

ORIGINAL ARTICLE

## Factors Associated With Cesarean Delivery in Women Followed-up in Primary Care

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**Highlights:**

1. Malnutrition and obesity are risk factors for cesarean birth.
2. Hypertension during pregnancy associated with cesarean section.
3. Anxiety symptoms during pregnancy are a risk factor for cesarean delivery.

**ABSTRACT**

The aim of this study was to check the anthropometric characteristics and factors associated with cesarean delivery in women followed-up in the primary care network of São Luís - MA. This is a cohort study, carried out with pregnant women who underwent prenatal care in Primary Health Care Units (PHCUs) in São Luís - MA and were followed-up up to 42 days after delivery. Statistical analysis was performed using Stata®, version 16.0, where Poisson Regression was used. For acceptance of the investigated associations in the final model, a value of  $p < 0.05$  was adopted. Of the 80 monitored women, 49.37% had a cesarean delivery, 5.33% started the pregnancy with malnutrition and 41.33% with excess weight at the end of pregnancy, 14.47% were malnourished and 46.5% were overweight. The factors associated with cesarean delivery were: adolescent pregnancy (RRI: 2.26; CI: 1.20-4.25), low level of education, which was classified as illiterate/incomplete elementary school I (RRI: 3.57; CI: 2.61-4.88), having had  $\geq 1$  pregnancies (RRI: 0.53; CI: 0.16-1.72), having anxiety symptoms (RRI: 2.24; CI: 1.20-4.19) and arterial hypertension during pregnancy (RRI: 5.75; CI: 1.18-2.81), having started the pregnancy with malnutrition (RRI: 6.79; CI: 1.43-3.22) and being obese at the end of pregnancy (RRI: 2.64; CI: 1.11-6.26). It is necessary to improve nutritional assistance during prenatal consultations, with the aim of preventing malnutrition and overweight, thus minimizing complications arising from nutritional status.

**Keywords:** Pregnancy. Cesarean Section. Malnutrition. Overweight. Obesity.

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## INTRODUCTION

In Brazil, there has been an increase in cesarean sections compared to normal births, as well as excessive interventions during vaginal births, in recent years<sup>1</sup>. It is also observed that research has been corroborating and highlighting the influence of nutritional status on the type of delivery<sup>2</sup>.

During pregnancy, several changes take place, such as physiological and anatomical changes, where nutritional needs become greater than normal, also influenced by the social, cultural and socioeconomic context<sup>3</sup>. However, recently, there has been an increase in weight gain during pregnancy, which exceeds the recommended limit, interfering with gestational outcomes<sup>1</sup>.

Gestational outcomes have a direct correlation with the health or nutritional status of the mother and are both related to excess weight and insufficient weight during pregnancy, which can lead to unfavorable outcomes, such as hypertension and gestational diabetes, cesarean section, prematurity, low birth weight and macrosomia<sup>4-5,3</sup>.

There is still a deficiency in nutritional assistance and basic information about diet, gestational weight gain and breastfeeding during prenatal care. Therefore, following-up or monitoring by a multi-disciplinary team in prenatal care is extremely important, since it enables early intervention, thus reducing maternal and fetal risks<sup>5</sup>. Excessive weight gain or inadequate diet during pregnancy requires more effective methods for monitoring nutritional status<sup>3</sup>.

The significant increase in pregnant women with weight gain is noticeable, which can lead to an increase in cesarean deliveries, and Brazil is recognized as one of the countries with the highest number of cesarean deliveries in the world. Due to this situation, the rate of surgical births is higher than the 15% limit recommended by the World Health Organization<sup>6</sup>.

The high percentage of cesarean deliveries includes not only deliveries performed in private institutions, but also includes public maternity hospitals<sup>7</sup>. The Brazilian Ministry of Health recommends cesarean section as an intervention method if there is a risk to mother and fetus. Despite having gained greater attention, the rate of cesarean deliveries is classified as an epidemic by the World Health Organization<sup>6</sup>. This reality causes increased risks during birth, such as maternal and perinatal morbidity and mortality and increased costs in health services<sup>7</sup>. Given this growing trend, there is concern and questioning about epidemiological changes, as well as the factors that lead to cesarean deliveries.

Nevertheless, some studies have already highlighted different types of non-clinical factors associated with the increase in the rate of cesarean sections in private clinics, such as socioeconomic characteristics and professional influences<sup>8-9,7,10</sup>. Considering that nutritional status can influence the route of delivery and is of great relevance given the increase in the percentage of cesarean deliveries, the current study checked the anthropometric characteristics and factors associated with cesarean deliveries in women followed-up in the primary care network of São Luís – MA.

