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What happens after a physical activity intervention during pregnancy?

A 6-year follow-up,
investigating the effects on mothers and offspring.

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Summary

BACKGROUND: To date, there is very few studies investigating long-term effect on physical activity (PA) interventions during pregnancy, and none investigating the effect on PA levels. Also, few studies investigate how the interventions effect offspring. Children are directly influenced by their parents concerning healthy living, including physical activity and nutritional habits, therefore this study aimed to investigate if an exercise intervention during pregnancy had effect on long-term physical activity levels of the women and their children.

METHODS: The study was a six-year follow-up of a randomized controlled trial. Previously sedentary primiparous women, mean age 30.7 ± 4 years, were randomized to an exercise group (EG) (n=52) or a control group (CG) (n=53) during pregnancy. The exercise intervention consisted of twelve weeks of supervised group exercise including cardiovascular and strength training, performed twice a week for 12 weeks. The follow-up was conducted as a standardized questionnaire telephone interview, with the outcome measures of total physical activity levels, exercise level, BMI and weight for both mother and offspring. Other measurements were adherence to health recommendations, motivation and barriers towards PA and self-perceived health, quality of life and well-being.

MAIN RESULTS: No difference was found between groups in regards of total weekly PA, weekly exercise, BMI or weight. There was a significant difference in mean weight for the women attending all 24 exercise classes during pregnancy. No differences were found in any of the other outcome and none was found among offspring.

CONCLUSION: Class-based exercise intervention showed no effect on long term PA levels between groups. Physical activity may have an effect on gestational weight gain when proper activity levels are reached, which again seems to have an effect on weight in long-term.

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Abbreviations

BMI	Body Mass Index (kg/m ²)
CI	Confidence Interval
CG	Control Group
EG	Exercise Group
GWG	Gestational Weight Gain
MET	Metabolic Equivalent of Task
MoBa	Mother and Child Study
MVPA	Moderate Vigorous Physical Activity
ODPHP	The Office of Disease Prevention and Health Promotion
PA	Physical Activity
PAPQ	Physical Activity and Pregnancy Questionnaire
RCT	Randomized Control Trial
SD	Standard Deviation
WHO	World Health Organization

1. Introduction

Overweight and obesity is a growing problem in the world (1-3) and pregnancy is a time where most women gain significant weight (4). Today, nearly half of normal weight women and two thirds of overweight and obese women exceed the limits of recommended weight gain (4,5). Exceeding the limit for gestational weight gain (GWG) has been associated with increased difficulty in attaining ideal weight postpartum (6,7), as gestational gain has consistently been the strongest predictor of postpartum weight (8-10). In later years, more women are having problems dealing with their postpartum weight retention (4,7), partly due to inactivity after pregnancy (11,12). Regular PA may reduce the risk of obesity and other chronic lifestyle diseases (1,13).

Hence, limiting pregnancy weight gain combined with healthy behaviors postpartum, is believed to influence the degree of weight change after pregnancy(7,12,14). GWG may also affect the offspring (15-17), as children are directly influenced by their parents concerning healthy living, including PA and nutritional habits (17).

Interventions on physical activity during pregnancy intend to reduce GWG and to decrease weight retention postpartum, and in long-term preventing overweight and obesity. The long-term (≥ 24 months) effect of interventions to increase PA levels described in literature on the general population shows inconsistent results (18,19).

Pregnancy is a period in women's lives that is considered a "teachable moment" (20), a period of social, physiological, behavioral and biological change (21). The health and well-being of both the mother and child may motivate many women to change their exercise and eating habits, so an intervention focusing on these aspects during pregnancy might take advantage of this natural redefining period (20). Preferably, participation in a lifestyle or physical activity intervention during pregnancy should persist after childbirth, benefiting both mother and child. Studies investigating PA as an intervention towards excessive GWG mostly end their follow-up period after 12-18 months. Currently, no study has been published with the main aim to evaluate long-term effects on PA levels or physical fitness after participating in a clinical trial during pregnancy.

2. Literature and theory

2.1 *Physical activity, exercise and health*

The relationship between physical activity (PA) and health has been well established (13), and is among the main messages health institutions and health personnel are trying to communicate to the public (1,22). In literature, PA is defined as “any bodily movement produced by skeletal muscles that result in a substantial energy expenditure” (23). Exercise is defined as planned, structured and repetitive PA that has the purpose to improve or maintain physical fitness, where physical fitness is a set of attributes that are either skill- or health-related (23). Health related physical fitness is important for everyday task functions and leisure-time activity (13), and is defined as the ability to complete daily tasks without exhaustion, with physiological features and characterizations that reduces the risk of chronic diseases and conditions (1). Overweight and obesity is among these conditions; a growing problem with epidemic proportion worldwide (24).

2.1.1 General recommendations of physical activity

To reduce the risk of chronic diseases and to maintain a good health, all healthy adults are recommended a minimum of 150 minutes of moderate PA per week, 75 min of high intensity PA per week or a combination of the two, in bulks of minimum 10 min (1,25). Moderate PA level is defined as activity that increases heart rate, for example brisk walking (24). In addition, all healthy adults are advised to include two sessions of muscle strengthening exercises and reduce their time spent in a sitting or physically resting position (1). Children and adolescents are advised a daily minimum of 60 minutes PA on moderate to vigorous intensity, with a minimum of three days with activities that strengthens their muscles and bones. They are also advised to reduce their time spent in a resting positions (1).

2.1.2 General recommendations of nutrition

A varied diet containing a lot of vegetables, fruit and berries, fiber and fish is the national recommendation for diet and nutrition. Processed meat, red meat, salt and sugar should be limited (1). It is important to have a good energy balance, thus limiting the intake of food with a high-energy index and little too no nutrition (1).

2.1.3 Adherence to general recommendations

Data on self-reported PA levels in Norway indicates that there is a decrease in the number of people not participating or having a low activity level in leisure time activity the last 15-20 years (2,26). This contrasts with the objectively measured PA level that showed that only three out of ten Norwegian adults met the national recommendations for PA, using accelerometers (27). Women were more active than men, and both education and income influenced the PA levels. It is believed that the increase in leisure time PA does not add up to increase in daily sedentary activities (26). People seems to spend too much time sitting, for both work and transportation (25).

