

# Nonbiological maternal risk factor for low birth weight on Latin America: a systematic review of literature with meta-analysis

Fatores de risco maternos não biológicos para o baixo peso ao nascer na América Latina: revisão sistemática de literatura com meta-análise

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## ABSTRACT

**Objective:** To identify non-biological maternal risk factors to low birth weight in Latin America. **Methods:** Systematic review of literature through meta-analysis. The tool for methodological evaluation was the Strengthening the Reporting of Observational Studies in Epidemiology Statement. Studies in non-pathological maternal risk factors to low-birth weight and those evaluated by a Strengthening the Reporting of Observational Studies in Epidemiology Statement method under C grade were excluded. **Results:** From seven studies, five pointed out the influence of maternal age under 20. In four studies maternal age above 35 years old was relevant to low birth weight. Other factors were present in only one or two studies. **Conclusion:** According to this study the maternal age under 20 and above 35 years old is a relevant factor to low birth weight. There are few studies with universal and solid methodology, which difficult a systematic review of literature though meta-analysis.

**Keywords:** Infant, low birth weight; Risk factors; Maternal age; Meta-analysis

## RESUMO

**Objetivo:** Identificar os fatores de risco maternos não biológicos para o baixo peso ao nascer na América Latina. **Métodos:** Revisão sistemática de literatura com meta-análise. O instrumento de avaliação metodológica foi *Strengthening the Reporting of Observational Studies in Epidemiology Statement*. Foram excluídos estudos com fatores de risco patológicos maternos para o baixo peso ao nascer e os trabalhos com avaliação da qualidade metodológica *Strengthening the Reporting of Observational Studies in Epidemiology Statement* com nota C. **Resultados:** Sete estudos foram incluídos dos quais cinco deles apresentaram idade materna <20 anos como fator de risco para baixo peso ao nascer. Em quatro estudos, a idade materna

>35 anos, influenciou o baixo peso ao nascer. Os demais fatores de risco apareceram em apenas um ou dois estudos. **Conclusão:** As evidências obtidas neste estudo sugerem que a idade materna <20 anos e >35 anos são significativas na influência ao baixo peso ao nascer. Observou-se uma escassez de trabalhos com metodologia criteriosa, dificultando a avaliação por meio de meta-análise.

**Descritores:** Recém-nascido de baixo peso; Fatores de risco; Idade materna; Meta-análise

## INTRODUCTION

Birthweight is a valued indicator in the evaluation of maternal and infant health conditions, since it reflects the quality of life of a community. Low birthweight classifies newborns weighing 2,500g or less. Historically, during the 1960s, studies on low birthweight showed an association with prematurity. During the 1970s, international researchers recognized that low birthweight was not associated with prematurity<sup>(1,2)</sup>.

Based on this presupposition, other variables were added to the incidence of low birthweight, such as obstetric (retardation of intrauterine growth and multiple births, for example), behavioral (smoking and drug use, for example), geographic (altitude and regions, for example), and ethnic factors. One of the elements that influences low birthweight is an uncertain date of birth, primarily in women with low levels of schooling who had children during adolescence and with inadequate prenatal care<sup>(2)</sup>. Studies on weight at birth developed in Brazil during the 1970s were based on non-probability

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samples, due to the lack of a standardized document in maternities. On the other hand, during the 1980s, the Brazilian Institute of Geography and Statistics (IBGE) carried out a probability survey in the Brazilian population among individuals <5 years of age to verify the prevalence of low birthweight. As of 1993, with the implementation of the Declaration of Live Births, variables that influence weight at birth have become clearer and more quantifiable for studies<sup>(3,4)</sup>.

Among the non-pathological maternal risk factors that interfere in birthweight, early or advanced maternal age (<20 years and >35 years), and weight gain during gestation (<8kg) have been frequently pointed out in a few Cuban, Argentine and Brazilian studies<sup>(5-12)</sup>.

