Intrauterine growth curves of twins: effects of socioeconomic level

Curvas de crescimento intra-uterino de gêmeos: efeitos do nível socioeconômico

Conceição Aparecida de Mattos Segre¹, Gloria Maria dal Colletto², Silvia Terezinha Rielli³

ABSTRACT

Objective: To study the influence of different socioeconomic level on intrauterine growth curves of singletons and twins. Methods: Data referring to the birth weight and gestational age of singletons and twins were obtained from neonatal records from three different hospitals so called A, B and C, from lower to higher socioeconomic level, in the 90s. Intrauterine growth curves were constructed for each population and then compared. Statistical methods included mean and standard deviation estimates, Students t test, analysis of variance followed by multiple comparison tests, non parametric tests and regression analysis. Results: At hospital A, 370 singletons and 370 twins were studied; at hospital B, 306 twins and 306 singletons; and at hospital, C 562 twins and 562 singletons. Intrauterine growth curves for singletons depict that at approximately 39 weeks, the higher socioeconomic hospital (C) has its curve above those of hospitals A and B. Considering twins born at 36 weeks gestational age there were significant differences among the three hospital, being the lowest weights those of hospital A. Conclusions: Birth weight of twins born at 36 weeks gestational age was dependent of their socioeconomic level and the intrauterine growth curves of twins begin to show such an influence later in pregnancy.

Key words: Infant, newborn; Twinning; Birth weight; Gestational age

INTRODUCTION

Growth curves described in the 1960s are used to classify neonatal intrauterine growth as normal or abnormal and have been used since then worldwide¹. In spite of various criticisms elicited by different authors they continue to be used as standards of intrauterine growth²-⁵.

The use of intrauterine growth curves built for singleton newborns is certainly not adequate for twins.

¹ Postdoctorate in Neonatal Pediatrics from the Escola Paulista de Medicina - Universidade Federal do Estado de São Paulo – UNIFESP – São Paulo (SP) Brazil. Instituto Israelita de Ensino e Pesquisa Albert Einstein – IIEP - São Paulo (SP), Brazil.
² PhD in biology from the Department of Parasitology - Instituto de Ciências Biomédicas – ICB - São Paulo (SP), Brazil.
³ Neonatologist. Graduate student at Instituto de Ciências Biomédicas – ICB - São Paulo (SP), Brazil.

Corresponding author: Conceição Aparecida de Mattos Segre - Instituto Israelita de Ensino e Pesquisa Albert Einstein - Av. Barão de Monte Mor, 549 - ap-61 - Morumbi - CEP 05687010 - São Paulo (SP) - Brazil - Tel.: 3747-0904 - e-mail: conceicao@einstein.br

Received on Apr 8, 2004 – Accepted on May 30, 2004

RESUMO

Objetivo: Estudar a influência de diferentes níveis socioeconômicos nas curvas de crescimento intra-uterino de recém-nascidos únicos e gêmeos. Métodos: Dados referentes ao peso de nascimento e idade gestacional de recém-nascidos únicos e gêmeos foram obtidos a partir dos registros neonatais de três hospitais diferentes, denominados A, B e C, a partir do nível socioeconômico mais baixo para o mais elevado, nos anos 90. Foram construídas curvas de crescimento intra-uterino para cada população e, então, comparadas. As análises estatísticas incluíram médias e desvios padrão, teste t de Student, análise de variância, seguida de testes de comparação múltipla, testes não-paramétricos e análise de regressão. Resultados: No hospital A, 370 recém-nascidos únicos e 370 gêmeos foram estudados; no hospital B, 306 únicos e 306 gêmeos; e no hospital C, 562 únicos e 562 gêmeos. As curvas de crescimento para os únicos mostraram que, aproximadamente na 39ª semana, o hospital de maior nível socioeconômico (C) apresentava curvas acima daquelas dos hospitais A e B. Considerando os gêmeos nascidos na 36ª semana de idade gestacional, foram encontradas diferenças estatisticamente significativas entre os três hospitais, sendo os mais baixos pesos referentes aos recém-nascidos do hospital A. Conclusões: O peso de nascimento de gêmeos nascidos com 36 semanas de idade gestacional foi dependente de seu nível socioeconômico e essa influência começa a se evidenciar tardiamente na gestação.