The PA level among children and adolescents is greatly reduced from age 9 to age 15. In Norway, almost 90 % of all 9-year-olds are meeting the recommendations for PA, but this is reduced to half by the age of 15, which means a 70 % drop in PA over six years. The decrease in PA from adolescent to young adult (early 20's) is 31 % (28).

2.1.4 Consequences of physical inactivity

Physical inactivity and obesity are independently significant predictors of morbidity and mortality (29). They are both associated with the same morbidity markers, and the development of chronic diseases like diabetes type II, cardiovascular diseases and some types of cancer (30). Inactivity leads to weight gain in most people, and those who are inactive or have a low activity level has a 50 % greater risk of becoming overweight and obese (31). Even though, this is not the only reason to why inactivity has a negative impact on health. Inactivity leads to a decrease in muscle mass, reduction in bone mass, reduction in the capacity of the cardiovascular system and change in metabolism. An inactive lifestyle also limits attainment of optimal cognitive health and alters the body's motor functions (29). Studies show that if a person is physically active, overweight and obesity is no longer a predictor for mortality (30,31). According to the World Health Organization (WHO), insufficient PA leads to approximately 3.2 million deaths every year (25), and is the fourth leading cause of death worldwide (32). Hence, it is better to be overweight and active, then normal weight and sedentary (30).

There is strong evidence supporting the theory that childhood obesity has an important influence on overall cardiovascular disease risk (33). The metabolic syndrome consists of visceral adiposity, glucose intolerance, hypertension, and dyslipidemia (34). It

predicts type 2 diabetes, cardiovascular disease and all-cause mortality in non-diabetic individuals. Worldwide, this is a major health challenge in adults, and now these risk factors are observed in children (33). It is likely to believe that this is due to the increasing prevalence of obesity. High maternal body mass index (BMI), low cardiorespiratory fitness and PA independently contributes to the metabolic syndrome in children and an increase in PA by 10-20 % daily will decrease the risk of metabolic syndrome in healthy children (35).

2.2 Physical activity during pregnancy

It is widely recognized that PA is beneficial in healthy pregnancies for both mother and fetus (6,36,37). According to randomized controlled trials (RCT), benefits for the mother are; improved cardiovascular function, decreased musculoskeletal discomfort, reduced incidence of edema and less risk of gestational hypertension and diabetes, and for the child; decreased fat mass, higher stress tolerance and highly developed neurobehavioral maturation (37). Regular aerobic exercise appears to improve or maintain physical fitness throughout pregnancy (38). This is seen in cohort studies that have shown that being physically active through pregnancy gives an increased probability of continuing to be active after pregnancy (1,39,40).

Recommendations for PA for women who were sedentary pre-pregnancy are moderate intensity PA with a gradual build-up towards 150 min of moderate PA per week (1). For women who were physically active pre-pregnancy, the recommendations are to continue the same activity level, if possible (1), including both aerobic and strengthening exercise (1). Despite this, women generally tend to reduce their level of physical activity during pregnancy (41-44). This is associated with an increased risk of pregnancy complaints and complications, like low-back and pelvic girdle pain, gestational diabetes, pregnancy-induced hypertension and excessive gestational weight gain (GWG) (4,37,45-47). Which again increases the long-term risk of overweight and obesity, and the risk of diabetes type 2 and cardiovascular diseases for both mother and offspring (48). Currently, knowledge about Norwegian pregnant women's adherence to the updated national guidelines is sparse, but data collected from 2008-2010 showed 14.6 % adherence to exercise prescriptions in mid-pregnancy (47).

2.3 Weight change and pregnancy

Pregnancy has been identified with weight change, both during and after, as women often struggle to return to their pre-pregnancy weight after giving birth. The weight women gain during pregnancy is referred to as GWG, and the weight not lost in the first few weeks following parturition (49,50). The term weight retention has been used in many studies, but with various definitions, some defining it as a period lasting up to 12 months. Therefore, studies are hard to compare, and throughout this thesis, the term weight retention will be used beyond the first six weeks will be mentioned with study length.

From conception to a year after delivery women are measured and self-reported to gain, on average, 0.5-4 kg (7,8,45,51), but a recent study from Haakstad and Bø (2014) reported that women tend to report a lower perceived weight gain than what is reality (52). In this study, most women were satisfied with their maternal weight gain, even though they gained excessively according to the Institute of Medicine (IOM) guidelines (52). The average mean weight gain was highest among normal weighted women (BMI <25), but due to a smaller range in the recommended weight gain for overweight women, more women in this weight class exceeded the recommendations compared to the normal weight women (52). Out of 69.6 % of the women who exceeded the IOM recommendations, only 22 % perceived their weight gain as excessive (52).

A Norwegian study reported 23.5 % of normal weight primiparous women as overweight after pregnancy (53), and other recent studies, conducted in Europe and the US, reported that between 13 and 20 % of women had weight retention of 5 kg or more at 12 months postpartum (8,12,51,54). A long-term study found BMI averagely increased from 25.6 to 27.3 from 6-months postpartum to the 8-10-year follow-up, with an average difference of 5.9 kg between women who lost all maternal weight postpartum and women who retained weight (7). Knowing that excessive GWG is a predictor for higher weight retention postpartum (55) and that the amount of overweight and obese women entering pregnancy is increasing (2,4), there is a higher risk of more cases of obesity. Being obese and overweight increases the risk of negative effects throughout pregnancy and postpartum, on both mother and offspring (48,56,57). IOM formed guidelines for appropriate GWG to reduce the risk of pregnancy complications, namely due to the increasing numbers of overweight and obesity following pregnancy

(4). These guidelines are based on the women's pre-pregnancy BMI and were revised in 2009, recommending a lower GWG for overweight and obese women compared to normal weight women (4). The recommended total weight gain for normal weight women ($BMI \leq 25$) is 11.5-16, for overweight women ($BMI 25-29.9$) 7-11.5 kg, and for obese women ($BMI \geq 30$) the recommended weight gain is 5-9 kg. Underweight women ($BMI < 18.5$) is recommended to gain between 12.5-18 kg (4).

