

# Antenatal maternal mental state and anthropometric characteristics of the neonates: I. Impact of symptoms of depression and anxiety

## Antenatalinė motinų psichikos būseną ir antropometrines naujagimių charakteristikas: I. Depresijos ir nerimo simptomų įtaka

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### SUMMARY

**Background.** Antenatal maternal depression and anxiety disorders are prevalent during pregnancy and might have adverse effect on obstetric, fetal and neonatal outcomes. Therefore, the aim of this study was to evaluate relationship between symptoms of antenatal maternal depression and anxiety versus anthropometric characteristics of the neonates.

**Methods.** Three-hundred and seven randomly selected pregnant women attending two obstetric clinics agreed to participate in the study and were evaluated for symptoms of depression using the Edinburgh Postnatal Depression Scale (EPDS) and for symptoms of anxiety using the Spielberger Trait Anxiety Inventory (STAI) in the first, second and third trimesters of pregnancy. After these women delivered a birth we analyzed 102 birth delivery medical case histories and obtained information about birth weight, height, Apgar scores of neonates and calculated Body Mass Index (BMI) of neonates.

**Results.** There were positive and significant correlations between scores on the EPDS in the third trimester of pregnancy as well as on scores on the STAI in the third trimester of pregnancy versus BMI of neonates ( $r=0,24$ ,  $p=0,03$  and  $r=0,22$ ,  $p=0,05$ , respectively). Woman who scored 12 or more on the EPDS in the third trimester of pregnancy as well as woman who scored 50 or more on the STAI in the third trimester of pregnancy delivered neonates with significantly higher BMI than woman who scored less than 12 on the EPDS and less than 50 on the STAI in the third trimester of pregnancy ( $14,6 \pm 1,5$  vs.  $13,2 \pm 1,2$ ,  $p=0,02$  and  $14,0 \pm 1,4$  vs.  $13,2 \pm 1,2$ ,  $p=0,02$ , respectively).

**Conclusions.** Symptoms of antenatal maternal depression and anxiety are associated with higher BMI of neonates. Woman with clinically significant symptoms of depression and/or symptoms of anxiety have delivered neonates with significantly higher BMI when compared to woman without symptoms of depression and/or anxiety.

**Key words:** antenatal maternal depression and anxiety, birth weight, height, Apgar scores, Body Mass Index.

### SANTRAUKA

**Įvadas.** Depresijos ir nerimo sutrikimai yra dažni nėštumo metu ir gali turėti neigiamos įtakos motinai ir vaisiui ar naujagimiui. Todėl šio tyrimo tikslas buvo įvertinti ryšį tarp depresijos ir nerimo simptomų pasireiškimo nėštumo metu ir naujagimio antropometrinių ypatybių.

**Metodai.** 307 atsitiktiniu būdu pasirinktos nėščiosios, kurios lankėsi dviejose akušerijos klinikose, sutiko dalyvauti tyrime. Nėščiujų depresijos ir nerimo simptomai buvo vertinami pirmą nėštumo trimestrą, antrą nėštumo trimestrą ir trečią nėštumo trimestrą. Depresijos simptomai buvo įvertinti naudojant Edinburgo pogimdyminės depresijos skalę (angl. *Edinburgh Postnatal Depression Scale*, EPDS); nerimo simptomai buvo įvertinti naudojant Spielberger asmenybės nerimo inventorių (angl. *Spielberger Trait Anxiety Inventory*, SANI). Antrame tyrimo etape buvo analizuojamos 102 moterų gimdymo ligos istorijos. Iš ligos istorijų buvo surinkti duomenys apie naujagimių svorį, ūgį ir Apgar skalės rezultatus. Taip pat buvo suskaičiuotas naujagimių kūno masės indeksas (KMI).

**Rezultatai.** Nėštumo metu EPDS ir SANI skalėse surinktų balų skaičius trečią nėštumo trimestrą koreliavo teigiamai ir statistškai reikšmingai su naujagimių KMI (atitinkamai  $r=0,24$ ,  $p=0,03$  ir  $r=0,22$ ,  $p=0,05$ ). Moterys, kurios trečią nėštumo trimestrą surinko 12 ir daugiau EPDS balų, ir moterys, kurios trečią nėštumo trimestrą surinko 50 ir daugiau SANI balų, pagimdė naujagimius su statistškai reikšmingai didesniu KMI nei moterys, kurios surinko mažiau nei 12 EPDS balų ir mažiau nei 50 SANI balų trečią nėštumo trimestrą.

