrs/wk)<sup>35</sup>.

The specific values in MET indicated in all questions follow the pattern (question: MET: value), [3:2.5], [4:2.0], [5:3.0], [6:2.7], [7:4.0], [8:3.0] [9:4.0], [10:1.8], [11:1.0], [12:3.2], [13:2.5], [14:2.3], [15:3.0], [16:4.5], [17:2.5], [18:4.0], [19:1.5], [20:3.5], [21:5.0], [22:6.0], [23:7.0],

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Variables	Measurements	Categories	Instrument
<b>Socioeconomic factors</b>			
<b>Emotional conditions</b>			
Maternal-fetal attachment	-Level of maternal-fetal attachment	- Low - Medium/high	Escala de Apego Materno-Fetal <sup>28</sup>
Anxiety	-Level	- Low - High	Brazilian State-Trait Anxiety Inventory (STAI) <sup>29</sup>
Stress	-Symptoms	- Absence of symptoms - Presence of symptoms	Perceived Stress Scale (PSS-14) <sup>30,31</sup>
Self-esteem	-Positive or negative self-assessment	- Low - Medium/High	Rosenberg Self-Esteem Scale (Ras) <sup>32</sup>
Body image	- Satisfaction Level	- Positive - Negative	Body Attitudes Questionnaire (BAQ) <sup>33</sup>
<b>Physical activity level of pregnant women</b>			
General physical activity	- Measurement/ quantity	- Physically inactive - Mild - Moderate/vigorous	- Physical Activity Questionnaire for Pregnant Women <sup>34,35</sup>
Household chores	- Measurement/ quantity	- Physically inactive - Mild - Moderate/vigorous	
Caring for people	- Measurement/ quantity	- Physically inactive - Mild - Moderate/vigorous	
Occupation	- Measurement/ quantity	- Physically inactive - Mild - Moderate/vigorous	
Sports and Exercise	- Measurement/ quantity	- Physically inactive - Mild - Moderate/vigorous	
Locomotion	- Measurement/ quantity	- Physically inactive - Mild - Moderate/vigorous	
Leisure	- Measurement/ quantity	- Physically inactive - Mild - Moderate/vigorous	

\* The education variable was determined by the highest reported level of education and then categorized into: elementary school (incomplete and complete), high school (incomplete and complete), higher education/postgraduate (incomplete and complete).

\*\* We chose to adapt and standardize the use of the term physically inactive according to the Physical Activity Guide for the Brazilian Population of 2021<sup>8</sup>.

Source: Authors.

[24:3.5], [25:6.0], [26:4.5], [27: See *compendium*<sup>38</sup>], [28: See *compendium*<sup>38</sup>], [29:1.8], [30:3.0], [31:2.0], [32:4.0], [33:3.3]<sup>34,35</sup>.

The calculation was performed observing the following guidelines. For questions 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 17, 18, 19 the duration count corresponded to the duration categories 0 – 0.25 – 0.75 – 1.5 – 2.5 – 3.0, and the value found was

multiplied by seven days a week. As for questions 11, 29, 30, 31, 32, 33, the duration times corresponded to 0 – 0.25 – 1.25 – 3.0 – 5.0 – 6.0 multiplying the values by seven days a week; and for questions 15, 21, 16, 20, 21, 22, 23, 24, 25, 26, 27, 28 these questions correspond to duration in the time ranges 0 – 0.25 – 0.75 – 1.5 – 2.5 – 3.0 and these values are already in weekly form<sup>34,35</sup>.

The collected data were organized and analyzed using the IBM SPSS Statistics software version 22.0 for Windows. First, a double verification was carried out.

Descriptive analyses were performed using absolute and percentage frequency and central tendency measures. Then, bivariate analyses were performed between the outcome variable (level of physical activity during pregnancy) and each independent variable (sociodemographic factors, occupational factors, obstetric factors, behavioral factors, social aspects, health conditions and emotional conditions) using the chi-square test to verify the association between them. Variables with a descriptive level (*p*-value) of up to 20% were selected for multiple analysis. The hierarchical multinomial logistic regression model was used, following the scheme presented in Figure 1, consisting of blocks of variables at distal (education, family income, maternal age, marital status, maternal work and number of children), intermediate (smoking, alcohol consumption, family APGAR and social support) and proximal (pre-pregnancy nutritional status, maternal-fetal attachment, anxiety, stress, self-esteem and body image) levels.