Several studies report GWG to independently predict weight gain, in both short-term (4,14,45,46,53,54) and long-term (7,58-61). Most women do not gain within the recommendations for GWG (45,54,60), and a majority of these women gain exceedingly (46,54,60). Even though normal weight women on average doesn't exceed the IOM guidelines for GWG they might be in the upper quartile of GWG in their BMI class and be at a higher risk of becoming overweight after giving birth (52). One study found that pre-pregnancy weight or less was resumed for 41.7%, while 25 % weighed more than 4.5 kg above pre-pregnancy weight, one year postpartum (45), in similarities to a long-term Swedish study found that 25.4 % of women who were normal weight ($BMI < 25$) before pregnancy were overweight at a 15-year follow-up (62).

In conclusion, there seems to be two major factors effecting the long-term development of overweight and obesity in women, excessive GWG and postpartum weight retention. It is not easy to determine if postpartum weight retention is a direct result of excessive GWG or a result of an altered lifestyle during pregnancy, following in to the postpartum period and the time following close to a year after delivery (49,63). So, even though GWG has a strong correlation with postpartum weight retention, gaining weight after delivery may also play a significant role in the development of obesity (9).

2.3.1 Other predictors for weight changes after pregnancy

Physical activity postpartum

After giving birth, it is recommended to start with PA as soon as possible, and to start exercising after six weeks postpartum (1). PA is important to help reduce weight retention after pregnancy and to reduce weight gain that might follow the postpartum period (16), and may help mental health and cardiorespiratory fitness (64). Women who perceived themselves as more physically active than others are less likely to retain substantial weight after pregnancy (12). Most reports and studies shows that the

majority of women are inactive or do not have sufficient PA levels following pregnancy (11,45,64-66). A high percentage of these women had been physically active pre-pregnancy (11,45), even though resuming pre-pregnancy PA is believed to be easier for women who were physically active during pregnancy (40)

The highest reported barriers for exercising are personal and parenting duties, in which include lack of time, motivation, low energy levels and lack of childcare (11,64,67). From three to 12 months postpartum, partner support and the women's desire to feel better were the most common enablers for PA (11,67).

A 2013 Cochrane review based on 14 RCT's found PA after delivery alone not to be effective on weight loss, but mixed interventions of exercise and diet gave results compared to usual health care during pregnancy (68). The authors suggest a mixed approach due to all other known benefits of PA. Other studies have found that an active lifestyle and higher levels of self-reported PA decreases the risk of weight gain (14,43). In the study by Rooney et al. women reporting to have participated in aerobic exercise after giving birth had less weight after 8-10 years compared to those who did not. Other PA, like walking, running, biking or swimming did not affect weight gain for those who were active compared to those who were not, neither at 12 months or in the 8-10-year follow-up (7). A lot of women perceive walking as a good form of exercise, both during pregnancy and postpartum and walking has been associated with less weight retention (69,70). However, some of the walking may not be at a high enough intensity, or have a sufficient duration, to help reduce weight among this group, as a study among U.S. adults found that less than 40 % of individuals walking for exercise met the recommendations for PA (69). The advantage of working out in groups and getting instructions and motivation from both other participants and the aerobics instructor, might be an explanation why aerobic exercise was successful. Aerobic exercise groups might also be more likely to happen on a regular basis with set times than working out alone, and it might be easier to follow through (7).

Socio-demographic variables

Besides meeting the recommendations for PA, other behavioral factors may also have association with weight retention, weight gain and general health (10,71). Breastfeeding is believed to promote weight loss, although a recent systematic review highlights the

difficulties in examining this association due to confounding factors (72). However, four out of five high quality studies demonstrated a positive association between weight loss and breastfeeding at one year postpartum (72). Women with beneficial behaviors during the first year after pregnancy reduced their odds of retaining more than 5 kg with 77 %. Some unbeneficial behaviors, like television viewing and trans-fat intake, was directly associated with substantial weight retention in the early postpartum period (70) and other factors like total energy intake, sleep and educational level have been found independently associated with weight change up until 12 months after delivery (12).

2.4 PA interventions to prevent excessive GWG

Longitudinal studies have shown that there is a significant difference in mean weight gain between active and inactive women and high/low PA level is associated with not exceeding/exceeding the IOM recommendations for GWG, respectively (5). For women meeting the recommendations for PA during pregnancy the odds for excessive GWG was 29 % lower compared to inactive women (5). In the 2009 IOM report the authors highlighted the need for studies investigating the effect of PA on weight gain during pregnancy (4). A meta-analysis conducted on studies up to 2009 suggested that PA during pregnancy might be successful in reducing GWG (73). Since then, studies have investigated the relationship between exercise and weight gain in cohorts and trials with PA as the intervention, alone or as a combined lifestyle changing intervention.

Systematic reviews and meta-analyses has been conducted on studies intervening to reduce GWG through PA alone (73,74), combined with diet (75-79) or combined with lifestyle changes through behavioral theories for change (78,80,81). A few have also reviewed studies where the main outcome is to reduce decline in PA throughout pregnancy (82,83). Most of these reviews suggest PA to be inversely associated with excessive GWG, but find it hard to conclude due to lack of high quality studies, homogeneity and compliance from the participants (75-77,80,82). Muktabhant et al (2012) found it hard to recommend any intervention for optimal GWG due to lack of evidence, small effect size and large differences in interventions (78), in similarity with other reviews (76,83).

Choi and colleagues (2013) conducted a systematic review and meta-analysis on randomized controlled trials investigating the effect of PA and PA plus diet intervention on bodyweight in overweight and obese women, and found supervised PA plus diet to

have the best effect (77). In a meta-analysis of 12 RCT's with a PA intervention regardless of BMI status, Streuling et al. (2010) suggested that women in the intervention group had a significantly lower average GWG compared to the control group (73). A review of 2014 found limited evidence that exercise can be used to limit GWG after reviewing studies with exercise-only interventions (74). Out of the two reviews on PA promotion, one found a reduction in the decline of PA (82) and the other found small to no effect (83).

