Maternal socio-economic factors and the risk of low birth weight in Lithuania

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Key words: *case-control study, low birth weight, socio-economic factors.*

Summary. *Aim. To evaluate the importance of maternal socio-economic factors on the risk of low birth weight in Lithuania.*

Material and methods. The case-control study involved 851 newborns with low birth weight (<2500 g) (cases) and 851 newborns with normal weight (controls). Study was accomplished from 1st February, 2001 until 31st October, 2002 in six main maternity hospitals in Lithuania. Mothers of infants were interviewed on the first day after delivery using the structured questionnaire. The database was processed by the application of statistical package "SPSS for Windows v.10.0".

Results. Young (<20 years) and older (35 years and older) maternal age, primary or basic education, being single, divorced or widowed, low income, living in rural area and unemployment before pregnancy and during pregnancy increased the risk to deliver low birth weight baby in univariate analysis. In logistic multivariable regression analysis, low education, low income and unemployment during pregnancy significantly increased risk of low birth weight – OR – 2.0, 1.7 and 1.6 respectively. Interaction between several unfavorable risk factors increased risk of low birth weight by 3.4–7.8 times, being the highest among mothers with low education, unstable marital status and low income.

Conclusion. Maternal unfavorable socio-economic factors increased the risk to deliver low birth weight baby.

Background

Low birth weight (LBW, <2500 g) is an important indicator of reproductive health and general health status of population. LBW is considered the single most important predictor of infant mortality, especially of deaths within the first month of life (1). It is also a significant determinant of infant and childhood morbidity, particularly of neurodevelopmental impairments such as mental retardation and learning disabilities (2). The third target of World Health Organization (WHO) document "Health for All in 21st Century" has stated that "by the year 2020 all newborn babies, infants and preschool children in the region should have better health, ensuring a healthy start in life". The primary objective for the implementation of this target is to reduce the number of infants born below 2500 g (3).

Both the uterus and fetus have long been supposed to be protected from environmental influences, and birth weight considered to be determined by genetic and ethnic factors (4). Later studies have shown that fetal growth and development to a great extent are influenced by factors such as mother's inadequate nutrition, chronic diseases, abuse and hard physical work (5). Recently number of studies has demonstrated association between LBW and maternal poor socio-economic conditions (6, 7). Birth weight may be a highly sensitive marker of family socio-economic circumstances during gestation and thus of future socio-economic career as well as the biological outcomes of intrauterine development (8). Researchers who have examined the reasons of steadily unchanged rate of low birth weight during the last decades concluded that besides the effective medical prenatal care the importance of socio-economic factors, such as maternal education, marital status, income, employment and occupational status, social support, place of residence and interaction among some of these variables, is emphasized (6, 9, 10). Following the policy of WHO, every country should invest in the

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families' socio-economic welfare and implement the state policy supporting the expectance of planned, desirable offspring and the developing good paternal skills (3).

LBW is primarily a problem in developing countries (7), while the importance of LBW also is growing in the countries in transition, which are distinguished by the rapid socio-economic changes and rather great inner socio-economic inequalities (11, 12). The incidence of LBW was inconsiderably, however, steadily increasing during last decade, especially in the countries of former Soviet Union and Central and Eastern Europe (13). Incidence of LBW in Lithuania (in 1998 – 4.5 percent) is rather low comparing to average incidence in European Union (6.5 – respectively) (13). However, besides the differences in newborns' health according to the maternal medical and biological factors, the socio-economic inequalities in perinatal health were recently observed (12, 14).

The aim of this paper is to evaluate the importance of maternal socio-economic factors on the risk of low birth weight in Lithuania.

Materials and methods

The results of this paper are based on a prospective case-control study, involving 851 newborns with LBW (birth weight below 2500 g, irrespective of gestational age) (cases) and 851 newborns with normal weight (controls). Only single live birth babies with LBW were selected as cases. Full-term (37–41 gestational weeks) babies with normal (2500 g and above) weight adequate for gestational age, born at the same day and being the same sex as cases were selected as controls. In case of failing to fulfill the appropriate criteria for the same-day born baby, another one was selected born one day before or after.

The study was accomplished from 1st February, 2001 until 31st October, 2002. Study was carried out in six main maternity hospitals in Lithuania (2 – in Vilnius, 1 – in Kaunas, Klaipėda, Šiauliai and Panevėžys – respectively).