The block of sociodemographic, occupational and obstetric characteristics was the first to be included in the model, remaining as an adjustment factor for the intermediate and proximal levels. Subsequently, the variables of the intermediate level (behavioral factors and social aspects) were included, remaining as an adjustment factor for the variables of the proximal level. Finally, the variables of the proximal level (health and emotional conditions) were included. At all levels, only those variables that presented descriptive level  $p \leq 0.05$  remained in the model, after adjustment for the variables of the previous levels. Adjusted odds ratios (OR) were estimated, with their respective 95%CI values.

The project of this investigation was approved by the Research Ethics Committee, through the Consubstantiated Opinion No. 2,483,623/2018. The participants gave their acquiescence via the Informed Consent Form and, in for minors, the Informed Consent Term was applied. There was also the formal agreement of the PHC Coordination of the Municipal Health Department, through the Institution's Term of Agreement for Participation in Research and Official Letter of the institution.

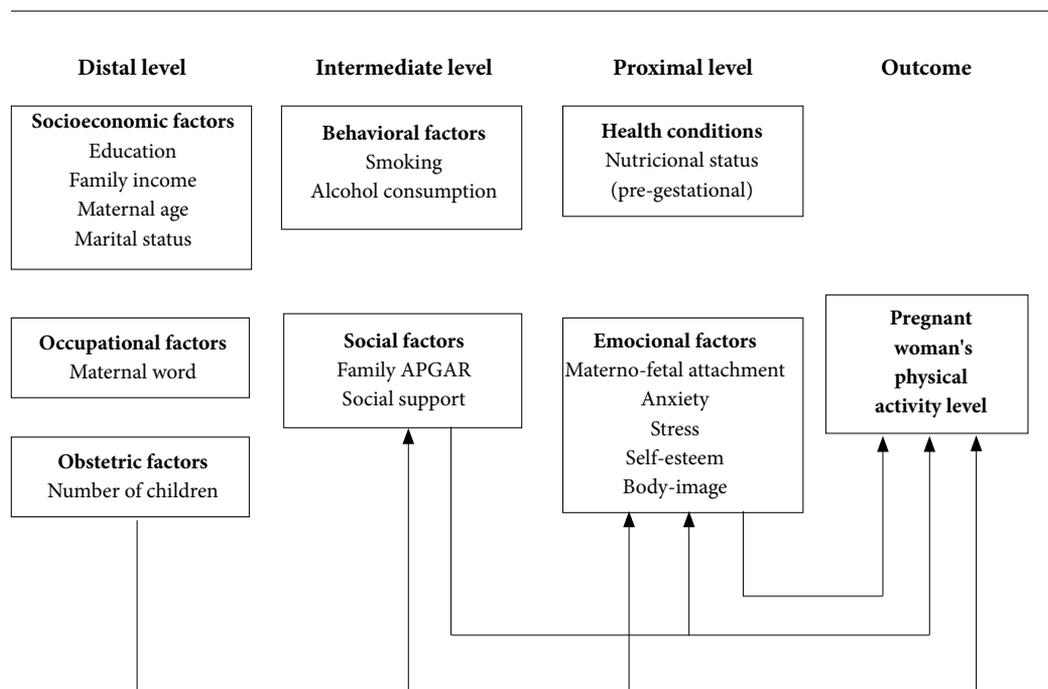
## Results

A total of 1,279 pregnant women participated in the study, most of them (48.7%) between 21 and 30 years old. Regarding marital status, 76.9% reported having a partner. As for education, 64.9% had attended high school. It was observed that 44.9% of the sample received less than one minimum monthly wage. Most of the participants (56.4%) were housewives, "moonlighted" or did not exercise any professional occupation. As for obstetric factors, 49.2% of women had two or more children. Other characteristics are shown in Table 1.