2.4.1 2.4.1 Long-term effect of PA interventions

Most intervention studies in pregnancy focus on optimal GWG, pregnancy complaints and birth outcomes (78). Fewer focus on promoting PA and even fewer on the long-term effect of the intervention. Currently, no intervention studies were found that investigates the interventions effect on future PA levels. The long-term effect of PA interventions is interesting due to the general adult populations failure to adhere national health recommendations for physical health, and the decline in PA level during and after pregnancy.

Long-term effect on PA has been studied on healthy people of all ages (19,84-86), and as a preventative measure for people in risk of diseases (18) with adverse outcome. A 1998 systematic review found reason to be optimistic towards long-term changes after lifestyle interventions, and found the interventions effective in increasing or maintaining levels of PA that meet or exceeds the national guidelines for PA in both previously sedentary adults and obese children (87). A more recent review found evidence for long-term increases in both PA and physical health after interventions targeting healthy adults; however, these follow-up studies ended at 24 months (88). Hence, there is evidence that PA interventions has a long-lasting effect on PA levels, but type of intervention and target group may affect the outcome.

2.5 Behavioral change

For an individual to be able to start a course of behavioral change, the willingness, and more important, the readiness to change must be present (89). If one is motivated to change, one is willing to engage in behaviors expected to give desirable results (89,90).

It is important that for a behavioral change to be successful that the individual believe in the change, have positive beliefs about the importance of the change, have knowledge and skills to engage in the change and last, but not least, have the adequate support from all parts in his or her surroundings (91). An intervention will have little too no effect if conducted on a population not ready for change (89).

A teachable moment is described as a set of circumstances or an event that leads a person to positively change their health behavior (92). Pregnancy is referred to as such an event due to the mother's strong motivation to protect the well-being of the fetus, and the social or public pressure to refrain from behavior that might be harmful to the fetus (20). Teachable moments are not a standardized concept of behavioral change, and is mostly used synonymously with "opportunity". Some use it as an event or context that is associated with a better possibility of the preferred outcome (93). Lawson and Flocke (2009) tried to sum up the concept of teachable moments, and concluded with it being an event that is "co-created through interaction", especially in situations dependent on clinician-patient communication (93).

Another model used to assess individual readiness for a change towards a healthier behavior is the trans-theoretical model, where change involves a process through five stages. Haakstad et al. investigated this model in a cohort of pregnant women. They found more than half of their participants reporting to be in the stages categorized as regularly active, and only 1.3 % reporting no intention to modify PA level (94). The participants classified as inactive showed a high motivational intention to increase their PA level, and the authors suggest pregnancy to be a window of opportunity to establish long-term PA habits in women (94).

2.6 *Childhood overweight and obesity*

A woman's behavior before, during and after pregnancy does not only affect her health and well-being, but also that of the child (39, 95-97). A child's growth and development, both physiological and mental, have been studied in relation to the mothers' behavior surrounding pregnancy and as in many other population studies in the later decades, overweight and obesity has been a major subject in this area. Obesity and inactivity in childhood is mostly caused by genetics and environment (98) and it is as much of a growing problem for children and adolescents as it is for the adult

population (22). The prevalence of overweight and obesity among 8th graders in Norway increased, respectively, with 57 % and 108 % in boys, and 47 % and 83 % in girls, from 1993 to 2000. Due to this, the national growth charts have been updated and screening for early obesity signs suggested implemented in schools (99).

Genetic predisposition, prenatal environment and lifestyle factors is the key to understanding childhood obesity. Based on family and twin studies, genetic factors are believed to explain 40-70% of BMI variations (100). Pérez-Escamilla and Bermúdez has described two evidence-based cycles that help explaining the maternal-child overweight relationship (101). The first one is called the “maternal” cycle, where the primiparous mother gains excessive weight in pregnancy and retaining excessive weight postpartum, resulting in women becoming overweight and obese entering a second pregnancy (101). The second one, called the offspring cycle, is where the child is born to an overweight mother, or a mother who gains excessive weight during pregnancy, and thus is more likely to store excessive body fat very early in life (101). This is in turn a risk factor for the development of obesity as studies have shown that excess weight in childhood is likely to persist in to adulthood (17,102). As described by Nader et al. (2012): if the child is a girl she becomes a high-risk adolescent and a high-risk mother with a high- risk infant who then turns in to a high-risk child, and the cycle continues (103). Even though, if one is born genetically disposed for overweight and obesity, the risk is modifiable. A Finnish cohort on young adult twins, found that PA significantly reduced the influence of genetic factors on waist circumference and BMI (104). Parents can influence all PA, diet and screen time, and these are important factors that can reduce risk of early childhood overweight and obesity (17,103).

2.6.1 Maternal influence on offspring

Before pregnancy

Several studies have investigated the correlation between pre-pregnancy maternal BMI and offspring outcomes, and found it to be a predictor of offspring adiposity and obesity (48,56,57,97,102,105-107).

In a birth cohort follow-up study on offspring of pre-pregnancy obese mothers, 52 % were obese in childhood, 62% at adolescence and 44% in early adulthood (102). Kaar et al. (2014) found maternal pre-pregnancy BMI to have effect on several childhood outcomes at an average age of 10 years, including adiposity, but the effect was reduced for offspring of mothers with adequate GWG (56). Positive associations on adiposity between parents and offspring have been consistent across many studies, and the risk of familial obesity increases as the level of obesity increases (48,56). A Norwegian cohort found both maternal and paternal pre-pregnancy BMI to be modestly positively associated with offspring BMI at age 3 (107). They concluded that shared familial genetic and environmental risk factors was a more likely to explain offspring BMI at age 3 than the intrauterine environment (107). Fraser et al. found more adverse cardiovascular risk factors at age 9 in offspring of mothers with a high pre-pregnancy weight (97). A systematic review and meta-analysis concluded with pre-pregnancy overweight/obesity to increase the risk for offspring with high birth weight, macrosomia, large for gestational age and subsequent overweight (57). PA levels prior to pregnancy effected the risk of weight gain in the offspring, with higher levels reducing the risk (108).

