APPENDIX

Summary

PRECONCEPTION DIETARY INTAKE AND PHYSICAL ACTIVITY

The importance for future lifestyle and health of two generations

Dietary intake and physical activity are ever-recurring daily lifestyle behaviours. These lifestyle behaviours are important for a person’s health, especially when a woman has the wish to conceive or is pregnant, since a woman’s lifestyle before and during pregnancy affects her own health as well as the health of her offspring. Nevertheless, many women of reproductive age do not meet the recommended dietary intake and physical activity guidelines (chapter 1). It is, however, difficult to change lifestyle. Teachable moments such as the period around pregnancy can be used as a trigger to change dietary intake and physical activity: Besides their own health, future mothers feel responsible for the health of their expected child. By making use of this teachable moment to stimulate a healthy lifestyle, we hypothesised that a preconception lifestyle intervention has the ability to improve cardiometabolic health and lifestyle of two generations: women and their children.

In chapter 2 we studied the effects of a preconception lifestyle intervention on dietary intake and physical activity in infertile women, who were aged between 18 and 39 years old, with a BMI ≥29 kg/m². In total, 577 women were randomised into a six-month lifestyle intervention program aiming to lose 5-10% of their body weight (intervention group; N=290) or prompt infertility treatment (control group; N=287; the LIFEstyle study). Women in the intervention group were advised to consume a healthy diet according to the Dutch dietary guidelines of 2006, including a caloric reduction of approximately 600kcal compared to their usual caloric intake, but not consuming less than 1200kcal/day. Furthermore, participants were advised to be physically active 2-3 times a week for at least 30 minutes at moderate intensity (60-85% of maximum heart rate frequency), and to increase physical activity in daily life by taking 10,000 steps per day. Women allocated to the intervention group reduced their intake of sugary drinks, savoury snacks and sweet snacks compared to the control group. Furthermore, they increased their physical activity compared to women allocated to the control group. The decreased intake of sweet snacks persisted up to six months after the intervention program ended. These results showed that a preconception lifestyle intervention led to modest improvements in dietary intake and physical activity.
We followed these women over time and studied the effects of the preconception lifestyle intervention on diet, physical activity and body mass index (BMI) at 5.5 years after randomisation (chapter 3; WOMB project). Women allocated to the intervention group reported a lower energy intake at 5.5 years after randomisation. Furthermore, women in the intervention arm who successfully lost weight during the intervention period (i.e. BMI<29kg/m² or ≥5% weight loss) had a significantly lower BMI at 5.5 years after randomisation compared to women in the intervention arm who did not lose weight successfully. Additionally, women who successfully lost weight during the intervention period also reported a significantly lower energy intake compared to the control group. We did not observe a difference in macronutrient intake as percentage of total energy, diet quality, or physical activity between the intervention and control group, irrespective of successful weight loss during the intervention. Our results showed the potential sustainable effect of preconception lifestyle change on long term energy intake and BMI, which is more pronounced in women allocated to the intervention group who were successful in losing weight during the intervention.