Descritos: Recém-nascido; Gemelaridade; Peso ao nascer; Idade gestacional
According to Williams et al.(6) whose study in California evolved 2.265.478 live births comprising 1002 twins, at 38 weeks gestational age the multiple 50th percentile falls below the singleton 10th percentile, thus indicating that one half of all multiple births would be classified as growth retarded by singleton standards at that gestational age. They also pointed out that the minimum perinatal mortality rate for newborns of multiple gestations falls between the 50th and 90th percentiles, but at a point about 500g below that of singletons.

In 1998, a study comparing the fetal growth of singletons and twins at three Hospitals with different socioeconomic levels, in the city of São Paulo, showed that the pattern of fetal growth of twins is restricted when contrasted to that of singletons, regardless of socioeconomic level.(7)

The study of Alexander et al.(5), in 1996, although evaluating 3.134.879 live births, referred only to singletons and did not mention multiple births. They emphasized that in general, the previously published fetal growth curves underestimated the 1991 United States reference curve. This study brings out the question of reference curves and their adequacy to a specific population and its own characteristics. So, it seems to be most appealing to investigate how socioeconomic factors may influence birth weight and intrauterine growth curves in multiple births.

OBJECTIVE
To study the influence of socioeconomic level on intrauterine growth curves of singletons and twins born to mothers of three different socioeconomic backgrounds.

METHODS
This was a retrospective study, focused on the singleton and multiple births that occurred in 1990 decade at three different Hospitals.

Data refer to the 90th decade and were obtained from the neonatal records of Hospitals A, B and C, from lower to higher socioeconomic level.

Hospital A (very-low level) is a foundation for poor people without any type of social security, Hospital B (medium level) is a private institution servicing middle class stratum people and Hospital C (high level) is also a private institution servicing high social class individuals, which were classified according to their educational degree(6,9).

At Hospital A, 370 twins and 370 singletons were studied; at Hospital B, 306 twins and 306 singletons and at Hospital C, 562 twins and 562 singletons. The singletons were the prior or consecutive birth for each twin.

Intrauterine growth curves were constructed for each population and then compared. Statistical methods included mean and standard deviation estimates, Student’s t test, analysis of variance followed by multiple comparison test (LSD-Least Significance Difference), non parametric tests (Kruskal-Wallis and Dunn) and regression analysis, which were performed using the SPSS V11.5 program.

RESULTS
Firstly we compared the sex distributions within the three Hospitals, the conclusion being that there was no significant difference between them, both at single births ($\chi^2 = 2.30; P = 0.317$) and twins ($\chi^2 = 2.66; P = 0.264$). Therefore, data for both sexes were jointly analyzed.

The gestational age, means and standard deviations, are shown on table 1 and when studied by the Kruskal-Wallis test (K-W) have shown to be significantly different among the three Hospitals, both for singletons ($\chi^2 = 19.36; P = 0.000$) and for twins ($\chi^2 = 41.44; P = 0.000$). By applying the multiple comparison test (Dunn) between each two Hospitals, it was noticed that the gestational age at Hospital C was significantly lower than that at Hospital A, either for singletons ($P<0.001$) or twins ($P <0.05$), and also lower as compared to that at Hospital B ($P<0.05$ for singletons and twins).