Behavior during pregnancy

The importance of the offspring's environment *in-utero* has been identified through epidemiological studies (109), possibly having consequences for the long-term health of the offspring (110). David Baker made a hypothesis that the conditions in the maternal womb has a programming effect on the fetal physiology, and that this was more important than later childhood environment (111). Amongst others, Lawlor et al.(2012) found evidence supporting this theory in large prospective cohort, in overweight and obese women (95). In normal-weight women, offspring BMI was explained by family genetics and early environments (95). The in-utero programming in overweight women is believed to create a metabolic syndrome in the offspring increasing risk of disease even before birth (112). Overweight and obese women have an increased risk of gestational diabetes mellitus, and often a higher insulin resistance than normal weight women. This could result in an elevated availability of lipids for fetal growth and higher birth weight and fat mass in the offspring (112). There is good evidence for a clear relationship between higher birth weight and adiposity (110,113). Children born to

mothers with gestational diabetes mellitus have a higher risk of developing childhood obesity and diabetes type 2.

Excessive GWG outside the IOM recommendations has been associated with increased odds of childhood overweight and obesity in several studies, in as early as 2 years of age, independent of several covariates and mediating factors. (114). A meta-analysis from 2012 found evidence for at least a 21 % risk relation between childhood overweight and excessive weight gain (115). Associations between maternal GWG and offspring overweight and obesity has been found in studies in childhood (46,56,96,97,102,105,116,117), adolescence (95,102,118) and adulthood (102,116). Two studies found GWG to have a greater impact on the offspring of normal-weight women, compared to the overweight/obese, suggesting that the effect of GWG may be independent of genetic predictors (114,117).

Levels of PA and its effect on fetal growth has been investigated in several studies (109,110,119,129). Hopkins and associates found aerobic training during pregnancy to lower offspring birth weight and reduce growth-related peptides compared to controls (109), while Pomeroy et al. found PA during pregnancy to affect metabolic outcomes in both mother and offspring (119). A Norwegian study found no association between maternal leisure time PA and mean birth weight of the offspring, but women with a BMI >25 gave birth to kids with a higher mean birth weight. They state in their study that they did not have data for pre-pregnancy PA, and point out that the results may be due to a decline in PA during pregnancy (120). The studies are conflicting, and two recent large cohorts suggested that the independent effect of exercise on birth weight is minimal and possibly explained by confounding effects of maternal body composition (110). Clapp and Capeless reported a mean reduction in birth weight of 310 g in offspring's of women undergoing a program of vigorous weight-bearing exercise throughout their pregnancy compared to close matched controls (121). A follow-up of this study showed that offspring of exercising mothers remained lighter and leaner than their controls at age 5 (122).

There are only a few studies on long-term postnatal growth in offspring of exercising women. Two of the studies is conducted by Clapp et al., suggesting maternal exercise may, depending on exercise volume, promote health benefits into childhood (40). Two

other studies found PA in pregnancy not to have any protective effects on the metabolic profile of the offspring at age 15 and 20 (123,124), although one found an association to a higher offspring PA level at age 14 (124).

After birth

Habits of diet and physical activity are established in early childhood and depend on the environment, solely provided by the adults (125,126). Obesity mainly being a result of positive energy balance over time may give reason to believe that difference in diet and activity-related parenting practices can influence child adiposity. In Norway, children participating in organized PA and sports have decreased significantly through the last decade (22). This is the main arena for PA in children and adolescents, and a decline is worrying. A longitudinal study from the US found less PA and more television watching after school increased the risk of children becoming overweight (127) and that already overweight children had fewer opportunities for productive activities at home than children that were never overweight (127). Hence, parents are found to play an important role in offspring PA through direct involvement and being active role models (128). Transport, modelling and encouragement are important in both childhood and adolescent, and studies find mothers to provide a higher level of limit setting on sedentary behavior (17,129) and higher level of logistic support (17,129,130) for both sexes compared with fathers.

Parental BMI was found as one of the strongest predictors of childhood obesity at age 2 to 9 in a recent case-controls (96), in resemblance with other studies (131,132). But it's difficult to determine overweight and obesity comes from genetics at birth or if it's based on lifestyle factors and environment. Also, a poor lifestyle has an influence on health. In a British cohort, the parent-offspring BMI associations were maintained from birth into mid-life, largely unaffected by adjustment for lifestyle factors (116), but maternal BMI in early childhood was also associated with most lifestyle factors in offspring adulthood. Those whose mothers were obese were eating more fried food, watching more television, participating in the least amount of PA and were smoking compared to offspring of mothers who were normal weight, both at early adulthood and mid-life (116). Other studies have found maternal obesity after pregnancy to be a strong predictor of childhood, adolescence and early adulthood obesity, with a risk ratio above 6.0 for adult obesity (102). Fogelholm et al. found parent inactivity to be a strong and

positive predictor of child inactivity (126), and another larger Norwegian study found that healthy changes in parental life-style was associated with lower occurrence of adolescent overweight in offspring (15). Hence, lifestyle choice and their predictors of overweight and obesity are influenced by parents and can be altered.

In conclusion, there are different factors playing parts in childhood overweight and obesity, but in the end a major part comes down to parental behavior, both prior, during and after pregnancy. If the parents are not physical active and concerned about a healthy lifestyle, chances are the children will continue the same behaviors.

3. Aims of the study

Pregnancy is considered an ideal period in life to change habitual pattern (20), and it is of interest to investigate if educational advice and participation in a supervised exercise program during pregnancy influences the women beyond pregnancy, which may also influence the lifestyle of the family. Physical activity is important to prevent the increasing level of inactivity and obesity in children that we see today and parental PA levels and encouragement is known to affect children (126,133-135).

