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The significance of under- or overweight during childhood as a risk factor for hypertensive diseases in pregnancy

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Abstract Hypertensive diseases in pregnancy are still a major cause of foetal and maternal mortality. Known risk factors allow identification of only a small number of patients at risk of developing such a complication. However, better knowledge of the risk profile would improve an early adequate monitoring of these pregnancies. We therefore investigated the correlation between under- or overweight during childhood and the development of hypertensive diseases during pregnancy. The study was designed as a cross-sectional case control study. A self-administered questionnaire was distributed to 2600 women, who had contacted the German pre-eclampsia self-help group for information on hypertensive diseases in pregnancy and 1233 control women recruited in different hospitals. Diagnosis according to criteria of the international society for hypertensive diseases in pregnancy was based on medical records. 766 women with a hypertensive disease during their pregnancy and 951 control women with normal pregnancies were evaluated after verifying for exclusion criteria and complete data sets. Student *t*-test, chi square test and multivariate logistic regression models were used for statistical analysis. A history of under- (OR 2.1, 95% CI 1.23—3.61) or overweight (OR 1.46, 95% CI 1.01—2.12) during childhood is associated with an increased risk for hypertensive diseases in pregnancy, which is at least partly independent of pre-pregnancy BMI. In combination with other risk factors, a history of under- or overweight during childhood will help to identify patients at risk for hypertensive diseases in pregnancy.

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1. Introduction

Hypertensive diseases in pregnancy (HDP) are still one of the leading causes of maternal mortality, prematurity and perinatal death [1]. Despite intensive research during the past decades, no causal treatment of HDP is available to date. Prophylactic options are therefore of major clinical importance. Unfortunately the currently known risk factors, i.e. parity, chronic hypertension, increased pre-pregnancy BMI, ethnicity, renal diseases, dyslipidemia, autoimmune diseases, multiple gestations and family risk factors allow identification of only a small group of women, who are at risk of developing HDP. Therefore a better definition of the risk profile for HDP is needed to offer patients an adequate monitoring of their pregnancy. In addition, knowledge of further risk factors may improve the understanding of pathophysiological mechanisms in the aetiology of HDP.

One of the well known risk factors for HDP is a high pre-pregnancy BMI [2—5]. A worldwide study of 52 communities (INTERSALT study) has shown, that in non-pregnant women, body weight has the strongest, most consistent and independent correlation with blood pressure, of all measured characteristics, aside from age [6]. To our knowledge only one study investigating the correlation between childhood overweight and hypertension in pregnancy has been published [7]. In this small study group, the investigators showed that weight problems during childhood may play an important role in the aetiology of HDP [7]. The role of weight problems in childhood is already known in the aetiology of cardiovascular diseases, where interestingly an increased risk is also present, when adolescents lose the excess weight during the adult period [8]. This suggests that obesity during adolescence may set triggers that are associated with a higher risk for cardiovascular diseases in the adult [8].

While the currently available data provide evidence for a correlation between childhood obesity and an increased risk for HDP, there are to our knowledge no data about the correlation between underweight during childhood and HDP. Recent studies have shown, that there is an increased risk for diseases associated with HDP such as hypertension, diabetes, arteriosclerosis, etc. in adulthood when children are born underweight [9]. Although details of pathophysiological mechanisms still remain unclear "foetal programming" is discussed as the underlying cause for the augmented risk for these adult diseases. As diabetes, arteriosclerosis and HDP share many common risk factors, it seems likely that HDP may also be influenced by "foetal programming".

We therefore investigated whether there is any correlation between under- and/or overweight during childhood and the development of HDP as an adult.

2. Methods

The presented data are part of the Hy-Di-PreG-project (*Hy*pertensive *Di*seases in *Preg*nancy) a nationwide study exploring aetiologic factors in the genesis of HDP. The project was designed in cooperation with the German pre-eclampsia self-help group (Gestosefrauen e.V.). The study was approved by our institution's ethic committee and all participants signed informed consent.

A standardized self-administered questionnaire comprising obstetrical and psychosocial questions was developed on the background of current literature and the clinical experience of the investigators. The questionnaire was sent to 2600 women who had contacted the German pre-eclampsia self-help group for information on HDP. 168 responses came from professionals, doctors, nurses and midwifes. 1067 women, one of which had HDP, sent back their completed questionnaire. It seems likely that the percentage of professionals in the group of non-respondents is equal or higher than in the group of respondents. In addition, women also contacted the pre-eclampsia self-help group when HDP was suspected, but could be excluded after review of their medical records. Therefore, the exact response rate of women actually presenting HDP cannot be calculated.

Control women were recruited in seven hospitals. Women were excluded from the control group if they met one of the following criteria: HDP, chronic hypertension, BP $\geq$ 140/90 mm Hg more than once during pregnancy, hypo- or hyperthyroidism, gestational diabetes, diabetes mellitus, autoimmune diseases, proteinuria $\geq$ 0.3 g in 24-h urine or $\geq$ 1 g/L in spontaneous urine ($\cong$ $\geq$ 1+ on urine dipstick) during pregnancy and/or insufficient knowledge of the German language.

After being given information on the aims of the study, the questionnaire was filled in by 1233 controls with uncomplicated pregnancies. Subsequent to verifying exclusion criteria 1484 control women were approached to be included in the study, of which 1233 agreed to participate. Lack of time was named as the main reason (92%) for not participating in the study. We received 1063 completed questionnaires, 951 of which could be included in the study. 112 of them had to be excluded due to incomplete data sets. Differences between control women participating or refusing to participate/being excluded were not statistically significant with regard to age, parity or socio-economic status. All women gave written consent to verification of their diagnosis through their medical records.

According to definitions from the international society for the study of hypertension in pregnancy (ISSHP) [10], diagnoses in the patient group were differentiated using the following definitions:

Gestational hypertension (GH): Blood pressure $\geq$ 140/90 mm Hg after 20 weeks of gestation and no longer than six weeks post-partum on two occasions $\geq$ 6 h apart;

Chronic hypertension (CH): Blood pressure $\geq$ 140/90 mm Hg before 20 weeks of gestation and after the 6th post-partal week on two occasions $\geq$ 6 h apart;

Pre-eclampsia (PE): GH/CH + second degree proteinuria [$\geq$ 0.3 g in a 24-h urine specimen or dipstick proteinuria score $\geq$ 1+ in random urine collection];

HELLP-syndrome (H): hemolysis [lactic dehydrogenase $\geq$ 3 STD, aspartate amino-transferase $\geq$ 3 STD, alanine aminotransferase $\geq$ 3 STD, platelet count $\leq$ 100 G/L].

The group of pregnancies with HELLP-syndrome also includes patients with a combination of HELLP-syndrome and hypertension or proteinuria as defined above. In order to have the same exclusion criteria, women with diabetes