Studying the effects of a preconception lifestyle intervention in the short and long term, we observed that the degree to which individuals changed their lifestyle after the intervention differed. This variation could affect their cardiometabolic health. To get more insight in dose-response relationships between lifestyle and body weight change with cardiometabolic health, we examined in chapter 4 if changes in dietary intake, physical activity and body weight of obese infertile women during the first six months of the LIFEstyle study were associated with their cardiometabolic health 3-8 years later (N=50 up to 78; BMI, blood pressure, body composition, pulse wave velocity, glycaemic parameters and lipid profile). Furthermore, we studied if changes in lifestyle and body weight during the first six months of the LIFEstyle study were associated with having metabolic syndrome at follow-up. Reductions in the intake of savoury and sweet snacks were associated with reduced insulin resistance 3-8 years later, but adjustment for current lifestyle weakened these associations. We found borderline significant associations (P<0.10) between fruit intake and physical activity with fat free mass, and between sugary drink intake with HDL-cholesterol, and an inverse association between weight with HDL-cholesterol. These results indicated that changing lifestyle is an important first step towards a more favourable cardiometabolic health, but maintaining this change is needed to improve cardiometabolic health in the long term.
Women's preconception lifestyle also has important implications for the growth, development and health of her offspring. However, little is known about the associations between maternal preconception dietary intake and physical activity with cardiovascular health of the offspring. We therefore studied this association in women who participated in the LIFEx_style study and their offspring, conceived within 24 months after randomisation (N=28 up to 46; chapter 5). Offspring cardiovascular health was measured by physical examinations (BMI, waist to height ratio, blood pressure, body composition and pulse wave velocity) in a mobile research vehicle. Preconception vegetable intake was inversely associated with offspring diastolic blood pressure and preconception maternal fruit intake was inversely associated with offspring pulse wave velocity. Against our expectations, preconception intake of maternal sugary drinks was positively associated with offspring fat free mass. This finding is in contrast with literature. We did not observe any other associations between preconception dietary intake and physical activity and offspring cardiovascular health. To conclude, higher intakes of vegetable and fruit before conception were associated with better cardiovascular health in the offspring. Since our sample size was small preconception research in larger study populations should replicate our findings.

In chapter 6, we systematically reviewed all current evidence on the association between maternal dietary intake and physical activity before and during pregnancy with offspring blood pressure and vascular health (pulse wave velocity and intima media thickness). We searched the databases MEDLINE and EMBASE from inception to June 30, 2017. Human intervention trials as well as observational studies among pregnant women or women planning to conceive, examining maternal dietary intake and/or physical activity before and/or during pregnancy and examining offspring cardiovascular outcomes related to micro and macro circulation were included in our systematic review. In total, of the 5145 articles retrieved and screened 19 articles were judged to be eligible for inclusion. Sixteen articles reported on the association of maternal dietary intake during pregnancy with offspring cardiovascular health and three articles reported on the association of maternal physical activity during pregnancy with offspring cardiovascular health. We concluded that there is a lack of consistent evidence to be able to draw robust conclusions on the association of women's dietary intake and physical activity before and during pregnancy with blood pressure and vascular health of the offspring. We did find evidence for a positive association of maternal carbohydrate intake in pregnancy with offspring blood pressure, and a negative association of maternal protein intake in pregnancy with offspring carotid intima media thickness. No consistent findings
for maternal fatty acid intake were found. For energy intake, fibre intake, protein to carbohydrate ratio, specific foods, dietary patterns and maternal physical activity the number of studies was too low to draw conclusions. Harmonization of valid exposure and outcome measurements, and the development of core exposure and outcome sets are needed to enable more robust conclusions.

In chapter 7, the main findings of this thesis were discussed and put into a broader perspective. We showed that the preconception lifestyle intervention was successful in decreasing the intake of high caloric snacks and beverages and in increasing physical activity. However, changes in lifestyle were modest. We expected that the most important motivation for obese infertile women to change their lifestyle preconceptionally would be that obesity negatively influenced the chances of becoming pregnant. However, the struggle with infertility and the accompanying stress might have made lifestyle changes more difficult, suggesting that it might be beneficial to start intervening earlier. Additionally, cardiovascular health outcomes in children participating in the WOMB project and results of our systematic literature review suggest the importance of prolonged lifestyle coaching after conception. Furthermore, our results suggest that preconception lifestyle interventions in obese women should not only focus on discouraging unhealthy behaviours to lose weight, but also encourage healthy behaviours to optimize offspring health. Moreover, to achieve larger and more sustainable preconception lifestyle change, we recommend to actively involve the partner in future preconception lifestyle interventions. Both partners should be motivated for and informed about a healthy lifestyle for the benefit of their own health and that of their offspring.