## MATERIAL AND METHODS

This was a longitudinal cohort study, conducted from February 2021 to May 2022. The research was held in the city of São Luís - MA, in four Primary Health Care Units (PHCUs). The sample was non-probabilistic, totaling 80 women.

The cohort study is a type of observational study that starts from exposure towards the outcome, that is, it consists of observing and analyzing the relationship between the presence of risk factors and the development of illnesses. Participants are followed-up for a period to identify new cases of the outcome (CAMARGO; SILVA; MENEGUETTI, 2019)<sup>11</sup>.

Data collection was held by a multidisciplinary team made up of students from the Nutrition, Medicine and Physiotherapy courses, which went to PHCUs, the place where pregnant women had their prenatal appointments. The pregnant women were approached, the stages of the research were explained to them, and then the Free and Informed Consent Form (FICF) and the Free and Informed Assent Form (FIAF) were read out to them. Accordingly, the questionnaires were administered and some of the necessary information was collected from the prenatal care booklet. In order to continue the research, the interviewee was asked to contact us to arrange the next stage when she was already in the puerperium.

Pregnant and puerperal women who were followed-up in the third trimester of pregnancy and in the puerperal period participated in the research. The inclusion criteria used were: pregnant adolescents and adults with a single fetus. Conversely, twin pregnancies and those who did not agree to sign the FICF or FIAF were not included. Moreover, women who did not respond to the puerperium-related questionnaire during the research period were excluded (n=45), according to Flowchart 1.

Four questionnaires were administered, three during pregnancy and one in the puerperium. For this work, in the questionnaire applied during pregnancy, socioeconomic and demographic variables were evaluated (age, education, race, marital status and economic class); anthropometric characteristics (weight before pregnancy, weight at the end of pregnancy and height), reproductive characteristics (number of deliveries) and lifestyle habits (physical exercise during pregnancy).

In order to identify the economic class, the questionnaire from the Brazilian Association of Research Companies (ABEP, as per its Portuguese acronym) was used, which categorizes households through the point system in quantitative variables of bathrooms, maids, automobiles, microcomputer, dishwasher, refrigerator, freezer, washing machine, DVD, microwave, motorcycle and clothes dryer. The classification was made using the number of items mentioned by each of the interviewees, which could vary from 0 to 4 or more in terms of possession of the items. Similarly, the level of education of the head of the family was considered, with a score for each level of education: 0, Illiterate/Incomplete Elementary School I; 1, Complete Elementary School I/ Incomplete Elementary School II; 2, Complete Elementary School II/Incomplete High School; 4, Complete High School/Incomplete Higher Education; 7, Complete Higher Education. They were also asked about access to public services, such as running water and paved streets. From the collected points, the classes were categorized according to the obtained score, and then the classes were classified into A, B1 and B2, C1, C2 and D/E<sup>12</sup>.

Regarding anthropometric data, the weight before pregnancy was self-reported by the pregnant woman and the height was collected from the prenatal record of each pregnant woman. The pre-pregnancy BMI was based on the classification of the National Academy of Sciences of the Institute of Medicine<sup>13</sup> as underweight: <18.5 kg/m<sup>2</sup>; eutrophy: 18.5 - 24.9 kg/m<sup>2</sup>; overweight: 25 - 29.9 kg/m<sup>2</sup> and obesity ≥ 30kg/m<sup>2</sup>.

In order to evaluate anxiety symptoms, the Depression, Anxiety and Stress Scale (DASS-21) was used, consisting of a set of three scales to measure the negative emotional state related to depression, anxiety and stress. This is an instrument composed of 42 items, where each dimension contains 14 items, divided into subscales of 2 to 5 items with similar content. The anxiety scale evaluates autonomic arousal, effects on skeletal muscle, situational anxiety and subjective experience of anxious affect<sup>14</sup>. For the final score, the anxiety subscale values were added and analyzed according to the classification of the anxiety symptoms manifested by them: 0-3 = normal; 4-5 = mild; 6-7 = moderate; 8-9 = severe; and ≥10 = extremely severe<sup>15</sup>. Subsequently, this variable was categorized into “with anxiety symptoms” and “without anxiety symptoms”.