The number of prenatal visits is considered a key point in diminishing complications during pregnancy and could have a direct influence on birthweight. The Ministry of Health recommends that prenatal care be given at the Basic Healthcare Units, and that it encompass at least six medical and/or nursing visits. Research has indicated the number lower than four prenatal visits as a significant factor of influence on the occurrence of low birthweight; on the other hand, two other studies have shown that the number of prenatal visits did not directly influence weight at birth<sup>(3,13,14)</sup>.

In the topic on the influence of newborn gender on the birthweight, literature points to prevalence of greater weight for the male gender<sup>(3,4,15)</sup>.

During the 1990s, a new factor appeared to be added to the others in the influence of low birthweight: the caesarean birth, which if indicated indiscriminately, increases the error of the date of birth by anticipating it<sup>(16)</sup>.

The United Nations Children's Fund presented a document showing the global incidences of low birthweight. In Latin America, these data varied from 5% in Chile, to 21% in Haiti, with a mean of 10.35%, which distances us significantly from countries in the European Community with 6.4%, and in North America, with a mean of 7.7% of cases of low birthweight<sup>(17)</sup>.

Considering the aspects mentioned as to behavior of birthweight in Latin America, a region with geographical, cultural, and social similarities and which presents a characteristic of miscegenation of European, African, and Amerindian ethnicities, a question arises as to the behavior of low birthweight on this continent.

Despite the variable "weight at birth" already having been extensively studied in developed countries, still, in Latin America, the variable has not has much research, and is limited to large urban areas of this vast continent<sup>(18)</sup>.

## OBJECTIVE

The objectives of this study were to identify the non-pathological maternal risk factors for low birthweight in Latin America, and to evaluate the influence of these risk factors on low birthweight.

## METHODS

This is a systematic review of literature that consists of the use of systematic methods to identify, select, and critically evaluate studies pertinent to the theme chosen<sup>(19,20)</sup>.

To evaluate the methodological quality, and inclusion and exclusion criteria, the recommendations of the Strengthening the Reporting of Observational Studies in Epidemiology Statement (STROBE) were used. The papers were read and classified into three categories: A (studies that satisfied  $\geq 80\%$  of the criteria requested), B (satisfied 50 to 80% of the criteria requested) and C (satisfied less than 50% of the criteria)<sup>(21)</sup>.

Included were prospective and retrospective cohort studies, as well as case-control and cross-sectional studies as long as they showed non-pathological maternal risk factors for low birthweight in Latin America. The scan was performed without considering time or date of publication, and regardless of the language and form of publication. Excluded were studies with pathological maternal risk factors for low birthweight, studies that covered perinatal mortality, studies conducted outside of the Latin American continent, and papers with Grade C for methodological quality evaluation STROBE.

As primary outcome, the variable was "newborn with low birthweight". As secondary outcome, the following variables were used: maternal age (in years), gestational age (in weeks), number of prenatal visits, maternal level of schooling (years of study), maternal socioeconomic level, type of delivery (vaginal or cesarean), maternal weight gain during pregnancy, parity (number of births), and maternal insertion in the work market (yes or no).

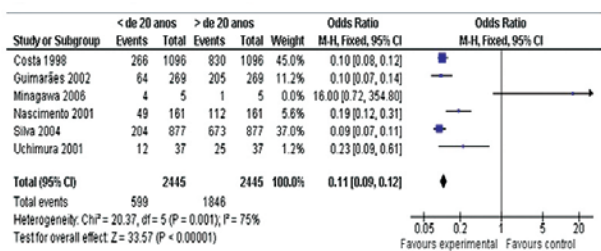
The search was carried out by means of the key words of the variables of this study by on-line access of the following databases: Thesis Database of the Coordination for the Improvement of Higher Education Personnel (Capes), from March 3, 2008, to April 28, 2008; Scientific Electronic Library Online (SciELO), October 27, 2008, to October 30, 2008; *Literatura Latino-Americana e do Caribe em Ciências da Saúde* (LILACS), from April 29, 2008, to June 9, 2008; and PubMed, from November 10, 2008, to December 7, 2008.