Independent variables that presented *p*-value  $\leq 0.20$  in the bivariate analysis – age ( $p = 0.002$ ), education ( $p < 0.001$ ), family income ( $p < 0.001$ ), maternal work ( $p < 0.001$ ), number of children ( $p = 0.032$ ), maternal-fetal attachment ( $p = 0.155$ ), anxiety ( $p < 0.001$ ), stress ( $p = 0.017$ ) and self-esteem ( $p = 0.133$ ) – were included in the multiple model (Table 1).

Table 2 presents the classification of the levels of physical activity of pregnant women in general and in the dimensions: household chores, caring for people, occupation, sport and exercise, locomotion, and leisure. It was observed that 23.2% were classified as physically inactive in the general domain. In the domain household chores, 64.9% of the respondents presented a pattern classified as physically inactive. Regarding the category of physical activity related to care, 89.0% of those who perform this activity were classified as physically inactive. In the occupation domain, 36.5% of the pregnant women were considered physically inactive. In the sports and locomotion categories, 93.1% and 93.2% were physically inactive, respectively, while 41.4% were considered inactive in the leisure domain.

Considering the physically inactive level as a reference for the dependent variable, results of the multinomial logistic regression indicated statistical evidence of association of the mild level with the variables age from 21 to 30 years (OR = 1.52;  $p = 0.047$ ) and up to 20 (OR = 1.82;  $p = 0.018$ ), income above two salaries (OR = 2.26;  $p = 0.020$ ), salaried work (OR = 1.74;  $p = 0.027$ ) and maternal-fetal attachment at a medium/high level (OR = 1.53;  $p = 0.018$ ). The variables income from one to two minimum wages (OR = 2.53;  $p = 0.006$ ), above two wages (OR = 3.51;  $p = 0.002$ ), salaried work (OR = 4.59;  $p < 0.001$ ) and self-employed (OR = 2.44;  $p = 0.007$ ), high level of anxiety (OR = 2.20;  $p < 0.001$ ), presence of stress symptoms (OR = 1.89;  $p = 0.015$ ) and



**Figure 1.** Hierarchical theoretical model of the possible factors associated with the level of physical activity in pregnant women assisted in primary health care.

Source: Authors.

medium/high maternal-fetal attachment (OR = 1.52;  $p = 0.034$ ) were associated with moderate/vigorous level of physical activity (Table 3).

## Discussion

This epidemiological survey provided an analysis of the performance of physical activity and associated factors among pregnant women assisted by the FHS teams. According to the findings, approximately half of the pregnant women practiced mild physical activity and one third moderate/vigorous in the general domain. In this same domain and in the others, a significant portion of the participants was considered physically inactive. The following statistical evidence of association was found: mild level of physical activity was associated with the factors age from 21 to 30 and up to 20 years, income above two minimum wages, paid work, and maternal-fetal attachment at a medium/high level. Income from one to two minimum wages and above two wages, employed and self-employed work, the presence of anxiety and stress symptoms, in addition to medium/

high maternal-fetal attachment, were factors associated with moderate/vigorous level.

These results are relevant because they allow the recognition of factors that hinder the adoption of a more physically active lifestyle<sup>40</sup>. The practice of physical activity is related to positive outcomes for the health of the woman and child to be born, such as the lower risk for the development of gestational diabetes, hypertension, excessive gestational weight gain, preeclampsia, and depression symptoms. To date, there is no evidence of negative effects of moderate-intensity physical activity in healthy pregnant women<sup>41,42</sup>. It is widely argued that, in the absence of obstetric complications, the continuity or starting of safe physical activity should be encouraged. Considering that this behavior contributes to the prevention of negative events and health promotion, it is also beneficial to the health system<sup>41,43</sup>. The FHS is a strategic scenario for actions to promote body practices and physical activity<sup>41</sup>. Multiprofessional prenatal care is necessary, with the inclusion of physical education professionals in PHC, to guide the adoption of health-related behaviors<sup>40</sup>.

**Table 1.** Characterization of the sample and bivariate analysis for the levels of physical activity in pregnant women assisted in primary health care. Montes Claros, MG, Brazil, 2018/2019 (n = 1,279).