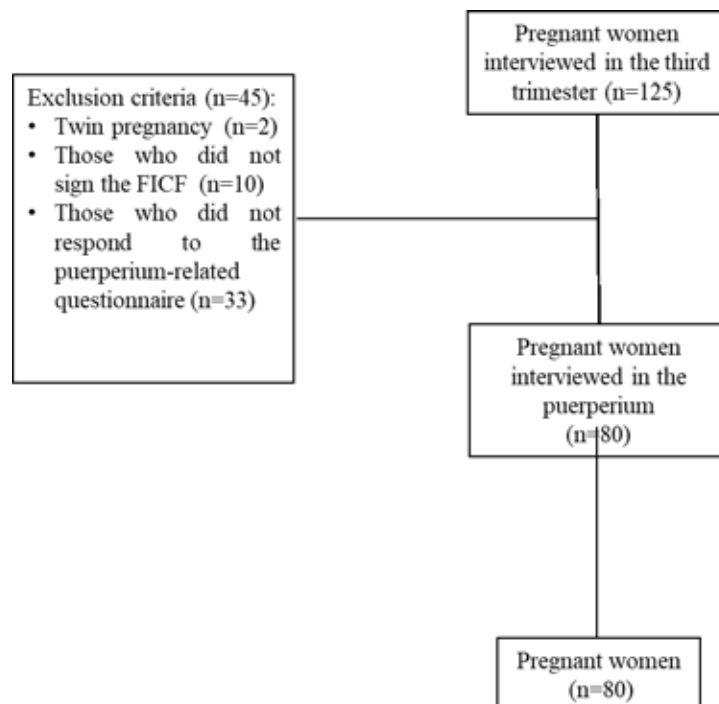
In order to identify Food and Nutritional Insecurity (FNI), the Brazilian Food Insecurity Scale (EBIA, as per its Portuguese acronym) was used. EBIA provides questions that allow the identification

and indication of Food and Nutritional Security (FNS) and FNI. It is a very cost-effective tool. It consists of 14 questions, with “yes” or “no” responses referring to the last three months, with a final score resulting from the sum of positive responses. It has three types of classification for IAN: mild food and nutritional insecurity, moderate food and nutritional insecurity and severe food and nutritional insecurity<sup>16</sup>. This variable was categorized into: “food and nutritional security” and “food and nutritional insecurity”.

In the puerperium, up to 42 days after birth, variables were collected to identify clinical characteristics (diseases diagnosed during pregnancy and risky pregnancies); anthropometric characteristics (weight at the end of pregnancy) and reproductive characteristics (type of delivery and reason for choosing it). The weight at the end of the pregnancy was collected from the prenatal care booklet of pregnant women referring to the information about the date of the last consultation. With the weight and height data, the Body Mass Index ( $BMI = \text{weight}/\text{height}^2$ ) was calculated and the nutritional status at the end of pregnancy was classified according to the Atalah curve (1997)<sup>17</sup>, taking into account the gestational week.

The collected data were tabulated and organized in Microsoft Office Excel®, version 2011, and later transferred for analysis in the Stata® program, version 16.0. Qualitative variables were described by absolute and relative frequencies. Multivariate analysis was also performed using the Poisson regression method, where all variables associated with the outcome variable (cesarean delivery) with statistical significance of up to 20% were included in the multiple models. In order to accept the associations investigated in the final model, a value of  $p < 0.05$  was adopted. As this is a longitudinal epidemiological cohort study, RRI (relative risk index) was used, that is, the probability of an event happening in exposed people compared to the probability of the event happening in non-exposed people.

This study is part of a larger project entitled “Gestational Cohort”, which was approved by the Research Ethics Committee (REC) of the *Centro Educacional Universitário do Maranhão* (CEUMA, as per its Portuguese acronym) (Opinion Nº 3.258.471). All pregnant women signed the FICF or FIAF before data collection.



Flowchart 1. Flowchart of pregnant and puerperal women interviewed in Primary Health Care Units in São Luís- MA and exclusion criteria.

Source: Designed by the authors, 2023.

## RESULTS

A total of 80 women were followed-up during the last trimester of pregnancy and the puerperium, of which 51.25% (n=41) were aged 20 to 29 years. Most pregnant women self-declared to be brown (65%; n=52) and 43.59% (n=34) lived with their partners. When checking education, it was observed that 57.50% (n=46) had complete high school/incomplete higher education. With regard to economic class, 90.54% (n=67) were from economic classes C1, C2 and D/E. Taking lifestyle into consideration, 93.67% (n=74) did not practice physical exercise during pregnancy (Table 1).

Table 1. Socioeconomic, demographic and lifestyle characteristics of women followed-up during prenatal and puerperium in Primary Health Care Units. São Luís – MA, 2023.