The structured questionnaire consisted of four sections with 39 questions. The information on general data about mother and infant, maternal socio-economic factors (age, marital status, education, income, employment status and place of residence), hazardous habits (smoking, alcohol consumption and drug use) and occupational factors was collected. Mothers were interviewed on the first or second day after delivery by the instructed interviewers.

Independent Ethical Board of Kaunas University of Medicine approved the study in 2000. The participation was voluntary and the informed consent was obtained from all mothers to check medical information concerning their pregnancy period and delivery if necessary.

Statistical analysis

The dependent variable was birth weight (low or normal birth weight). Independent variables were the following maternal socio-economic factors: age, marital status, education, income, place of residence and employment. The maternal age was categorized as less than 20 years, 20–29 years, 30–34 years and 35 years and older. According to educational level mothers were grouped into three categories: primary or basic, secondary, and vocational or university education. According to marital status mothers were categorized as single, divorced or widowed, and married or cohabiting. The average disposable income in cash in 1998 was 350 Lithuanian Litas (LTL) per household capita per month (1 LTL=0.25 USD). According to income mothers were classified into two categories: having low income (300 LTL and less) and having high income (more than 300 LTL). According to place of residence mothers were classified as living in urban area or rural area. According to employment status before pregnancy and during pregnancy mothers were divided into two categories: employed and unemployed.

The database was processed by the application of statistical package "SPSS for Windows v.10.0". The descriptive analysis was performed calculating the distribution of cases and controls within categories of socio-economic factors. The reference group within separate age and socio-economic factors was that with the lowest proportion of LBW, i. e. 20–29 years old mothers, married or cohabiting, those with vocational or university education, having high income (>300 LTL), living in the urban area, employed before pregnancy and employed during pregnancy. Since all variables were categorical, χ^2 statistics were calculated initially to describe the relationship between all independent variables and LBW (dependent variable). Two-tailed probability (p) values of less than 0.05 were considered to indicate statistical significance. Odds ratios (OR) to deliver LBW baby according to maternal socio-economic factors and their corresponding 95% confidence intervals (CI) were calculated.

Next, the factors significant in the univariate analysis were included in the logistic multivariable regression with forced entry of selected variables. In order to consider the possible effect of confounding factors the prevalence of hazardous habits (e. g. smoking, alcohol consumption and drug use during pregnancy) was calculated. The differences between mothers in cases

and controls were found only according to prevalence of smoking during pregnancy. This variable was considered as confounding factor and it was included in logistic multivariable regression analysis.

Moreover, the interactions of unfavorable socio-economic factors were analyzed and the risks to deliver the LBW baby were calculated. In the univariate analysis all the variables except maternal education were classified into two categories. Therefore, in order to avoid the interaction within the different categories of education and considering secondary education as sufficient if compared to primary or basic, in logistic multivariable regression analysis two categories of maternal education were composed – primary or basic, and secondary, vocational or university. Moreover, in the logistic multivariable regression analysis unemployment before pregnancy was excluded in order to avoid the interaction with the unemployment during pregnancy.

Results

The proportions and the risks of LBW according to maternal age groups and socio-economic factors are presented in Table 1. The group of mothers aged 20–29 years was selected as the reference group and the odds ratios to deliver LBW baby for other age groups were calculated. The odds ratio for young (less than 20 years) mothers to deliver LBW baby was 2.2 (95% CI 1.55–3.22), while the odds ratio for older (35 years and older) mothers was 1.7 (95% CI 1.27–2.24).

The unstable marital status was associated with significantly higher risk of LBW. The odds ratio for these mothers to deliver LBW baby was 2.2 (95% CI 1.63–2.98), if compared to married or cohabiting women.

The highest probability to deliver LBW baby had mothers with primary or basic education (OR – 3.4, 95% CI 2.59–4.54), while secondary education increased LBW risk as well (OR – 1.6, 95% CI 1.29–

Table 1. **The proportions and the risk of low birth weight according to socio-economic factors – univariate analysis**