**Išvados.** Didesnis motinų depresijos ir nerimo simptomų skaičius trečio nėštumo trimestro metu yra susijęs su didesniu naujagimių KMI. Moterys, kurioms buvo kliniškai reikšmingi depresijos ir nerimo simptomai trečio nėštumo trimestro metu, pagimdė naujagimius su didesniu KMI nei moterys, kurioms kliniškai reikšmingų depresijos ir nerimo simptomų trečią nėštumo trimestrą nebuvo.

**Raktažodžiai:** nėštumas, depresijos simptomai, nerimo simptomai, naujagimis, svoris, ūgis, kūno masės indeksas, Apgar balai.

### INTRODUCTION

Antenatal maternal depression, as well as antenatal maternal anxiety disorders are prevalent during pregnancy and are

major health problems [1, 2]. Results from recent population-based study showed that the prevalence of depression and/or anxiety disorders among pregnant woman is up to 30% and it

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seems to be higher during pregnancy than postpartum [3]. In Lithuanian pregnant woman the prevalence of depressive disorders was found to be about 7% and the prevalence of symptoms of depression was found to be about 17% [4].

It is well known that depression and anxiety disorders have negative impact on well-being of pregnant woman, on their relationship with family members and might interfere with fetus growth and development. If untreated, these antenatal mood disorders together with socio-economic deprivation and with other adverse factors may increase the likelihood of postnatal depression [5, 6].

Antenatal maternal depression and antenatal maternal anxiety disorder may have adverse effect on obstetric, fetal and neonatal outcomes. It is well known that antenatal maternal depression and anxiety, as well as maternal psychological stress are associated with poor birth outcomes including prematurity and miscarriage [7, 8]. The recent study from Pakistan shows that depression during pregnancy predicts low birth weight [9]. Low birth weight is associated with increased risk of mortality and morbidity of infants [10]. Furthermore, antenatal maternal depression as well as antenatal anxiety disorder is a risk factor for behavioral and emotional problems [11] and psychotic illness [12] in later life of children. Another important issue is that woman suffering from depression and anxiety disorders might be taking psychotropic medication for these disorders. These medications easily cross placenta and might have negative impact on fetus [13].

Therefore the aim of this study was to evaluate the relationship between symptoms of antenatal maternal depression, symptoms of antenatal maternal anxiety and anthropometric measurements of neonates.

### SUBJECTS AND METHODS

The study and its consent procedures were approved by the Regional Committee of Ethics in Biomedical Research at the Kaunas University of Medicine, Kaunas, Lithuania. In a period of 2003-2005 pregnant woman attending two obstetric clinics in Kaunas, Lithuania, were randomly invited to participate in the study. Three-hundred and seven pregnant women agreed to participate in the study and were evaluated by psychiatrist for symptoms of depression and symptoms of anxiety in the first trimester (12<sup>th</sup> – 16<sup>th</sup> week of pregnancy), in the second trimester (22<sup>nd</sup> – 26<sup>th</sup> week of pregnancy) and in the third trimester (32<sup>nd</sup> – 36<sup>th</sup> week of pregnancy) of pregnancy. From a sample of woman who agreed to participate in the study we randomly selected 102 women and obtained birth delivery medical case histories after they delivered a birth. Three (3%) women were excluded from the study because they had diagnosis of diabetes, 2 (2%) women were excluded from the study because they delivered very low body weight neonates (<1500 g).

Symptoms of depression were evaluated using validated Lithuanian version [14] of the Edinburgh Postnatal Depression Scale (EPDS) [15]. Though originally this instrument was designed for screening of postnatal depression, today it is widely used for evaluation of depression symptoms throughout all periods of women's life in clinical practice as well as in epidemiological studies [16]. The EPDS is beneficial against other instruments used for screening of depressive symptoms during pregnancy because it evaluates psychological, cognitive, but

not physical symptoms of depression that are prevalent during pregnancy. The EPDS is easy to administer and most important it is an effective screening tool for identifying woman with depressive symptoms during pregnancy. The EPDS is a ten item self rating instrument and takes 2 to 5 minutes to complete. Each item is scored from 0 to 3 to which subject responds based on her experience over the past seven days. Possible scoring range is from 0 to 30. The score on the EPDS indicates severity of depression symptoms. Study by Lapkiene et al. [14] found that the EPDS is an optimal screening instrument for severe depressive illness when cut-off score of 12 and more is used with sensitivity of 95% and area under the ROC curve of 0.94. Therefore in this study we considered that women are positive for symptoms of depression if they scored 12 or more on the EPDS.