Variables	Characterization		Níveis de atividade física				p-value
	n	%	Physically inactive n (%)	Mild n (%)	Moderate/Vigorous n (%)	Total n (%)	
<b>Distal Level</b>							
<b>Socioeconomic factors</b>							
Age							
Over 30*	360	29.4	53 (17.4)	133 (43.8)	118 (38.8)	304 (100.0)	0.002
21 to 30 years old	597	48.7	116 (22.1)	230 (43.9)	178 (34.0)	524 (100.0)	
Up to 20 years	268	21.9	76 (31.8)	95 (39.7)	68 (28.5)	239 (100.0)	
Marital Status							
With partner*	979	76.7	196 (23.0)	364 (42.7)	292 (34.3)	852 (100.0)	0.860
Without partner	297	23.3	61 (23.6)	114 (44.0)	84 (32.4)	259 (100.0)	
Education							
Elementary school*	194	15.2	50 (29.8)	78 (46.4)	40 (23.8)	168 (100.0)	< 0.001
High school	829	64.9	181 (25.0)	296 (40.9)	246 (34.0)	723 (100.0)	
Higher education/graduation	254	19.9	27 (12.2)	103 (46.6)	91 (41.2)	221 (100.0)	
Family income							
Up to half a wage*	126	10.3	41 (35.0)	53 (45.3)	23 (19.7)	117 (100.0)	< 0.001
Half to less than a wage	424	34.6	114 (29.9)	166 (43.6)	101 (26.5)	381 (100.0)	
One to two wages	410	33.4	62 (17.8)	147 (42.2)	139 (39.9)	348 (100.0)	
Above two wages	266	21.7	25 (11.2)	92 (41.3)	106 (47.5)	223 (100.0)	
<b>Occupational factors</b>							
Maternal work							
Housewife/moonlighting/none*	721	56.4	201 (30.9)	292 (44.9)	157 (24.2)	650 (100.0)	< 0.001
Salaried	426	33.3	36 (10.3)	132 (37.8)	181 (51.9)	349 (100.0)	
Self-employed	131	10.3	20 (17.5)	54 (47.4)	40 (35.1)	114 (100.0)	
<b>Obstetric factors</b>							
Number of children							
None*	147	13.4	26 (21.1)	44 (35.8)	53 (43.1)	123 (100.0)	0.032
1 child	409	37.4	84 (23.3)	174 (48.2)	103 (28.5)	361 (100.0)	
2 or more	539	49.2	112 (23.5)	198 (41.5)	167 (35.0)	477 (100.0)	

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The results of this study indicated the low prevalence of physical activity among the participants. In basic health units in Fortaleza – Ceará/ Brazil, a considerable portion (51.4%) of the participants also identified a level of mild energy expenditure<sup>35</sup>. Research in Rio Grande – RS also found that approximately one third (32.8%) of the sample investigated reported practicing some physical activity<sup>44</sup>. Research with pregnant women living in Vitória da Conquista – Bahia/ Brazil classified 52% of the surveyed women as physically inactive<sup>17</sup>. Comparisons between such prevalences should be viewed with care, due to the population, cultural, and methodological dif-

ferences in the various study scenarios.

The physical discomforts triggered by organic adjustments of pregnancy and the conceptions of society that worships the reduction of physical activity in this phase as care may explain the expressive prevalence of physical inactivity. The implementation and development of public policies focusing on the orientation and encouragement of such activity for this group should be considered to overcome these challenges represented by physical and cultural issues<sup>20</sup>.