Variable	Cases (n=851) (n/%)	Controls (n=851) (n/%)	OR (CI)
Age:			
Less than 20 years	95/11.2	50/5.9	2.2 (1.55–3.22)
20–29 years (reference group)	462/54.3	544/63.9	1.0
30–34 years	149/17.5	156/18.3	1.1 (0.87–1.45)
35 years and older	145/17.0	101/11.9	1.7 (1.27–2.24)
Marital status:			
Single/divorced/widowed	142/16.7	71/8.3	2.2 (1.63–2.98)
Married/cohabiting (reference group)	709/83.3	780/91.7	1.0
Education:			
Primary/basic	219/25.7	95/11.2	3.4 (2.59–4.54)
Secondary	327/38.5	303/35.6	1.6 (1.29–1.98)
Vocational/university (reference group)	305/35.8	453/53.2	1.0
Income:			
300 LTL and less	452/53.1	264/31.0	2.5 (2.07–3.07)
More than 300 LTL (reference group)	399/46.9	587/69.0	1.0
Place of residence:			
Rural area	322/37.8	228/26.8	1.7 (1.35–2.04)
Urban area (reference group)	529/62.2	623/73.2	1.0
Employment before pregnancy:			
Unemployed	439/51.6	271/31.8	2.3 (1.87–2.78)
Employed (reference group)	412/48.4	580/68.2	1.0
Employment during pregnancy:			
Unemployed	457/53.7	292/34.3	2.2 (1.83–2.70)
Employed (reference group)	394/46.3	559/65.7	1.0

n – number of mothers, OR – odds ratio, CI – 95% confidence interval.

1.98), if compared to vocational or university education group.

Mothers with low income had 2.5-fold higher risk of delivery of LBW baby (95% CI 2.07–3.07), while the odds ratio to deliver LBW baby for mothers living in rural area was 1.7 (95% CI 1.35–2.04). Also unemployment either before pregnancy or during pregnancy significantly increased the risk of LBW baby (OR – 2.3 and 2.2 – respectively).

The factors increasing LBW risk significantly in the univariate analysis were included in logistic multivariable regression analysis with forced entry of selected variables (Table 2). Smoking during pregnancy was selected as the confounding factor and included in the logistic multivariable regression analysis model. The results showed that low (primary or basic) education, unstable marital status (single, divorced or widowed), low income and unemployment during pregnancy significantly increased LBW risk, independently of other risk factors. Also every additional year of age decreased the risk of LBW by 3 percent.

In order to evaluate the influence of several risk factors, logistic multivariable regression analysis including interaction of unfavorable socio-economic factors was performed (Table 3). The results showed that the odds to deliver LBW baby was the highest for interaction between low education, unstable marital status and low income – the odds was 7.8 (95% CI 4.32–14.06), while low educated and having unstable marital status mothers were at 5.7-fold higher risk to deliver LBW baby (95% CI 3.31–6.47). Low education interacting with low income or unemployment during pregnancy significantly increased the LBW risk (OR – 4.8, 95% CI 3.44–6.57 and OR – 4.7, 95% CI 3.35–6.47, respectively). Low income was the most common risk factor, which increased the risk to deliver LBW baby in the interaction with unfavorable maternal factors such as young or older maternal age, unstable marital status and unemployment during pregnancy, OR varying from 3.4 to 4.4.

Discussion

Number of researchers stated that maternal socio-economic factors (education, marital status, income and employment status) are associated with particular health behavior peculiarities and health status that can further directly influence the newborns' health. Low educated mothers with low income and without permanent employment are more frequently malnourished, have unhealthy habits (smoking, alcohol consumption and drug abuse), chronic diseases and inadequate prenatal care (9, 12). However, some investigators concluded that maternal education remains a significant factor increasing the risk to deliver LBW baby even after adjustment for possible confounding factors such as maternal age, parity, obstetrical anamnesis and prenatal care level (6). S. S. Hirve et al found that the risk of LBW is directly correlated with mother's education, and the etiological fraction in exposed to the risk factor accounted for 41.4 percent of LBW cases (7). Researchers from the North Carolina University (USA) reported that intellectual abilities of children born with low birth weight had the strong relationship with the maternal intelligence, which is determined by their education, as well as with the marital status and income, which formed the general home environment (15). The results from other study showed the association between paternal education and infants' birth weight. According to the researchers' assumption, this is based on the association with maternal social class

Table 2. **The odds to deliver the low birth weight baby according to maternal socio-economic factors using logistic multivariable regression analysis**

Variable	OR	CI	p
Maternal age (in years)	0.97	0.95–0.99	0.001
Unstable marital status	1.5	1.06–2.04	0.022
Low education	2.0	1.49–2.71	<0.001
Low income	1.7	1.58–2.84	<0.001
Living in the rural area	1.3	1.01–1.58	0.04
Unemployment during pregnancy	1.7	1.37–2.10	<0.001
Smoking during pregnancy	2.6	1.96–3.49	<0.001

OR – odds ratio, CI – 95% confidence interval, p – probability.