Meta-analysis is a statistical method applied to a systematic review, which integrates the results of two or more primary studies (clinical trials or observational studies). As an instrument of statistical analysis, Review Manager 5, available on-line, was used. Since this review showed cross-sectional and case-control studies, the dichotomic variables were treated by measurement of the odds ratio (OR), with their respective 95% confidence intervals (95% CI)<sup>(19,20)</sup>.

**RESULTS**

A total of 2,133 studies were found, 47 of them in PubMed, 1,043 in Lilacs, 311 in SciELO, and 732 were summaries of Capes theses. After prior selection, 64 studies were identified. Despite the large number of papers traced in Latin America, only seven were selected, six of them in Brazil<sup>(3,4,15,22-24)</sup> and one in Cuba<sup>(25)</sup>.

In figure 1, the graph shows a distancing in five studies of the values of OR to the left of number 1, demonstrating that maternal age <20 years displays significance as an influence on low birthweight. Only one study showed a shift to the right of the graph, but was not considered significant due to the small number of the sample<sup>(24)</sup>. Heterogeneity was identified among the studies included ( $I^2=75\%$ ;  $p=0.001$ ), which might be explained by the difference found in the number of events that varied from 1 to 830 among the groups.

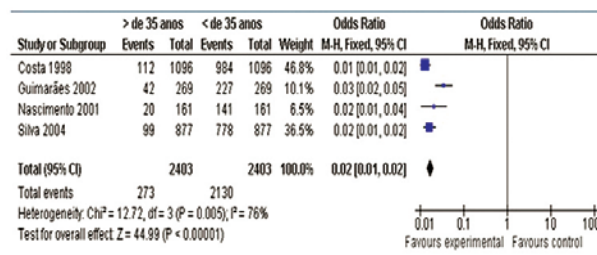


Costa 1998,<sup>3</sup> Guimarães 2002,<sup>5</sup> Minagawa 2006,<sup>24</sup> Nascimento 2001,<sup>22</sup> Silva 2004,<sup>3</sup> Uchimura 2001.<sup>23</sup>

**Figure 1.** Odds ratio of prevalence of low birthweight for maternal age <20 years

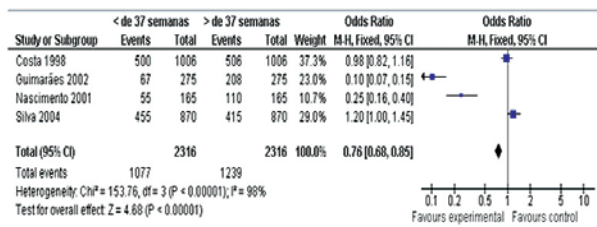
Figure 2 shows a distancing of the values of OR to the left of number 1, favoring the experimental group (maternal age >35 years), showing the influence on low birthweight.

Figure 3 shows two studies that touch null (number 1), and therefore show no significant differences between the groups with gestational age <37 weeks and >37 weeks<sup>(3,4)</sup>. However, two studies show a shift to the left of the graph, indicating that gestational age <37 weeks is significant<sup>(15,22)</sup>.



Costa 1998,<sup>3</sup> Guimarães 2002,<sup>5</sup> Nascimento 2001,<sup>22</sup> Silva 2004.<sup>3</sup>

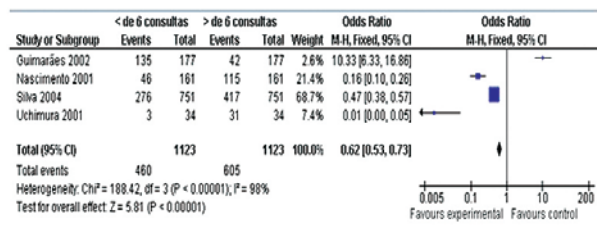
**Figure 2.** Odds ratio of prevalence of low birthweight for maternal age >35 years