When grouping a set of questions that seek to identify the daily time spent on energy in the various situations of daily life in the form of

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Variables	Characterization		Níveis de atividade física				p-value
	n	%	Physically inactive n (%)	Mild n (%)	Moderate/Vigorous n (%)	Total n (%)	
<b>Intermediate Level</b>							
<b>Behavioral Factors</b>							
Smoking							
No*	1,225	96.1	244 (23.0)	458 (43.1)	361 (34.0)	1,063 (100.0)	0.576
Yes	50	3.9	14 (29.2)	18 (37.5)	16 (33.3%)	48 (100.0)	
Alcohol consumption							
No*	1,127	88.5	229 (23.4)	416 (42.5)	333 (34.0)	987 (100.0)	0.883
Yes	147	11.5	29 (22.0)	59 (44.7)	44 (33.3)	132 (100.0)	
Family APGAR							
Functional family *	1,062	83.4	212 (23.1)	394 (43.0)	310 (33.8)	916 (100.0)	0.949
Dysfunctional family	211	16.6	46 (23.7)	81 (41.8)	67 (34.5)	194 (100.0)	
Familia disfuncional	211	16,6	46 (23,7)	81 (41,8)	67 (34,5)	194 (100,0)	
Social support							
Low*	237	18.8	48 (23.0)	97 (46.4)	64 (30.6)	209 (100.0)	0.417
High	1,024	81.2	210 (23.6)	370 (41.7)	308 (34.7)	888 (100.0)	
<b>Proximal Level</b>							
<b>Health conditions</b>							
BMI							
Underweight*	155	18.8	34 (26.0)	53 (40.5)	44 (33.6)	131 (100.0)	0.214
Adequate	293	35.6	64 (24.9)	106 (41.2)	87 (33.9)	257 (100.0)	
Overweight	375	45.6	58 (18.4)	152 (48.1)	106 (33.5)	316 (100.0)	
<b>Emotional conditions</b>							
Maternal-fetal attachment							
Low*	436	35.4	103 (26.8)	155 (40.4)	126 (32.8)	384 (100.0)	0.155
Medium/high	797	64.6	150 (21.7)	306 (44.3)	235 (34.0)	691 (100.0)	
Anxiety							
Low level*	657	54.6	159 (27.7)	252 (43.8)	164 (28.5)	575 (100.0)	<0.001
High level	547	45.4	86 (18.0)	201 (42.0)	192 (40.1)	479 (100.0)	
Stress							
Absence of symptoms*	1,049	83.4	223(24.6)	394(43.4)	291(32.0)	901(100.0)	0.017
Presence of symptoms	209	16.6	33(17.6)	76(40.4)	79(42.0)	188(100.0)	
Self-esteem							
Low*	16	1.3	1 (7.1)	5 (35.7)	8 (57.1)	14 (100.0)	0.133
Medium/High	1248	98.7	255 (23.5)	467 (43.0)	364 (33.5)	1,086 (100.0)	
Body image							
Positive*	586	47.9	116 (22.5)	225 (43.6)	175 (33.9)	516 (100.0)	0.764
Negative	638	52.1	132 (24.2)	228 (41.8)	185 (33.9)	545 (100.0)	

\*Reference category.

Source: Authors.

physical activity, it was found in the leisure category the greatest representation of energy expenditure with about one third of those surveyed in the moderate/vigorous classification of physical activity. This result differs from research with low-risk pregnant women assisted in the PHC of

Fortaleza, which reported the highest energy expenditure in the category household chores, with 54.4% at the moderate/vigorous level<sup>35</sup>.

In the sport and exercise category, 93.1% of the interviewees were classified as physically inactive, results similar to those found in a study con-

**Table 2.** Classification of physical activity levels of pregnant women assisted in primary health care by domain. Montes Claros, MG, Brazil, 2018/2019 (n = 1,279).

Domains	Physically inactive n (%)	Níveis de atividade física		Sample loss * n (%)
		Mild n (%)	Moderate/vigorous n (%)	
Overall	258 (23.2)	478 (42.8)	378 (34.0)	165 (12.9)
Household chores	797 (64.9)	425 (34.6)	6 (0.5)	51 (3.9)
Caring for people	684 (89.0)	72 (9.4)	12 (1.6)	511 (39.9)
Occupation	226 (36.5)	179 (29.0)	213 (34.5)	661 (51.6)
Sports & Exercise	624 (93.1)	44 (6.6)	02 (0.3)	609 (47.6)
Locomotion	1,055 (93.2)	64 (5.6)	14 (1.2)	146 (11.4)
Leisure	475 (41.4)	271 (23.7)	401(35.0)	131 (10.2)

\*Absence of complete answers in the domain of the instrument on physical activity.