Table 3. **The odds to deliver the low birth weight baby according to interaction between maternal socio-economic factors using logistic multivariable regression analysis**

Interaction between variables	OR	CI
Older age + single/divorced/widowed vs. other age + married/cohabiting	2.1	0.93–4.81
Older age + low income vs. other age + high income	4.1	2.68–6.22
Young age + low income vs. other age + high income	3.4	2.18–5.35
Primary/basic education + low income vs. secondary/vocational/university education + high income	4.8	3.44–6.57
Single/divorced/widowed + low income vs. married/cohabiting + high income	4.4	2.95–6.46
Primary/basic education + single/divorced/widowed vs. secondary/vocational/ university education + married/cohabiting	5.7	3.31–9.98
Unemployed during pregnancy + low income vs. employed during pregnancy + high income	3.6	2.85–4.65
Unemployed during pregnancy + primary/basic education vs. employed during pregnancy + secondary/vocational/university	4.7	3.35–6.47
Unemployed during pregnancy + single/divorced/widowed vs. employed during pregnancy + married/cohabiting	3.8	2.58–5.53
Primary/basic education + single/divorced/widowed + low income vs. secondary/vocational/university + married/cohabiting + high income	7.8	4.32–14.06

OR – odds ratio, CI – 95% confidence interval.

and general welfare of family (16). In our study low maternal education was associated with the highest risk to deliver LBW baby confirming the results of other authors.

Researchers from California University (USA) found the association between low birth weight and family income as well as the direct correlation between the income and employment (17). According to the literature review from period for years 1946–1969, women who were employed during pregnancy had the higher risk of low birth weight, stillbirth and perinatal death, if compared to unemployed. However, later studies from 1970 showed the different tendencies of the higher incidence of LBW among unemployed pregnant women. Moreover, the differences in the proportions of LBW between various occupational groups were observed during last few decades (18). There are several possible reasons explaining the importance of maternal employment. Firstly, modern occupational devices and environment of workplace guarantee the better working conditions. With the improvement of industrial and manufacturing technologies the hard manual work became less popular, which is accounted for the higher risk of complicated pregnancy. Secondly, employment is also associated with other socio-economic factors, such as education, income, social class and marital status. According to results from different studies, employed expectant mothers are more likely to be married, nonsmoking and to have better prenatal care (14, 19). Naturally, the unemployed women have more problems related to deprivation and social insecurity. It was found that women employed only in the first trimester had the same pregnancy outcomes and newborn's birth weight as the unemployed ones. According to our study results, the maternal income and employment before pregnancy and during pregnancy were the important predictors of LBW.

The marital status is regarded as unstable if mother is single, divorced or widowed. The results from different studies showed the association between unstable marital status and the higher risk of LBW (10, 12, 14). This status affects the maternal economic, social and psychological welfare. It is apparent that mothers with unstable marital status during pregnancy suffer more economic deprivation, feel less in control of their life, are more dependent on state support, look after themselves less well, are more emotionally distressed and experience more serious life events than married or cohabiting women (20). Unstable marital status is also related to the delivery in young age, unemployment, low education, low income and unhealthy health behavior (10, 14). Some authors found that unstable

marital status has stronger influence in case of delayed childbearing (35 years and older) (14, 21). Researchers maintain that the influence of social factors declines if the study results are adjusted to maternal age, parity and hazardous habits (9, 12). Our results of univariate analysis supported the hypothesis that marital status was the important social predictor of LBW, while its significance decreased in logistic multivariable regression analysis. On the other hand, unstable marital status in the interaction with maternal low education, low income or unemployment during pregnancy significantly increased the risk to deliver LBW baby.

Our results confirmed the U-shaped relationship between maternal age and LBW risk – young (less than 20 years) and older (35 years and older) mothers were at higher risk to deliver LBW baby, if compared to other age groups. Maternal age is associated with some other factors. The growth of incidence of LBW among teenagers and elderly mothers could be partly explained by their smoking (14). Teenage mothers are more likely than others to be poor, less educated, unmarried and they are less likely to receive early prenatal care – all known risk factors for low birth weight. Consequently, efforts to improve the socio-economic environment of pregnant teenagers may reduce their risk of poor reproductive outcomes but will not eliminate it. Besides, every effort should be made to persuade pregnant teenagers to obtain adequate prenatal care and to adopt a healthy lifestyle (17). The question of whether delaying childbearing increases the risk of LBW is of importance both to women who are contemplating the postponement of childbearing and to physicians who are counseling patients any attendant risk. The higher proportion of LBW in the older maternal age at delivery is associated with the higher morbidity of chronic and age-related diseases like antepartum hemorrhage and arterial hypertension as well as the unhealthy behavior. However, delayed childbearing is associated with an increased risk of LBW even after adjustment for maternal complications and other risk factors (19).