Variables	n	%
<b>Age group (years)</b>		
≤ 19	12	15.00
20 - 29	41	51.25
≥ 30	27	33.75
<b>Race</b>		
White	18	22.50
Black	10	12.50
Brown	52	65.00
<b>Marital status*</b>		
Living with a partner	34	43.59
Single	19	24.36
Married	13	16.67
Stable union	12	15.38
<b>Education</b>		
Illiterate/Incomplete Elementary School I	3	3.75
Complete Elementary School I/Incomplete Elementary School II	5	6.25
Complete Elementary School II/Incomplete High School	18	22.50
Complete High School/Incomplete Higher Education	46	57.50
Complete Higher Education	8	10.00
<b>Economic class*</b>		
B1 and B2	7	9.46
C1, C2 and D/E	67	90.54
<b>Physical exercise during pregnancy*</b>		
No	74	93.67
Yes	5	6.33
<b>Total</b>	<b>80</b>	<b>100</b>

\*Sample losses

Source: Designed by the authors, 2023.

Regarding reproductive characteristics, 73.08% (n=57) declared that the pregnancy was unplanned and 19.48% (n=15) had a risky pregnancy. As for the type of delivery, 50.63% (n=40) had a normal birth and 49.37% (n=39) had a cesarean section, showing similar percentages, and 94.87% (n=74) had a full-term birth. It was also found that 53.85% (n=42) of pregnant women manifested anxiety symptoms during pregnancy (Table 2).

Table 2. Clinical, reproductive and anthropometric characteristics of women followed-up during prenatal and puerperium in Primary Health Care Units. São Luís – MA, 2023.

Variables	N	%
<b>Planned pregnancy*</b>		
No	57	73.08
Yes	21	26.92
<b>Risky pregnancy</b>		
No	62	80.52
Yes	15	19.48
<b>Number of deliveries</b>		
0	40	48.19
1	27	32.53
2	13	19.28
<b>Type of delivery*</b>		
Vaginal	40	50.63
Cesarean	39	49.37
<b>Gestational age at the time of delivery*</b>		
Full-term	74	94.87
Premature	4	5.13
<b>Anxiety symptoms during pregnancy*</b>		
No	36	46.15
Yes	42	53.85

\*\*Sample losses

Source: Designed by the authors, 2023.

With respect to pre-pregnancy nutritional status, 53.33% (n=40) were eutrophic and 41.33% (n=31) were overweight. At the end of pregnancy, the number of eutrophic pregnant women decreased to 39.47% (n=30), just as there was an increase in the percentage of excess weight (46.05%) (Chart 1).

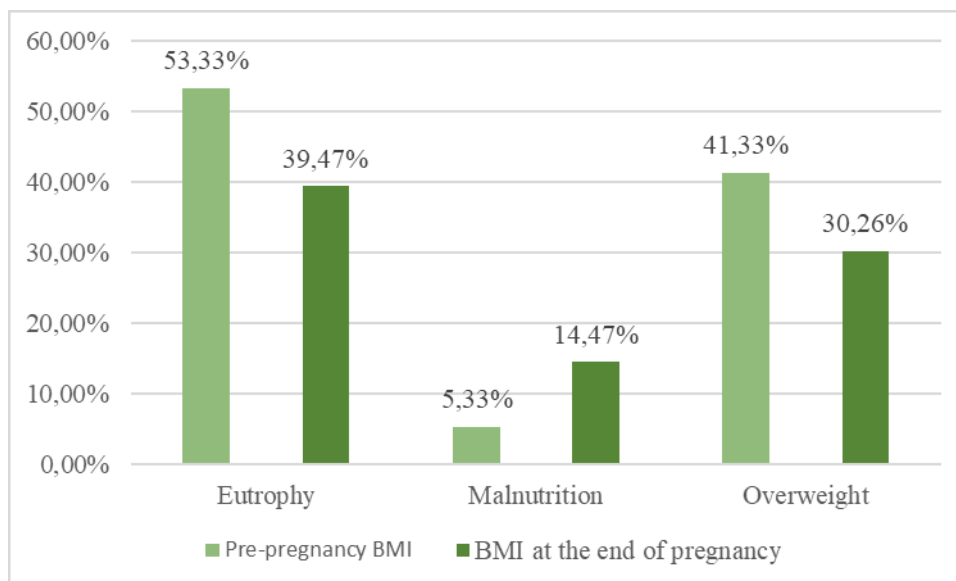


Chart 1. Pre-pregnancy nutritional status and status at the end of pregnancy of women followed-up during prenatal and puerperium in Primary Health Care Units. São Luís – MA, 2023.