Source: Authors.

**Table 3.** Adjusted model of multinomial logistic regression of factors associated with levels of physical activity in pregnant women assisted in primary health care. Montes Claros, MG, Brazil, 2018/2019 (n = 1,279).

Variables	Levels of physical activity					
	Mild			Moderate/vigorous		
	OR	IC 95%	p-value	OR	IC95%	p-value
Age						
Over 30*	1	-		1	-	
21 to 30 years old	1.52	1.01-2.31	0.047	1.20	0.76-1.90	0.434
Up to 20 years	1.82	1.11-2.97	0.018	1.36	0.80-2.33	0.259
Income						
Up to half a wage*	1	-		1	-	
Half to less than a wage	1.14	0.68-1.89	0.628	1.50	0.80-2.82	0.209
One to two wages	1.52	0.87-2.65	0.143	2.53	1.30-4.90	0.006
Above two wages	2.26	1.14-4.49	0.020	3.51	1.62-7.64	0.002
Work						
Housewife/moonlighting/none*	1	-		1	-	
Salaried	1.74	1.07-2.84	0.027	4.59	2.78-7.59	< 0.001
Self-employed	1.48	0.80-2.74	0.214	2.44	1.27-4.69	0.007
Anxiety						
Low level*	1	-		1	-	
High level	1.42	1.0-2.03	0.052	2.20	1.50-3.22	< 0.001
Stress						
Absence of symptoms*	1	-		1	-	
Presence of symptoms	1.18	0.72-1.94	0.510	1.89	1.13-3.16	0.015
Maternal-fetal attachment						
Low*	1	-		1	-	
Medium/high	1.53	1.07-2.17	0.018	1.52	1.03-2.22	0.034

OR: odds ratio, CI: 95% confidence interval, Reference category for physical activity level: physically inactive.

\* Reference category. Model adjustment quality: Goodness-Pearson = 388.086, p = 0.166, Pseudo R2 Nagelkerke = 0.159, -2 Log Likelihood = 770.463, p < 0.001.

Source: Authors.

ducted with women between the 20th and 28th weeks of pregnancy, followed up in prenatal care of basic health units in the city of Manaus/AM<sup>45</sup>. The high prevalence of inactivity in this domain may mean that the pregnant woman does not practice systematized physical activity, with the recommended intensity, frequency and duration<sup>4</sup>.

The practice of light physical activity was significantly more frequent in pregnant women with younger age groups, a result similar to those found in Pelotas-RS<sup>46</sup>, Bristol-England<sup>47</sup> and Beirut-Lebanon<sup>48</sup>. The possible explanation for the relationship between younger age and physical activity during pregnancy may be due to the fact that younger women are more concerned with body image and adopt a healthier lifestyle, thus recognizing the contribution of regular and oriented physical activity during pregnancy.

The practice of physical activity at the mild level and at the moderate/vigorous level showed statistical evidence of association with the factors: family income, maternal work, anxiety, and maternal-fetal attachment. It was observed that the highest income was associated with the practice of physical activity at the mild and moderate/vigorous levels. Divergent results were observed in an investigation conducted with a sample of 1,171 pregnant women from Singapore, in which those with higher family income were more likely to reduce physical activity<sup>16</sup>. But they were similar to those of research with pregnant women attended in the PHC of Vitória da Conquista/BA, in which income greater than two minimum wages served as a protective factor for a higher level of physical exercise<sup>17</sup>.

Low family income showed statistical evidence of association, with a three times higher probability of physical inactivity in a cross-sectional study conducted with a sample of 400 pregnant women in high-risk prenatal care in Massachusetts-USA<sup>19</sup>. An investigation carried out with the objective of evaluating the status of physical activity in pregnant women identified that the indices vary according to family income<sup>15</sup>. It was also found an association of physical activity with age and income in a study in the USA with a sample of 1,280 pregnant women<sup>49</sup>.