Costa 1998,<sup>3</sup> Guimarães 2002,<sup>5</sup> Nascimento 2001,<sup>22</sup> Silva 2004.<sup>3</sup>

**Figure 3.** Odds ratio of prevalence of low birthweight in gestational age

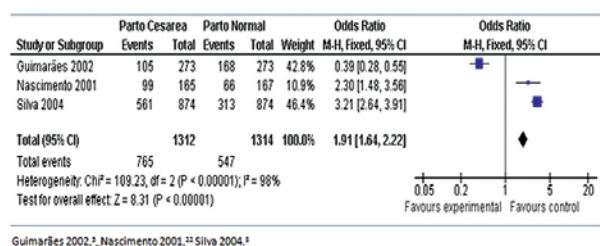
Figure 4 shows only one study with a shift to the right of the null point (number 1), in which more than six visits appear as a factor for increased low birthweight<sup>(15)</sup>. In two studies, the OR appears to the left of the graph, showing that less than six visits is a significant factor for low birthweight<sup>(3,22)</sup>. In one study, the horizontal line ends in an arrow, indicating that the CI extends beyond the graph scale since the sample number was insufficient<sup>(23)</sup>. Heterogeneity was identified among the studies included ( $I^2=98\%$ ;  $p=0.00001$ ), which can be explained by the difference found in the number of events that varied from 3 to 417 among the groups.



Guimarães 2002,<sup>5</sup> Nascimento 2001,<sup>22</sup> Silva 2004,<sup>3</sup> Uchimura 2001.<sup>23</sup>

**Figure 4.** Odds ratio for prevalence of low birthweight in number of prenatal visits

In figure 5, two studies are observed shifting to the right of the null point (number 1), showing a greater number of low weight newborns in vaginal deliveries<sup>(3,22)</sup>.



Guimarães 2002,<sup>2</sup>; Nascimento 2001,<sup>12</sup>; Silva 2004.<sup>3</sup>

**Figure 5.** Odds ratio for prevalence of low birthweight and type of delivery

One study shows a higher number of low birthweight newborns in cesarean deliveries<sup>(15)</sup>.

Newborn gender influence on birthweight was found in three studies, which showed no significant shifts on the graphs that would suggest this factor as an influence for low birthweight<sup>(3,4,15)</sup>.

For the issue of maternal level of education, three studies in which the meta-analysis was applied showed no significance as to its influence on birthweight<sup>(15,23,24)</sup>.

When parity was associated with low birthweight, it was noted that only one study showed primiparas as having a greater prevalence of low birthweight newborns, and another study, with a smaller sample, showed lower prevalence of low-weight newborns in women with less than two deliveries<sup>(4,22)</sup>.

Only one study showed data of maternal insertion or not in the job market, marital status, and family income as risk factors for low birthweight, making it impossible to design a comparative graph<sup>(24)</sup>. Of the three studies that show maternal weight gain during gestation as related to low birthweight, it is noted that each displayed divergent values such as a minimal weight gain during pregnancy (<7kg; <8 kg; ≤9kg), making it impossible to evaluate these data on a meta-analysis graph<sup>(23-25)</sup>.

## DISCUSSION

Early maternal age has been a relevant factor of influence on low birthweight, despite many authors varying the reference age for this factor (<19 years, <18 years, <20 years). Many of them have demonstrated in their work the importance of the precociousness of age of pregnancy and the delivery of a low birthweight child<sup>(9,11-14)</sup>. On the other hand, in their studies some Cuban and Bolivian authors failed to demonstrate women <20 years of age as a factor of influence on low birthweight<sup>(7,8,14)</sup>.

Among the mechanisms that explain the reason for greater prevalence of low birthweight in younger women are immaturity of the reproductive system and emotional immaturity<sup>(13)</sup>.

Most authors reviewed share the view that pregnancy in younger women is associated with low birthweight. Studies in which a meta-analysis was applied, despite not being numerous (sic), point to this factor as being incisive.