In the non-adjusted analysis, adolescent pregnancy (RRI: 1.66; CI: 0.95-2.90), education, being illiterate/incomplete elementary school I (RRI: 4.25; CI: 1.36-1.33), complete elementary school I/incomplete elementary school II (RRI: 0.40; CI: 0.13-1.17), complete elementary school II/incomplete high school (RRI: 0.44; CI: 0.26-0.74), complete high school/incomplete higher education (RRI: 0.46; CI: 0.34-0.63), having had two births (RRI: 0.30; CI: 0.04-1.86), have anxiety symptoms (RRI: 1.68; CI: 1.02-2.78), having had one or more pregnancies (RRI: 0.83; CI: 0.62-1.10), arterial hypertension during pregnancy (RRI: 1.76; CI: 5.50-5.61), having started the pregnancy with malnutrition (RRI: 0.60; CI: 0.10-3.50) and having obesity at the end of pregnancy (RRI: 2.72; CI: 1.08 - 6.84) were factors associated with cesarean section (Table 3).

In the final model, adolescent pregnancy (RRI: 2.26; CI: 1.20-4.25), education, being illiterate/incomplete elementary school I (RRI: 3.57; CI: 2.61-4.88), complete elementary school I/incomplete elementary school II (RRI: 0.18; CI: 0.44-0.81), complete elementary school II/incomplete high school (RRI: 0.43; CI: 0.21-0.87), complete high school/incomplete higher education (RRI: 0.46; CI: 0.22-0.94), having had two births (RRI: 1.98; CI: 3.78-8.99), having anxiety symptoms (RRI: 2.24; CI: 1.20-4.19), arterial hypertension during pregnancy (RRI: 5.75; CI: 1.18-2.81), having started the pregnancy with malnutrition (RRI: 6.79; CI: 1.43-3.22) and being obese at the end of pregnancy (RRI: 2.64; CI: 1.11-6.26) were factors associated with cesarean section (Table 3).

Table 3. Non-adjusted and adjusted analyses of factors associated with cesarean sections of women followed-up during prenatal and puerperium in Primary Health Care Units. São Luís – MA, 2023.

Variables	Cesarean Delivery					
	RRI	Non-adjusted 95% CI	p-value	RRI	Adjusted 95% CI	p-value
<b>Age group (years)</b>						
20 – 29	1	-	1	1	-	1
≥ 30	1.38	(0.83-2.31)	0.208	1.33	(0.80-2.20)	0.261
≤ 19	1.66	(0.95-2.90)	<b>0.071</b>	2.26	(1.20-4.25)	<b>0.011</b>
<b>Education</b>						
Complete Higher Education	1	-	1	1	-	1
Complete High School/ Incomplete Higher Education	0.46	(0.34-0.63)	<b>&lt; 0.001</b>	0.46	(0.22-0.94)	<b>0.034</b>
Complete Elementary School II/Incomplete High School	0.44	(0.26-0.74)	<b>0.002</b>	0.43	(0.2-0.87)	<b>0.020</b>
Complete Elementary School I/Incomplete Elementary School II	0.40	(0.13-1.17)	<b>0.097</b>	0.18	(0.44-0.81)	<b>0.025</b>
Illiterate/Incomplete Elementary School I	4.25	(1.36-1.33)	<b>&lt; 0.0001</b>	3.57	(2.61-4.88)	<b>&lt; 0.0001</b>
<b>Number of deliveries</b>						
0	1	-	1	1	-	1
1	1.20	(0.69-2.00)	0.501	8.30	(0.71-96.50)	0.091
2	0.30	(0.04-1.86)	<b>0.198</b>	5.83	(3.78-8.99)	<b>&lt; 0.0001</b>
<b>Physical exercise during pregnancy</b>						
Yes	1	-	1	1	-	1
No	0.58	(0.35-0.96)	<b>0.036</b>	0.90	(0.45-1.78)	0.766
<b>Food and Nutritional Security</b>						