A study developed in the city of Cruz das Almas, Bahia/Brazil, with the participation of women of gestational age equal to or greater than 28 weeks found low income as one of the determinants of physical inactivity in pregnancy<sup>50</sup>. The explanation for the association between higher income and physical activity may be due to the knowledge of pregnant women about the

appropriate exercises for this phase of life, as well as greater opportunities to perform it. The higher income also provides women with greater access to knowledge and understanding about the importance of physical activity for the health and well-being of pregnant women and their babies<sup>51</sup>.

Maternal paid work was associated with physical activity at the mild and moderate/vigorous levels, while self-employment was associated with moderate/vigorous levels. This result contrasts with those of a study developed with low-risk pregnant women assisted in the PHC of Botucatu/SP, which observed that working outside the home reduced the chance of reaching the recommended level of activity<sup>18</sup>. In a prospective study in Recife/PE, with obese and overweight pregnant women, when evaluating the work/occupational activity variable, and a 0.63 mean MET increase was observed for those who worked in relation to those who did not work<sup>52</sup>.

The positive effect of maternal work on the practice of physical activity during pregnancy is probably due to the fact that women who perform any professional activity outside the home can value their health more and recognize the importance of physical exercise for the health of the baby, as well as to maintain and improve their physical and emotional condition during pregnancy and postpartum recovery. Added to this is the fact that occupational activity provides greater body movement and, consequently, generates greater energy expenditure<sup>52</sup>.

The presence of anxiety and stress symptoms was associated with moderate/vigorous physical activity. The high level of anxiety was also borderline related to the practice of light physical activities. These results differ from those assumed a priori and differ from those recorded in São Luís/Maranhão<sup>53</sup>. A possible hypothesis is that pregnant women with such symptoms have sought to exercise more, after professional recommendations, as a form of mental health care. One should consider the cross-sectional nature of the current investigation, which does not allow defining a temporal and causality statement for the recorded result. Thus, longitudinal design and intervention investigations may better elucidate this finding.

One must also consider the relationship between the practice of regular physical activity and the presence of anxiety and stress symptoms. This is because pregnancy is considered a period in the life of women of greater vulnerability regarding mental health. An active lifestyle characterized by higher levels of physical activity can contribute to the psychic health of pregnant women, re-

ducing anxiety and stress. Psychological well-being is desirable for maternal and fetal health, and may have positive implications throughout child development and later, in adulthood<sup>42,54,55</sup>.

Greater maternal-fetal attachment was also a factor that was associated with physical activity at the mild and moderate/vigorous levels. This finding suggests that physical activity is a self-care behavior, which can provide a general feeling of health and physical well-being. It is a sensation that benefits the adaptation to pregnancy, the successful transition to motherhood and, consequently, the affective bond with the fetus<sup>54</sup>. Attachment includes behaviors and feelings of care, protection and integration with the fetus, expressed through affection, emotions, perceptions, concerns and expectations<sup>56</sup>. Although this construct is a predictor of the pregnant woman's behavior, there are gaps in evidence about its influence on the practice of physical activity.

This work has some limitations. One of them was the self-report, which may have been affect-

ed by social desirability and memory bias. The results obtained are valid only for the population of pregnant women assisted in the FHS units of Montes Claros, so extrapolations to other populations are not possible. It is suggested the development of further research on the subject, with longitudinal design, to explain cause and effect relationships for the associations detected.

Despite these limitations, it is worth noting the positive aspects of this survey. To measure physical activity and variables related to subjective constructs, instruments validated in Brazil were applied. The multinomial logistic regression analysis, with a hierarchical approach to the factors investigated, gave greater robustness and consistency to this investigation. The sample investigated was significant and representative of the population, strengthening the results and associations recorded. The findings obtained contribute to add epidemiological evidence on the importance of assessing physical activity and its determinants in pregnant women.

### **Collaborations**

IGC Freitas, CA Lima and VM Santos contributed to the conception and development of the study, data interpretation and elaboration of the article. FT Silva contributed to the analysis and interpretation of the data and critical review of the article. JSB Rocha, OV Dias, RRV Silva and MFSF Brito contributed to the study orientation, study conception and design, data analysis and critical review of the article. All authors reviewed and approved the final version of the article.

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