Search on PubMed throughout May 2017 revealed no long-term follow-up studies with respect to investigating the effect of PA exercise intervention during pregnancy. Most RCT studies investigate GWG and post-partum weight retention and stop their investigation after 12-18 months postpartum (78). Moreover, there were only two results on long-term follow-up on RCT's studying the effect of lifestyle intervention, including PA, in pregnancy on offspring (136-138). One was a study on obese women (136,137), which showed no differences in metabolic profile and body composition in the offspring. The other study investigated women in risk of gestational diabetes (138), and found a difference in BMI in the offspring of women adherent to diet and PA counseling advice. The only long-term follow-up study found, though not an RCT, investigating PA levels after pregnancy found that a group of women who exercised throughout pregnancy was more physically active and have better physical fitness, measured by VO₂max, blood tests, skin-fold test and a 2-mile run, than a group who stopped exercising during pregnancy five years after (40). Both groups in that study were physically active prior to pregnancy, whereas most PA intervention studies have targeted sedentary women investigate GWG and weight retention. Hence, there is limited knowledge on the long-term effect of a PA intervention in pregnancy with regards to both the mothers PA levels and effect of intervention on offspring.

This six-year follow-up therefore aimed to: (1) evaluate whether intensive exercise PA counseling and participation in supervised exercise during pregnancy had a long-term effect on PA level, body weight and BMI, (2) investigate differences in adherence to health recommendations, motivation and barriers for exercise and self-perceived health and (3) compare PA level, BMI and adherence of the offspring between the exercise group and the control group.

4. Methods and materials

4.1 *Study design*

The current study is a follow-up from a RCT conducted between February 2008 and March 2009, with the primary aim to evaluate the effect of regular exercise on maternal weight gain. This follow-up is the fourth examination, completed six years after the post-partum follow-up.

The primary and secondary results from the mother RCT is published elsewhere (139-142), but design and methods will briefly be summarized here. A total of 105 sedentary, primiparous women were randomized to either an exercise group (EG) or a control group (CG) between February and May 2008. The RCT was performed at the Norwegian School of Sport Sciences, Department of Sport Medicine. The participants were examined at baseline (between 12-24 weeks of gestation), after the intervention (week 36-38) and postpartum (6-12 weeks after delivery). Each visit lasted 60-75 minutes and started with individual standardized interviews and registrations of data from the maternity card. All postpartum follow-ups were completed by March 2009. The participants in EG received information about physical activity and healthy living in pregnancy and were assigned to an exercise class. The exercise program consisted of supervised exercise for 60 minutes, at least twice a week, for a minimum of 12 weeks. In addition, the participants were advised to undertake at least 30 min of moderate physical activity on the remaining weekdays (such as walking, bicycling, water-gymnastics), in accordance with recommendations for physical activity during pregnancy (143). The main study outcome measures were maternal weight gain and the proportion of women exceeding the IOM recommendations. Secondary outcomes included skin-fold thickness, postpartum weight retention, psychological measures such quality of life, well-being, body image and pregnancy depression, pregnancy complaints (pelvic girdle pain, low back pain and urinary incontinence), blood pressure, cardiorespiratory fitness and newborn birth weight (139-142,144-146). The present examination was conducted as a 50-minute standardized telephone interview, performed six years after study inclusion.

4.2 Participants

The 105 participants enrolled in this follow-up were contacted from March 2015 to August 2015. At first contact the aims explained and a formal request for participation was forwarded. If no contact was established by the end of August 2015, the participant was considered lost to follow-up examination.

Out of the 105 women from the mother study, 25 did not complete the follow-up. Hence, a total of 80 participants gave a written consent and completed the follow-up interview, five of these completed the questionnaire by e-mail. Reasons and losses to follow-up are given in Figure 1.

There were two participants who would not report their current weight. Ten women failed to report the weight and height of their children. Information about the child's sex was missing from seven participants from the previous study, and this was unfortunately not detected until after the interviews were completed.