Symptoms of anxiety were evaluated using the Spielberger Trait Anxiety Inventory (STAI) [17]. The STAI is widely used for clinical and research purposes in psychiatric population as well as in mentally healthy subjects, including pregnant women, to assess severity of anxiety symptoms [18]. It is a self rating scale consisting of 20 items; scores below 50 are normal; score on the STAI corresponds to severity of symptoms of anxiety. We considered that women are positive for symptoms of anxiety if they scored 50 or more on the STAI.

From birth delivery medical case histories we analyzed gender of the neonates, birth weight (in grams) of the neonates, height (in centimeters) of the neonates, Apgar scores on the 1<sup>st</sup> and 5<sup>th</sup> minutes of extrauterine life of the neonates and duration of the pregnancy (in weeks). We also calculated Body Mass Index (BMI) of the neonates. Weight and height of the neonates were substantiated by neonatologist who supervised childbirth in the first 24 postnatal hours. BMI was calculated using formula:  $BMI = \text{weight (kilograms)} / \text{height}^2 \text{ (meters)}$ . Apgar score of the neonates was evaluated by neonatologist who supervised childbirth in the 1<sup>st</sup> and 5<sup>th</sup> postpartum minutes. Apgar score is used in clinical practice to assess neonate's respiratory effort, heart rate, color, tone and reflex irritability [Table 1]. Scoring range is from 0 to 10. Apgar scores between 8 and 10 indicate that the neonate is making smooth transition to extrauterine life; scores  $\leq 7$  are associated with increased morbidity and mortality of neonates.

### STATISTICAL ANALYSES

All continuous data are presented as means  $\pm$  standard deviation, all categorical data as number and percent. First, we calculated Pearson's correlation coefficient between birth weight, height, BMI and Apgar scores on the 1<sup>st</sup> and 5<sup>th</sup> minutes of the neonates versus scores that women received on the EPDS and on the STAI in the first, second and third trimesters of pregnancy, respectively. In order to analyze whether anthropometric measurements of the neonates are associated with duration of pregnancy, we calculated Pearson's correlation coefficient between birth weight, height, BMI and Apgar scores on the 1<sup>st</sup> and 5<sup>th</sup> minutes of neonates versus duration of pregnancy.

Next we analyzed only those anthropometric characteristics of neonates that correlated significantly with scores on the EPDS and/or scores on the STAI, but not with duration of pregnancy. We compared anthropometric characteristics of the neonates of woman who scored 12 or more on the EPDS and/or 50 or more on the STAI in the third trimester of pregnancy ver-

Table 1. Apgar score

Criteria	Score		
	0	1	2
Color	All blue, pale	Pink body, blue extremities	All pink
Heart rate	Absent	<100 beats/min	>100 beats/min
Reflex response to nasal catheter/ tactile stimulation	None	Grimace	Sneeze, cough
Muscle tone	Limp	Some flexion of extremities	Active
Respiration	Absent	Irregular, slow	Good, crying

Table 2. Pearson's correlations between weight, height, body mass index, Apgar scores in the 1<sup>st</sup> and 5<sup>th</sup> minutes of the neonates and duration of pregnancy versus scores on the EPDS and the STAI in the first, second and third trimesters of pregnancy

Neonates' characteristics	Duration of pregnancy	Scores on the EPDS			Scores on the STAI		
		1 <sup>st</sup> trimester	2 <sup>nd</sup> trimester	3 <sup>rd</sup> trimester	1 <sup>st</sup> trimester	2 <sup>nd</sup> trimester	3 <sup>rd</sup> trimester
Birthweight	<b>0,48*</b>	0,15	0,16	0,20	0,15	0,19	0,18
Height	<b>0,30*</b>	0,02	0,09	0,06	0,06	0,11	0,02
Body mass index	0,18	0,17	0,1	<b>0,24*</b>	0,16	0,14	<b>0,22*</b>
Apgar score 1 <sup>st</sup> minute	<b>0,38*</b>	0,15	0,13	0,09	0,19	0,18	0,12
Apgar score 5 <sup>th</sup> minute	<b>0,38*</b>	0,10	0,17	0,10	0,08	<b>0,23*</b>	0,13
Duration of pregnancy (wks)	–	0,01	-0,01	-0,06	0,04	0,07	0,02

\*p<0,05

anthropometric characteristics of the neonates of woman who scored less than 12 on the EPDS and/or less than 50 on the STAI in the third trimester of pregnancy.