Means and standard deviations for birth weight are shown on table 2. The analysis of variance, either for singletons ($F = 6.997; P=0.001$) and twins ($F = 9.058; P = 0.000$), showed significant differences among the three Hospitals. The multiple comparison tests LSD showed a noticeable lower mean for singletons at Hospital A, as compared to Hospitals B and C ($P = 0.005$ and $P = 0.000$, respectively), however no difference was noted between Hospitals B and C. For the twins, Hospitals A and C showed means significantly lower than that for Hospital B ($P = 0.000$ for both comparisons). Means for Hospitals A and C did not differ between them.

Multiple regression analyses of the natural logarithm transformation of weight at birth on gestational age (GA), square gestational age (GA²) and third power gestational age (GA³) were carried out and have shown that the more effective results for adjustment purposes were obtained by GA and (GA³). All the regressions...
were statistically significant and their results are exhibited on table 3. From these data intrauterine growth curves for singletons and twins were developed. These curves are shown on figures 1 and 2 respectively, and depict that, for singletons’ average gestational age at birth (approximately 39 weeks), Hospital C has its curve above that of B and A. However, when examining the twin figure, at the average gestational age at birth (approximately 36 weeks) the curve for Hospital C is practically superposing that of Hospital A, no difference therefore being noted between them.

For the singletons curve one can notice that the highest socioeconomic level Hospital (C) had its growth curve slightly below that of the intermediate socioeconomic level Hospital up to 36 weeks gestational age, and by this time both curves cross each other. However, considering only singletons that were born at 36 gestational age, their birth weight did not show significant differences among the three Hospitals (table 4). From then on, the highest level Hospital curve show higher birth weight for singletons, whereas intermediate level Hospital follows that of the lowest level Hospital, a little bit above it.

Considering only the twins born at 36 weeks gestational age, their birth weights showed significant differences among the three Hospital, being the lowest weights those of Hospital A (table 4).

**DISCUSSION**

Although social class classification is still controversial and unsatisfactory, the population of pregnant women

---

**Table 2.** Number of births, mean and standard deviation (SD) of birth weight for singletons and twins at delivery, according the three Hospitals of different socioeconomic level, and the results of analysis of variance (F), with their respective probability (p).

<table>
<thead>
<tr>
<th>Hospital</th>
<th>N</th>
<th>Singletons Mean</th>
<th>SD</th>
<th>N</th>
<th>Twins Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>370</td>
<td>3107.95</td>
<td>549.56</td>
<td>370</td>
<td>2262.91</td>
<td>617.90</td>
</tr>
<tr>
<td>B</td>
<td>306</td>
<td>3217.84</td>
<td>476.94</td>
<td>306</td>
<td>2439.57</td>
<td>526.74</td>
</tr>
<tr>
<td>C</td>
<td>562</td>
<td>3228.72</td>
<td>486.02</td>
<td>562</td>
<td>2304.68</td>
<td>563.96</td>
</tr>
</tbody>
</table>

Anova F=6.997; p=0.001

**Table 3.** Significant regression coefficients obtained by stepwise multiple regression analysis of the logarithm of birth weight in grams on gestational age and its cubic terms.

<table>
<thead>
<tr>
<th>Singletons</th>
<th>Twins</th>
</tr>
</thead>
<tbody>
<tr>
<td>HA</td>
<td>HB</td>
</tr>
<tr>
<td>0.801</td>
<td>2.090</td>
</tr>
<tr>
<td>0.263</td>
<td>0.215</td>
</tr>
</tbody>
</table>

Anova F=9.058; p=0.000

<table>
<thead>
<tr>
<th>Hospital</th>
<th>N</th>
<th>Singletons Mean</th>
<th>SD</th>
<th>N</th>
<th>Twins Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>13</td>
<td>2711.54</td>
<td>302.04</td>
<td>48</td>
<td>2190.63</td>
<td>494.37</td>
</tr>
<tr>
<td>B</td>
<td>04</td>
<td>2982.50</td>
<td>569.93</td>
<td>24</td>
<td>2538.33</td>
<td>235.85</td>
</tr>
<tr>
<td>C</td>
<td>20</td>
<td>2822.25</td>
<td>286.79</td>
<td>102</td>
<td>2340.15</td>
<td>351.08</td>
</tr>
</tbody>
</table>