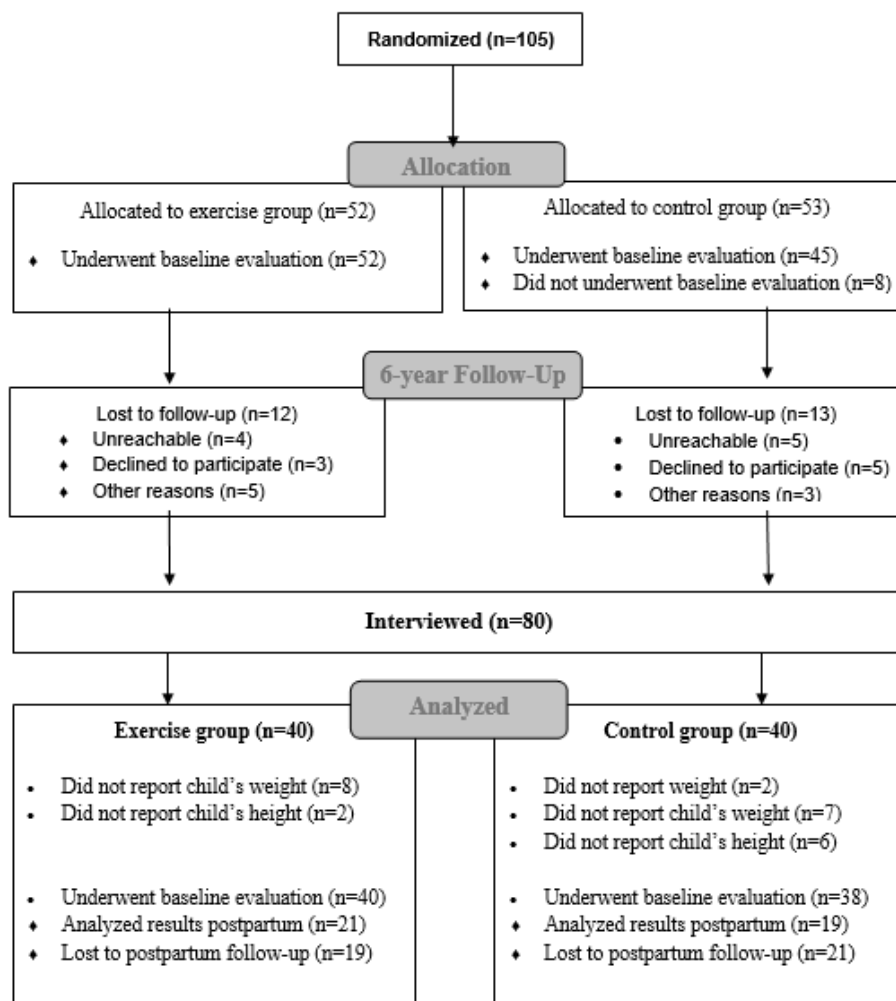


Figure 1: Flow chart

4.3 Assessment procedures

The standardized interview protocol used in the current follow-up is mainly from the baseline interview protocol. There are some questions added from the Norwegian Mother and Child study (MoBa) (147) and assessment of psychological variables retrieved from SF-36 (148) and WHOQOL-brief (149).

Still, there are some changes in this data-collection compared to the first study protocol. Since this follow-up is primarily for non-pregnant women, the questions concerning pregnancy have been altered. Some answer options have been changed from a 1-6 scale into a scale from 0-10, consistent with the rest of the questions.

The standardized interview questionnaire was two-folded, with 83 questions concerning the mother (A) (appendix 4), and 36 questions concerning the firstborn child (B) (appendix 5).

Part A was divided into 7 sections, titled: 1) background 2) health and lifestyle 3) health problems 4) PA a) transportation b) occupational activities c) household d) sports/exercise 5) sedentary activities 6) motivation and barriers 7) diet

Part B of the interview was divided into four sections, titled: 1) the child in general; 2) physical activity level; 3) everyday life and 4) diet. The child's everyday life included questions about time spent in front of a screen such as TV, computer, iPad and smartphone, sleeping hours and transportation to and from school.

The interviews were mainly carried out over telephone, with a possibility for the participants to complete the questionnaire via e-mail (n=5) due to inability to participate in the telephone interview.

The data collection was carried out between April and October 2015.

4.3.1 Intervention

The supervised exercise program was in a group setting and consisted of 60 minutes of aerobic dance. The aim was for the women to attend at least two out of three sessions weekly. Participants in the exercise group were also given advice and motivation via e-mails for moderate PA for 30 minutes for the remaining days, and motivated to integrate PA into their daily routines. All advice and motivation given during the intervention

period was directed as “life changers”, meaning that it was not only intended for the short period during the intervention, but as an ongoing change in behavior for better PA habits in the long term. The goal for the intervention was to help these women change their current lifestyle (exercising less than 60 min with structured exercise program and less than 120 min of brisk walking per week the last six months) and be more active for themselves and for their baby in the future.

Adherence to the exercise classes was controlled by the instructor, and the daily activity was registered in a personal diary. Daily PA and exercise intensity was initiated to be moderate, and evaluated by using Borg’s scale of perceived exertion.

All participants in the study received routine prenatal care in accordance with Norwegian standards, including seven to ten routine prenatal contacts and one second-trimester ultrasound examination. Prenatal care is free of charge in Norway and provided through alternating visits with midwives and doctors.

The women in the CG were asked to continue their usual lifestyle habits. They were not encouraged to stop being physically active, as this was considered unethical in accordance with current PA guidelines.

4.4 Outcome measures

Primary outcomes were total weekly PA level and weekly exercise level, bodyweight and BMI of the women. Secondary outcomes were adherence to health recommendations, motivation and barriers towards PA and self-perceived health, as well as PA habits, adherence to health recommendations and BMI for the offspring.

4.4.1 Primary outcomes

Physical activity levels

PA was assessed by a total of 19 questions, where eight questions concerned exercise, including mode of activity, duration, frequency and perceived intensity.

The participant reported their approximate time spent in daily activity in hours and minutes.

Ex:

- *Can you give an approximate number of how much time you spend walking (using your legs) in one day? (All activity is included, ex: walking to work and stores, picking up children, recreational walks) (..... minutes)*
- *How much time would you estimate you being active during your workday? (__hours__min)*

Exercise was reported in hours and minutes per week.

Ex:

- *Do you perform strengthening exercise? (yes/no)*
- *If YES, for how many hours a week? (__hours __min)*

To rate the level of activity intensity two different scales were used. Household activities was rated on a scale from 0-10, where 0 equals a very negative association and 10 equals a very positive association to the question and exercise was measured by the Borg's Scale (13).

- *How physically hard are your daily activities with family care and household activities? (0 - not at all, 10 – very hard)*

☹											☺
0	1	2	3	4	5	6	7	8	9	10	

To calculate total level of PA and current exercise level the metabolic equivalent of task (MET) were used. One MET is equivalent to the energy expenditure at rest, which for the average person is 3.5 ml oxygen per kg bodyweight per minute. All activity reported as moderate to vigorous physical activity (MVPA) was matched with its MET-value. Further, this value was added with the duration of the activity (in minutes) for each person. Hence, to calculate the daily level of PA all moderate to vigorous activities in transportation, work and household was combined. For total PA level weekly, daily PA was multiplied with five and added to time spent exercising.

Table 1: Aerobic intensity in terms of METs. From ODPHP (2011).

Intensity	METs
Light aerobic activity	1.1-2.9
Moderate aerobic activity	3.0-5.9
Vigorous aerobic activity	≥ 6

To reduce risk of several health problems, the current guidelines for PA recommend achieving a minimum of 600 MET-minutes per week from MVPA (150). This is consistent with 150 minutes of moderate intensity PA, or 75 min of vigorous intensity PA per week (151). Hence, groups were made accordingly. The MET-values for intensity levels was multiplied with 150 minutes, where was low (<449 MET-minutes), moderate was (450-885 MET-minutes) and high was (≥900 MET-minutes). Total PA will be grouped in accordance to Kuy et al. (152); Low active (600-3999 MET minutes), moderately active (4000-7999 MET minutes) and highly active (≥8000 MET minutes).