FNS	1	-	1	1	-	1
FNI	0.64	(0.40-1.00)	<b>0.052</b>	0.91	(0.55-1.49)	0.721
<b>Pre-pregnancy BMI</b>						
Eutrophy	1	-	1	1	-	1
Malnutrition	0.60	(0.10-3.50)	0.579	6.79	(1.43-3.22)	<b>&lt; 0.0001</b>
Overweight	1.41	(0.87- 2.29)	0.160	0.69	(0.38-1.25)	0.225
<b>Anxiety symptoms during pregnancy</b>						
No	1	-	1	1	-	1
Yes	1.68	(1.02-2.78)	<b>0.041</b>	2.24	(1.20-4.19)	<b>0.011</b>
<b>Number of pregnancies</b>						
0	1	-	1	1	-	1
≥ 1	0.83	(0.62-1.10)	<b>0.197</b>	0.53	(0.16-1.72)	0.295
<b>Risky pregnancy</b>						
No	1	-	1	1	-	1
Yes	1.72	(1.12-2.63)	<b>0.012</b>	1.58	(0.86-2.89)	0.136
<b>BMI at the end of pregnancy</b>						
Eutrophy	1	-	1	1	-	1
Malnutrition	1.95	(0.77-4.96)	0.158	1.33	(0.52-3.39)	0.537
Overweight	2.06	(0.81-5.24)	<b>0.129</b>	1.52	(0.61-3.78)	0.364
Obesity	2.72	(1.08-6.84)	<b>0.033</b>	2.64	(1.11-6.26)	<b>0.027</b>
<b>Systemic arterial hypertension</b>						
No	1	-	1	1	-	1
Yes	1.76	(5.50-5.61)	<b>&lt; 0.0001</b>	5.75	(1.18-2.81)	<b>&lt; 0.0001</b>

CI: Confidence interval. RRI: Relative risk index. FNS: Food and Nutritional Security. FNI: Food and Nutritional Insecurity.

Source: Designed by the authors, 2023.

## DISCUSSION

In this study, an increase of 9.14% in the prevalence of malnutrition was observed when comparing the pre-pregnancy BMI classification and the BMI at the end of pregnancy. Conversely, a relevant percentage of the interviewees started their pregnancy with excess weight and continued to be overweight at the end of the pregnancy. As for the factors associated with cesarean section, adolescent pregnancy, low levels of education, having anxiety symptoms, having already had more than one birth, having arterial hypertension during pregnancy, having started the pregnancy with malnutrition and being obese at the end of pregnancy were associated factors.

As for the pre-pregnancy nutritional status, this research identified a significant number of overweight women according to BMI. These data were similar to the study carried out by Lana et al. (2020)<sup>5</sup> with 1,088 puerperal women, in Belo Horizonte, Minas Gerais, Brazil, whose aim was to evaluate pre-pregnancy nutritional status, weight gain during pregnancy and factors associated with excessive weight gain. In the aforementioned research, it was observed that 31% of women were overweight or obese before pregnancy. This result differs from the study by Sampaio et al. (2020)<sup>18</sup>, carried out in Fortaleza, Ceará, Brazil, with 223 adult puerperal women, which aimed to identify gestational and nutritional characteristics and weight gain in the last trimester of pregnancy and in the immediate postpartum period, where it was found that 75.3% of women were eutrophic before becoming pregnant.



The current study highlights the high prevalence of excess weight at the end of pregnancy, data that corroborates the findings of Costa et al. (2021)<sup>3</sup>, carried out with 151 puerperal women, in São Luís, Maranhão, Brazil, with the aim of checking the prevalence of maternal excess weight and its gestational and perinatal consequences in women cared for at a philanthropic maternity hospital, where they identified that 36.6% were overweight at the end of pregnancy. Similarly, Manera and Höfelmann (2019)<sup>19</sup> carried out a study with the aim of estimating the prevalence of excess weight during pregnancy and identifying an association with pre-pregnancy excess weight in 301 pregnant women, users of health units with a Family Health Strategy, living in the city of Colombo, Paraná, Brazil, where they pointed out that 44.4% of those evaluated were overweight in the third trimester of pregnancy.

The high percentage of overweight and obesity before pregnancy and excess weight during pregnancy represent a public health problem, implying an increase in complications during pregnancy, such as pre-eclampsia, systemic arterial hypertension, diabetes mellitus, prematurity and cesarean delivery. The nutritional status of the mother is a determining factor for the health of the fetus and child, which can influence the emergence of health problems in the newborn, such as hypoglycemia, macrosomia, intrauterine growth restriction and hospitalization in a neonatal intensive unit. Therefore, it is important to underline that it is still necessary to monitor the nutritional status of pregnant women, as both being overweight and underweight can lead to unfavorable maternal and perinatal outcomes<sup>1</sup>.