The differences between the proportions of LBW among women living in rural and urban areas were significant only in univariate analysis, while in logistic multivariable regression analysis the importance of place of residence became not significant. Researchers from Virginia State University (USA) presented the assumptions related to the lower risk of LBW among women from urban areas. According to their results, it might be associated with better health care accessibility and more health-friendly environment (22). In our study the differences of proportions of LBW in rural and urban areas supported the common tendencies of socio-economic inequalities in health in Lithuania. Mothers living in rural area are more likely to be low educated and unemployed as well as to have lower income and more hazardous habits, if compared to mothers living in urban areas.

There are very few articles presenting the results about the influence of interaction between several maternal unfavorable socio-economic factors on newborns' birth weight. Researchers from Finland found significantly higher LBW proportion among mothers who were of young (less than 20 years) or older age (more than 29 years), unmarried and smoked during pregnancy, if compared to mothers who were 20–29 years old, married and non-smoking – 4.7 and 2.3 percent respectively (23). Results from study carried out in Puerto Rico showed that low educated mothers who also were of young age (less than 20 years) and unmarried had the higher risk to deliver LBW baby, if compared to older (20 years and older) and married mothers (RR – 1.2 and 1.0 respectively) (24). Maternal unemployment together with one of several unfavorable socio-economic factors such as unstable marital status, low education or low income significantly increased the risk of LBW in the Alabama County Case-Control Study for Low Birth Weight (25).

In summary, the analysis of relations between LBW and maternal socio-economic factors showed that the highest rates of LBW were found among young (at age less than 20 years) or older mothers (35 years and older), being in unstable marital status (single, divorced or widowed), low educated (with primary or basic education), having low income (less than 300 LTL), living in rural areas and unemployed before pregnancy and during pregnancy. Following the policy of WHO, every country should invest in the families' socio-economic welfare and implement the state policy supporting the expectance of planned, desirable offspring and the developing good paternal skills (10).

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Motinos socialiniai ir ekonominiai veiksniai ir mažo gimimo svorio rizika Lietuvoje

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Raktažodžiai: atvejo–kontrolės tyrimas, mažas gimimo svoris, socialiniai bei ekonominiai veiksniai.

Santrauka. *Tikslas.* Įvertinti motinos socialinių bei ekonominių veiksnių įtaką mažo gimimo svorio rizikai Lietuvoje.

Metodika. Tai prospektyvusis atvejo–kontrolės tyrimas. Ištirtas 851 mažo gimimo svorio naujagimis (<2500 g) (atvejai) ir 851 normalaus svorio naujagimis (kontrolinė grupė). Tyrimas vyko nuo 2001 m. vasario 1 d. iki 2002 m. spalio 31 d. šešiuose didžiausiuose Lietuvos gimdymo stacionaruose. Naujagimių motinos buvo apklaustos pimąją ar antrąją parą po gimdymo naudojant struktūrizuotą klausimyną. Duomenų analizė atlikta naudojant statistinę programą „SPSS for Windows 10.0“.

Rezultatai. Vienveiksnės analizės metu nustatyta, jog jaunas (iki 20 metų) ir vyresnis (35 metai ir daugiau) motinos amžius, mažas (pradinis ar pagrindinis) išsimokslinimas, nestabili šeimos padėtis (jei motina neištekėjusi, išsiskyrusi arba našlė), mažos pajamos, gyvenimas kaime ir nedarbas iki nėštumo bei nėštumo laikotarpiu didino mažo gimimo svorio riziką. Daugiaveiksnės logistinės regresijos analizės duomenimis, mažas išsimokslinimas, mažos pajamos ir nedarbas nėštumo laikotarpiu reikšmingai didino mažo gimimo svorio riziką – šansų santykis (ŠS) atitinkamai, 2,0, 1,7 ir 1,6. Keleto nepalankių veiksnių sąveika mažo gimimo svorio riziką padidino 3,4–7,8 karto. Nustatyta, jog didžiausia rizika pagimdyti mažo svorio naujagimį buvo mažo išsimokslinimo, nestabilios šeimos padėties ir mažas pajamas turinčioms moterims.

Išvados. Nepalankūs motinos socialiniai bei ekonominiai veiksniai didina mažo gimimo svorio riziką.

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