

SUMMARY

Cardiovascular diseases are the number one cause of death globally. In high-income countries, one in three individuals die from cardiovascular disease. Higher rates of cardiovascular disease are observed among socioeconomic disadvantaged groups. The association between cardiovascular disease and socioeconomic status can partly be explained by risk factors of cardiovascular disease (e.g. cigarette smoking and obesity) which are more common in adults with a low socioeconomic background. Increasing evidence indicates that several cardiovascular risk factors are already acting in utero and in early childhood. For example, cardiovascular disease is associated with adverse birth outcomes, accelerated growth, and overweight in childhood. These risk factors might also be associated with socioeconomic status and might therefore contribute to socioeconomic inequalities in cardiovascular disease. However, little is known about socioeconomic inequalities in cardiovascular disease risk factors in early childhood. This thesis focuses on the association between socioeconomic status and early cardiovascular disease risk factors. Secondly this thesis focuses on the explanatory factors in these relationships from a public health point of view. The background of this thesis is further addressed in **chapter 1**. This chapter also describes the ABCD study in which the studies of this thesis were performed. The ABCD study is a prospective pregnancy cohort in which information about pregnancy, birth outcomes, and infant feeding practice has been included. At age five-six, children underwent a health check including measures of body composition, blood pressure, and blood glucose metabolism.

In the first part of this thesis, we focus on the association between socioeconomic status and birth outcomes. In **chapter 2**, educational inequalities in small for gestational age are explained. Compared with high-educated mothers, the odds to deliver a small for gestational age birth is two times higher for women with low education. Maternal cigarette smoking and maternal height comprise the largest contributions in explaining the higher prevalence of small for gestational age birth among low-educated women. Other factors, such as maternal underweight, alcohol use, and psychological factors appear not to play a significant role. In **chapter 3**, the explanatory role of maternal cigarette smoking and environmental tobacco exposure are studied in the association of maternal education with preterm birth, low birth weight, and small for gestational age birth. The twofold higher risk of these adverse outcomes among low-educated women, compared to high-educated women can largely (43-66%) be explained by maternal cigarette smoking. Environmental tobacco exposure does not have an additional role in explaining these associations. **Chapter 4** provides evidence that the association between maternal education and small for gestational age birth can for a small part be explained by maternal vitamin D status. The contribution of maternal vitamin D status seems especially relevant in overweight women and women who conceived in wintertime.

In the second part of this thesis, the association of socioeconomic status with early growth and childhood body composition is described. **Chapter 5** describes that children with low-

educated mothers have an increased weight gain in the first year of life and an increased weight-for-length gain between 1 and 5 years of age. Educational inequalities in first year weight gain can be explained by maternal smoking and breastfeeding duration, whereas educational inequalities in early childhood weight-for-length gain can be explained by maternal body mass index. In **chapter 6** the results of a systematic review of research into socioeconomic inequalities in adiposity at preschool age are discussed. Overall, if ethnicity is taken into account adequately, there seems no relation of socioeconomic status to adiposity before six years of age. At five-six years of age Dutch children from lower socioeconomic background had a higher body mass index and fat mass index compared to children from higher socioeconomic background, as described in **chapter 7**. Explanatory factors of these findings are maternal smoking during pregnancy, maternal prepregnancy body mass index, and weight gain in the first year of life, the latter partly acting through shorter breastfeeding duration among low-educated women. **Chapter 8** discusses the use of body mass index as indicator of body composition. Maternal education is not only associated with a higher fat mass, but also with a lower lean mass and therefore body mass index might underestimate the socioeconomic gradient in true obesity, which is defined by excessive fat mass. As carbohydrate intake seems to play an important role in the development of childhood obesity, we focus on the relationship between carbohydrate/fibre intake and socioeconomic status in **chapter 9**. Children with low-educated mothers have a higher intake of mono-/disaccharides and a lower intake of fibre compared to children with high-educated mothers.

In the third part of this thesis, we address socioeconomic inequalities in cardiometabolic risk factors, particularly lipid- and glucose metabolism and subsequently blood pressure at age five-six. **Chapter 10** describes that children with low-educated mothers have a higher glucose, C-peptide and insulin resistance, which partly can be explained by a higher body mass index among children with low-educated mothers. There is no association between maternal education and cholesterol, high-density lipoproteins, low-density lipoproteins and triglycerides at age five-six. In **chapter 11** we demonstrate that children with low-educated mothers have 2.2 mm Hg higher systolic blood pressure, 1.7 mm Hg higher diastolic blood pressure and an almost twofold higher risk of being prehypertensive compared to children with high-educated mothers. Although in absolute numbers at an individual level these differences seem low, anticipated tracking and probable increase of these differences in later life signify the potential high impact of these findings in adulthood at public health level. These inequalities seem to have their origin very early in life as birth weight, breastfeeding duration and childhood body mass index partially explain these relations. As these determinants are potentially modifiable they may become important targets of intervention aiming at early prevention of cardiovascular disease. **Chapter 12** is a general discussion with a reflection on the results and methodological considerations including different indicators of socioeconomic status, the role of ethnicity, loss to follow up and residual confounding. Furthermore, this chapter makes recommendations for future research and public health practice. In short,

low socioeconomic status pregnant women should be motivated to stop smoking and start breastfeeding.