Conversely, the results of the current study also indicate that the percentage of malnutrition during pregnancy tripled when compared to the start of pregnancy. This data becomes new through the studies found by Freitas et al. (2019)<sup>4</sup> and Kuhn et al. (2020)<sup>20</sup>. However, the result of this research may have been influenced by the period in which data collection was held, as it was carried out during the COVID-19 pandemic. Therefore, considering that the degree of food and nutritional insecurity has increased in the Brazilian population, including in the state of Maranhão<sup>21</sup>, which may have influenced the percentage of women with malnutrition during pregnancy due to difficulty in accessing food. It should also be underlined that many changes that take place during pregnancy, such as physiological, metabolic and endocrine changes, generate symptoms, such as nausea and vomiting, which may consequently have led to a decrease in food intake and impaired nutritional intake. Nevertheless, adequate weight gain and maternal lifestyle play an essential role in defining the growth and development of the baby<sup>22</sup>.

In this study, adolescent pregnancy was a risk factor for cesarean section. Adolescent pregnant women had twice the risk of having a cesarean section compared to adult pregnant women. The data differ from those found by Rasador and Abegg (2020)<sup>9</sup>, who investigated the factors associated with the route of delivery in a reference public and private maternity hospital in Porto Alegre, State of Rio Grande do Sul, Brazil. Regarding maternal age, they did not find significant association, only showing a higher percentage of cesarean deliveries in women over 35 years of age (75.4%). This data differs from what was found in the study by Silva et al. (2021)<sup>1</sup>, which aimed to check the rates of vaginal births and cesarean sections in patients with a previous cesarean section and full-term pregnancy, as well as the factors associated with the recurrence of cesarean section. It was noted that cesarean deliveries were more prevalent in women under 35 years of age, contrasting with some studies<sup>23</sup>.

Madeiro, Rufino and Santos (2017)<sup>7</sup> analyzed the trend in the proportion of cesarean deliveries and associated factors in the city of Teresina, Piauí, Brazil, with data from the Live Birth Information System (SINASC, as per its Portuguese acronym) from 2000 to 2011 and collected the data of 224 municipalities that showed an increase in the number of cesarean deliveries in all age groups, being higher in women under 20 years old, but only age  $\geq 40$  years old was associated with cesarean delivery.

Adolescent pregnancy causes concern worldwide as it is a risk factor for maternal and fetal morbidity and mortality, and can therefore generate psychosocial and economic problems, harming personal and professional development of women, which reflects on the type of delivery due to lower preparation of the reproductive process<sup>24</sup>.

When evaluating the level of education, pregnant women who did not have completed higher education were more likely to have a cesarean section, especially those with less education (illiterate/incomplete elementary school I) (RRI: 3.57). Contrary to this finding, a survey carried out whose aim was to analyze the number of normal and cesarean deliveries in the city of Patos de Minas, Minas Gerais, Brazil, identified that 64.63% of women with eight years of education or more opted for the cesarean section as their route of delivery, thus demonstrating that women with higher levels of education are at greater risk of undergoing cesarean delivery<sup>25</sup>. Similar results were found by Guimarães et al. (2017)<sup>9</sup>, who described the prevalence of cesarean deliveries from SINASC data and checked the association between the type of delivery and the demographic characteristics of women who had children in public and private hospitals in Brazil, showing a frequency of cesarean deliveries of 58.2%, which was higher in young women with high levels of education.

Most studies point to advanced education as one of the main contributors to the greater number of cesarean deliveries<sup>26</sup>. However, the association of low education with cesarean section in this research may have been influenced by the location where the research was carried out. As previously mentioned, the research was carried out in PHCUs, where the greatest demand for care is represented by women with low incomes and low levels of education. Therefore, this result raises questions about the conduct currently adopted in the public sector, as normal birth and restricted use of episiotomy are prioritized in the Brazilian Unified Health System (SUS, as per its Portuguese acronym)<sup>27</sup>.

Nonetheless, discrepancies in the percentages of cesarean deliveries are also noticed when comparing the care provided in the SUS and in the private sector. In this regard, a careful look is required to implement measures that will identify the causes of the increase in cesarean deliveries in the public sector, as cesarean deliveries are associated with high rates of maternal mortality and are also associated with perinatal morbidity and mortality, leading to an increase in hysterectomies, blood transfusions and admissions to Intensive Care Units<sup>28</sup>.