A probability level of p<0,05 was taken as significant. Statistical analyses were performed using Statistical Package for the Social Sciences 12.00 software package (SPSS Inc., Chicago, Illinois).

## RESULTS

A total of 97 birth delivery medical case histories were analyzed. Mean age of mothers at the time of birth delivery was 30 ± 5 years; mean duration of pregnancy was 39 ± 2 weeks. Seventy-one (73%) woman had natural delivery and 26 (27%) had Cesarean section. There were 53 (55%) boys and 44 (45%) girls delivered.

We found that there was a positive and significant correlations between scores on the EPDS in the third trimester of pregnancy as well as on scores on the STAI in the third trimester of pregnancy versus BMI of neonates (r=0,24, p=0,03 and r=0,22, p=0,05, respectively) [Table 2]. There was also positive and significant correlation between scores on the STAI in the second trimester of pregnancy and Apgar scores on the 5<sup>th</sup> minute of extrauterine life of the neonates (r=0,23, p=0,03). Duration of pregnancy correlated significantly with birth weight, height, and Apgar score on the 1<sup>st</sup> and 5<sup>th</sup> minutes of neonates, but not with BMI of neonates. It means that higher BMI of neonates is associated with higher levels of depression and anxiety, but not with longer duration of pregnancy.

Next, we compared anthropometric measurements and Apgar scores of the neonates whose mothers scored 12 or more on the EPDS and 50 or more on the STAI with anthropometric measurements and Apgar scores of the neonates whose mothers scored less than 12 on the EPDS and less than 50 on the STAI, respectively, in different trimesters of pregnancy. As it might be predicted from the analyses of correlations, we found significant differences in the third trimester only for BMI, but not for other anthropometric measurements. Figure 1 and figure 2

show that woman who scored 12 or more on the EPDS in the third trimester of pregnancy as well as woman who scored 50 or more on the STAI in the third trimester of pregnancy delivered neonates with significantly higher BMI than woman who scored less than 12 on the EPDS and less than 50 on the STAI in the third trimester of pregnancy (14,6 ± 1,5 vs. 13,2 ± 1,2, p=0,02 and 14,0 ± 1,4 vs. 13,2 ± 1,2, p=0,02, respectively).

## DISCUSSION

This study shows that higher levels of antenatal maternal depression and anxiety in the third trimester of pregnancy are associated with higher BMI of neonates, and that woman who scored 12 or more on the EPDS and/or 50 or more on the STAI in the third trimester of pregnancy delivered neonates with significantly higher BMI when compared to woman who scored less than 12 on the EPDS and/or less than 50 on the STAI in the third trimester of pregnancy.

Large population-based study by Anderson et al. [3] performed in Sweden found that maternal antenatal depressive disorders and/or antenatal anxiety disorders, diagnosed using Primary Care Evaluation of Mental Disorders (PRIME-MD) questionnaire, were not independent risk factors for deteriorated neonatal outcomes, including small birth weight. We also did not find significant association between levels of symptoms of antenatal maternal depression/anxiety and birth weight. Instead we found that higher levels of antenatal maternal depression and anxiety are associated with higher BMI, which is directly proportional to bodyweight. This finding contrasts results of the study performed in a developing country [9] that found that maternal antenatal depression predicts low birth weight (≤2500 g). Authors of this study concluded that poverty together with poor maternal nutritional status, which often goes with depression in developing countries, might be important confounders of these findings.