Additionally, maternal age over 35 years has also been shown to be a relevant factor in influencing low birthweight. Over the last decades, this group of women has postponed pregnancy until they attain their desired economic and social stability, without considering that their “biological clock” continues to move and that their reproductive system ages anatomically and biologically<sup>(3)</sup>. Another aspect is the greater probability of the appearance of pathologies or medical complications associated with the advancement of maternal age<sup>(3,9)</sup>. Not all authors reviewed explored this datum as being significant, since it was only in the last decades of the 20th century that the number of women who initiated their gravid-puerperal cycle after 35 years of age increased, i.e., this is a relatively recent fact.

The occurrence of a greater number of low weight newborns are expected with a gestational age <37 weeks, since the beginning of fat deposit in the body occurs as of 34 weeks of gestation, when anatomical and physiological development are yet incomplete<sup>(3)</sup>. However, low birthweight has been the villain even in newborns with gestational age >37 weeks, and is often related to retardation of intrauterine growth and to error in the due date, besides fetal and obstetric pathologies.

The number of prenatal visits has been a key issue in diminishing complications during gestation, which can directly influence weight at birth. When referring to the number of prenatal visits, among the authors reviewed, no mention was made of the fact that less than four visits results significantly in the occurrence of low birthweight<sup>(3,13,14)</sup>.

With the increase in numbers of cesarean births over the last decades, the number of early deliveries has increased, which triggered premature births and a higher incidence of low birthweight<sup>(16)</sup>. However, two articles were noted that point to a higher number of newborns with low birth weights in vaginal deliveries, and one article indicates a greater number of low weight newborns in cesarean deliveries<sup>(3,15,22)</sup>.

In reference to the influence of the gender of the newborn on its birthweight, literature shows a prevalence of low weight for females. The three studies of this review did not provide statistical data sufficient to confirm the prevalence of gender in low birthweight<sup>(3,4,15)</sup>.

Researchers have observed that women with a low level of schooling show a greater occurrence of low birthweight children, as do women with no schooling at

all<sup>(2,11)</sup>. Different from the data presented in literature, this review found three papers in which women with more years of study had a slight prevalence of low birthweights, but it was not statistically significant<sup>(15,22,24)</sup>.

Primiparity is cited as having an influence on birthweight<sup>(4)</sup>. Of the two research papers reviewed, one shows primiparity as a relevant factor in low birthweight, and the other points to multiparity as being significant<sup>(4,22)</sup>.

The other risk factors evaluated appear in only one study, which showed data regarding maternal insertion or not into the work market, marital status, and family earnings as risk factors for low birthweight<sup>(24)</sup>. Three studies showed maternal weight gain during pregnancy related to low birthweight, but each of them showed divergent values, such as minimal weight gain during pregnancy ( $<7\text{kg}$ <sup>(24)</sup>,  $<8\text{kg}$ <sup>(25)</sup> and  $\leq 9\text{kg}$ <sup>(23)</sup>), precluding the evaluation of these data on a meta-analysis graph.

Despite the extensive number of studies (2,069 studies included in the first phase of selection), there was a very low number of studies after the application of the methodological evaluation STROBE, with a sample of only seven studies that passed the methodological grid. This fact leads one to believe that the methodology applied to the studies examined was not duly respected, leading to the appearance of methodological biases that impeded the use of these studies (which could have contributed to the evidence-based practice of healthcare). With implications for research, a scarcity was noted of papers with universal and rigorous methodology. The applicability of research in public health requires greater care in conducting our projects and a better definition of research strategies recognized worldwide, in addition to not using regional methodologies that hinder the evaluation of studies in a systematic review of literature.

## CONCLUSION

As an implication for professional practice, evidence obtained in this study suggests that maternal ages  $<20$  years and  $>35$  years are significant in influencing low birthweight. Gestational age, type of delivery, parity, insertion or not of the women in the work market, marital status, family income, and weight gain during pregnancy were non-biological risk factors in pregnancy that did not prove significant in influencing low birthweight in this review.

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