With regard to parity, it was observed that the greater number of births was a risk factor for cesarean section. These data differ from the results of the research by Sampaio et al. (2020)<sup>18</sup>, where they demonstrated that women with more than one birth have a greater preference for a normal birth. However, in the study by Feitosa et al. (2017)<sup>8</sup>, which aimed to analyze the factors that influenced the choice of type of delivery in puerperal women from Mossoró and Natal, state of Rio Grande do Norte, Brazil, found that primiparous women tended to undergo cesarean section in a greater proportion than multiparous women.

One of the main causes for the number of births influencing cesarean deliveries is the choice of the route of delivery in the first pregnancy, which often happens due to the influence of family members, people close to the pregnant woman or fear of the pain of normal birth. However, it should be pointed out that women who have had a previous cesarean section or more cesarean sections prior to their current pregnancies are one of the main reasons for having a cesarean section. Despite this, for cesarean delivery, it is necessary to have adequate indications, such as emergencies, iterative (more than two cesarean sections), fetal distress, macrosomia, failure of induction and maternal complications<sup>7</sup>. It is underlined that cesarean deliveries involve greater exposure of mothers and babies to risks, including perinatal and maternal deaths, as well as infections<sup>10</sup>.

Having anxiety symptoms during pregnancy was also a risk factor for cesarean section. Pregnant women who had anxiety symptoms during pregnancy were twice as likely to have a cesarean section when compared to pregnant women who did not have anxiety symptoms. Nevertheless, for this association, no study was found that could help us in the discussion of such a relationship. This association may be related to the fact that this research was carried out during the period of the COVID-19 pandemic. Because of that, the percentage of anxiety symptoms increased in different age groups, including pregnant women<sup>28</sup>, due to insecurity and lack of information or excessive information, mainly about the risks of the virus to the pregnant woman and fetus, also reducing the number of visits and consultations during the prenatal period. Therefore, the association of anxiety symptoms with cesarean section may be the result of the increased incidence of anxiety symptoms, influencing the choices of these women and generating fear regarding the pregnancy process and the delivery method, which includes greater concern about the risks imposed to them and their newborns, choosing cesarean delivery as the safest or best option<sup>29</sup>.

In this study, it was observed that pregnant women diagnosed with arterial hypertension during pregnancy had an almost six times higher risk (RRI: 5.75) of undergoing cesarean section when compared to pregnant women who were not diagnosed with arterial hypertension during pregnancy. Sousa et al. (2019)<sup>30</sup> used data about arterial hypertension in pregnant women and identified possible associated events, with 114 pregnant women cared for at the State Public Servant Hospital (HSPE, as per its Portuguese acronym) located in São Paulo, Brazil. The study showed that 43% of pregnant women had chronic hypertension and 33.3% had arterial hypertension by the twentieth week of pregnancy, of whom 27.4% had a cesarean section.

Hypertensive syndromes are one of the main causes of changes during pregnancy. In light of this, the emergence of hypertension becomes a determinant of cesarean delivery, as cesarean section is indicated in cases of complications during prenatal care or birth, a method adopted to protect both the life of the mother and the fetus<sup>30</sup>.

Among the limitations of this research, one can consider the non-measurement of weight prior to pregnancy, which was self-reported by the interviewees. In the same way, the weight at the end of pregnancy was checked in the medical records of the pregnant women from the last prenatal consultation. Another limitation was the difficulty in following-up puerperal women by applying the questionnaire during the puerperium. As a strong point, the study design should be highlighted, as it was a longitudinal epidemiological cohort, enabling the monitoring of women during pregnancy and puerperium, as well as carrying out research in four PHCUs in the city of São Luís - MA, allowing the identification of associated factors for cesarean section in pregnant women followed-up in primary care.

## CONCLUSION

Anthropometric characteristics proved to be a relevant factor that influences cesarean delivery, as having started the pregnancy with malnutrition and being obese at the end of pregnancy were risk factors for cesarean delivery. It is underlined that excess weight is a risk factor for the emergence of Chronic Non-communicable Diseases (NCDs), such as arterial hypertension during pregnancy, which was also associated with cesarean section in this study. Similarly, it was observed that being under 19 years old, having a low level of education, having a greater number of births and having anxiety symptoms during pregnancy were risk factors for cesarean section.

In view of what was observed, one can notice that it is necessary to develop behaviors that improve nutritional assistance during prenatal care, such as educational activities, actions and lectures related to nutritional care, nutritional guidance during prenatal consultations, aiming to guide these

women to prevent or intervene in maternal complications and promote autonomy in decisions during pregnancy. These behaviors can contribute to health promotion, given that, currently, the nutritionist is not part of the multidisciplinary team that makes up prenatal care in PHCUs located in São Luís – MA.

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