There is a debate in a literature about association between increased BMI, metabolic syndrome and depression. In developed countries depression is positively associated with increased

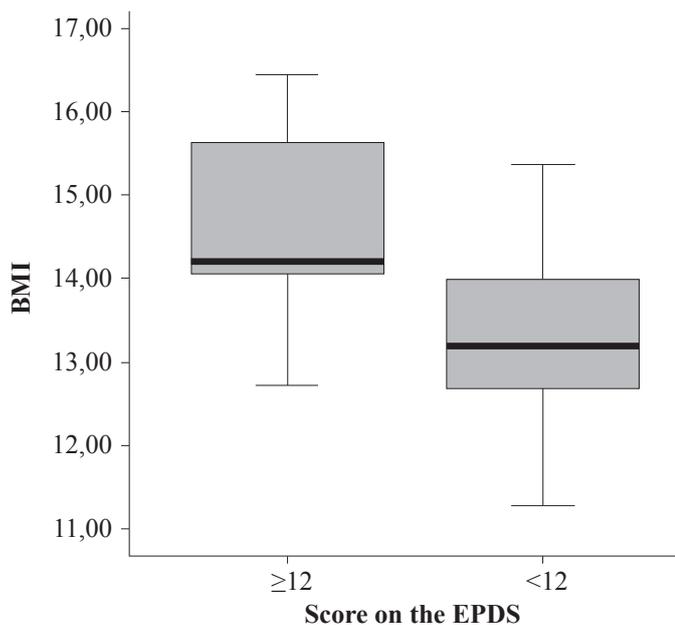


Figure 1. Body mass index (BMI) of the neonates whose mothers scored 12 or more on the EPDS in the third trimester of pregnancy versus BMI of the neonates whose mothers scored less than 12 on the EPDS in the third trimester of pregnancy,  $p=0,02$  (adjusted for gender of the neonates)

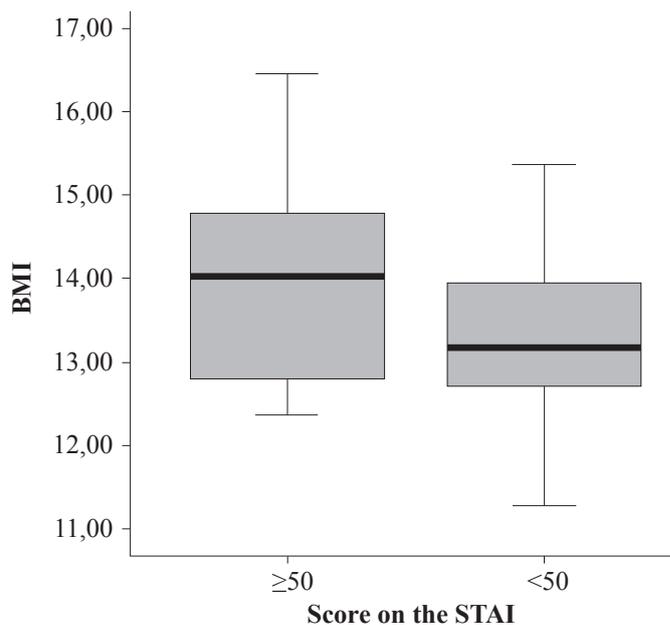


Figure 2. Body mass index (BMI) of the neonates whose mothers scored 50 or more on the STAI in the third trimester of pregnancy versus BMI of the neonates whose mothers scored less than 50 on the STAI in the third trimester of pregnancy,  $p=0,02$  (adjusted for gender of the neonates)

BMI, especially in white women [19]. Increased BMI and obesity are among major risk factor for diabetes [20] and may be related to increased birth weight of neonates [21]. Moreover, several recent publications have demonstrated that neonatal and infant body weight and BMI are important factors predicting cardiovascular morbidity, stroke and diabetes in adults [22, 23].

We also found that higher scores on the STAI in the second trimester of pregnancy were associated with higher Apgar scores on the 5<sup>th</sup> minute of extrauterine life. On the other hand duration of pregnancy has strongly correlated with Apgar scores as well as with all anthropometric measurements of neonates, but not with BMI. These findings suggest that duration of pregnancy is an important confounder for Apgar scores, birth weight and height of neonates, but not for BMI of neonates. Therefore an association of BMI of neonates with symptoms of anxiety and with symp-

toms of depression is independent from duration of pregnancy.

The main limitation of this study is a relatively small sample size (97 neonates) and studies with larger sample size are needed. On the other hand the strengths of this study included community-based population from a defined geographical area of Lithuania.

## CONCLUSIONS

Results of this study indicate that higher severity of symptoms of antenatal maternal depression and anxiety are associated with higher BMI of neonates. Woman with clinically significant level of symptoms of depression and/or symptoms of anxiety have delivered neonates with significantly higher BMI when compared to woman without clinically significant symptoms of depression and/or anxiety.

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