Anova F=1.146; p=0.330

**Table 4.** Singletons and twins birth weight at 36 weeks gestational age.

<table>
<thead>
<tr>
<th>Hospital</th>
<th>N</th>
<th>Singletons Mean</th>
<th>SD</th>
<th>N</th>
<th>Twins Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>13</td>
<td>2711.54</td>
<td>302.04</td>
<td>48</td>
<td>2190.63</td>
<td>494.37</td>
</tr>
<tr>
<td>B</td>
<td>04</td>
<td>2982.50</td>
<td>569.93</td>
<td>24</td>
<td>2538.33</td>
<td>235.85</td>
</tr>
<tr>
<td>C</td>
<td>20</td>
<td>2822.25</td>
<td>286.79</td>
<td>102</td>
<td>2340.15</td>
<td>351.08</td>
</tr>
</tbody>
</table>

Anova F=6.721; p=0.002
included in this study was classified by their level of education, as referred in the literature\cite{(8-9)}.

The analysis of the population of singleton newborns of lower socioeconomic level (Hospital A) showed a significantly lower mean birth weight compared to the other two Hospitals considering that their mean gestational age at birth was 39 weeks. The influence of socioeconomic level on birth weight is well known\cite{(10-13)} so this finding was to be expected. The intrauterine curves constructed for singletons showed that the curve for the high socioeconomic level population was upward those for the population of the other two Hospitals, at 39 weeks gestational age, according to the findings previously referred to birth weight for singletons and socioeconomic status. However, up to 36 weeks gestational age the birth weight of the newborns did not differ among the three Hospitals so, apparently, this is the gestational age when the nutritional status of the mother is determinant of the differences that were found among this population.

As for twins’ birth weight, the results were somewhat different and the mean birth weight of the newborns belonging to the population of the higher socioeconomic level behaved similarly to the population of the lowest level presenting no statistical differences. In a recent paper by Colletto et al.\cite{(14)} it was demonstrated that among the population of Hospital C the frequency of primigravidae mothers of twins was much higher than the multigravidae which could explain this finding, since birthweights of twins from multiparous mothers are greater than those from primiparous mothers\cite{(15)}.

When looking at the twins’ curves at 36 weeks gestational age, the curves from the populations of the three Hospitals are practically the same, probably pointing out that the fetus may be affected more or less by the limitation of uterine expansion in the late gestational weeks\cite{(16)} and that the etiology of prematurity and/or low birth weight in twins would be essentially mechanical, differently from singletons, where it is generally related to outer factors\cite{(17)}.

Only after this gestational age the three curves became obviously different, reaching higher values according to the higher socioeconomic levels. However, considering only the twins born at 36 weeks gestational age, their birth weights showed significant differences among the three Hospitals, reflecting the effect of socioeconomic level and probably the influence of the nutritional condition of mothers on the fetus besides any possible role of the mechanical factor.

Adverse consequences are high among twins, including low birthweight, prematurity, perinatal mortality, admission to neonatal intensive care and extended length of care, respiratory distress, cerebral palsy, developmental delay, contact with disability services and mortality to age 5 years. However, adaptations in pregnancy to support multi-fetal growth are not identical to fetal growth restriction in singleton pregnancies\cite{(17)}.

Low birth weight in twins and in singletons probably is not comparable and may have different implications for child growth and survival, so, it does not seem to be adequate to classify twins using the curves designed for single newborns.

CONCLUSIONS

Birth weight of twins born at 36 weeks gestational age was dependent of their socioeconomic level. The intrauterine growth curve of twins begin to show such an influence later in pregnancy, so it is not adequate to classify intrauterine growth of twins using curves built for singletons.

REFERENCES