Body weight and BMI

Body weight was self-reported pre-pregnancy and at the present follow-up interview. The participants' weight at baseline, post-intervention and postpartum was measured by the primary investigator and published by Haakstad et al. (2011).

Height and weight was used for calculating BMI. Underweight was defined as <18.5, normal weight as BMI <25, overweight as BMI ≥ 25 and obesity as BMI ≥ 30 (3). Weight measured right before birth was subtracted from pre-pregnancy weight for calculation of GWG.

4.4.2 Secondary outcome

Adherence to general health recommendations

Adherence to general health recommendations was calculated from the following four questions based on the Norwegian national guidelines, concerning PA, diet, time spent in sitting activities and smoking.

1. *Do you smoke daily? (yes/no)*
2. *The government of health recommend a minimum 150 min. moderate intensity PA every week (same as ca. 30 min, 5 days a week). Would you characterize yourself as physically active, based on these recommendations? (yes/no/don't know)*
3. *How many hours in total do you spend sitting daily (during work and leisure-time)?*
(watching TV, relaxing, reading, internet, PC, listening to music, office work etc.)
(___hours/weekday, ___hours/weekend)
4. *The Norwegian directorate of health recommends a varied diet with a lot of vegetables, fruit, berries, fiber and fish. The intake of processed meat, red meat, salt and sugar should be limited. To what extent would you say that you follow these recommendations? (0 – not at all, 10 – very well)*

Each of the answers to the questions had a set sum of point, and the best sum possible for all four questions was in total 15 points.

Not smoking and being physically active both gave one point each. The diet question was rated on a scale where 10 was the highest number. The question about time spent sedentary at home was divided in to four groups where 1-3 hours gave 3 points, 4-6 hours gave 2 points, 7-9 hours gave 1 point and 10 hours and over daily gave 0 points.

The adherence level was divided into three groups, no adherence (0-4 points), average adherence (5-10 points) and good adherence (11-15 points).

Self-perceived health and well-being

Knowing that self-perceived health may be a risk factor for morbidity and mortality (153), this was included as a sub-outcome for general health recommendations. We included three questions targeting this specifically, all answered on a 0-10 scale. To make sure all participants had the same assumption to interpret the questions, additional information was given defining the terms “physical fitness”, “physical health” and “mental health”.

- *All in all, how satisfied are you with your physical fitness?*
- *Physical fitness is defined as your total ability to perform, including endurance and strength.*
- *How satisfied are you with your physical health?*
- *Physical health is good bodily health, achieved through a balance of regularly physical activity, healthy diet and rest.*
- *How satisfied are you with your mental health?*
- *Mental health is decided from your ability to use cognitive and emotional abilities, to function in society and to face every-day demands.*

To assess quality of life and body image seven questions based on the SF36 (148), and the MoBa questionnaires (147) were used.

For example;

- *Do you have enough energy throughout the day to complete everyday tasks?*
(0-not at all, 10- very much so)
- *Are you satisfied with the way your body looks?* (0-not at all, 10 – very satisfied)
- *How important is your body figure and the way your body looks for your self-esteem?*
(0- very important, 10 – not at all)

As shown, questions were answered on a scale from 0-10. For the first three questions first mentioned, hereafter called basic self-perceived health, the maximum score was 30 points. The seven remaining questions were summarized with added together with the basic self-perceived health score, giving a maximum possible score of 90 points.

Barriers and motivation for PA

The questionnaire contained six questions targeting motivation, barriers and support towards PA. Most of these questions were also asked in the first interview at baseline. The two main questions in this category were about motives for being physically active or barriers towards PA. These questions had fixed responses combined from answers from two Norwegian studies. One, a qualitative interview with 12 pregnant women and

the other, a study on exercise behavior on individuals at risk for cardiovascular disease (154,155). The questions were:

- *If you currently are not physically active, what are your two main reasons for this?*
- *If you currently are physically active, what are your two main reasons for this?*

Some of the possible responses were altered or removed from this follow-up since the participants no longer were pregnant. The possible responses for the inactive were; insufficient time, lack of interest, sufficient exercise at work/home, too much effort to get started, difficulties due to children and childcare, lack of exercise companion, difficulty combining with work/studies, lack of availability of exercise options, negative experience with exercise, economic issues that prevents getting the help needed to start, no experience/never exercised, disease/handicap. The possible responses for the active were; enjoyment, appearance, relaxation/recreation, sports competitions, prevention of health complaints/increasing physical fitness, well-being and happiness, prevention of weight gain, increase self-confidence, decrease stress/depression, obligation, social reasons.

In addition to these two questions, three questions about support from surroundings were asked. This was based on the knowledge that social support is considered a motivation for PA among women (11,21)

- *How common is PA in your closest social network? (0- not common, 10 – very common)*
- *Do you have an exercise partner? (0- never, 10- always)*
- *Regarding PA, do you have support from family/partner? (0 – not at all, 10 – full support)*

Offspring physical activity level

There were 8 questions about the children's PA level (appendix 5). The main questions were how many times the mothers assumed their child was physically active on a moderate to high intensity level per week and if they believed their children followed the current recommendations for PA. Time spent physically active was measured in hours and minutes per day. The child's preferences of activity, enjoyment of PA and

positivism towards PA were also reported. Active school transportation has been studied to have an impact on moderate to vigorous PA in children between 9-12 years old (156), thus daily active transport on a 0-10 scale was compared between EG children and CG children.

PA for the offspring was not calculated the same way as the women's, due to the difference in energy expenditure per kg of body mass in children compared to adults, and the MET values are not valid to be used for the age group in this study (157). There has been formulated a compendium of energy expenditure for youth (158), with valid values for youth, but this would require the questions in the questionnaire to have been formulated differently to be used. Hence, answers from the questions were singularly compared between groups, and no groups were formed.

Offspring BMI

Offspring BMI was calculated from data provided by the mother. A percentile chart was used to determine BMI class, in agreement with Norwegian national guidelines for growth in children and adolescents between 2-19 years old (99). The children were divided into groups based on sex because of the difference in growth charts.

BMI of offspring was compared to BMI of the mother, their GWG and tested for differences between groups.

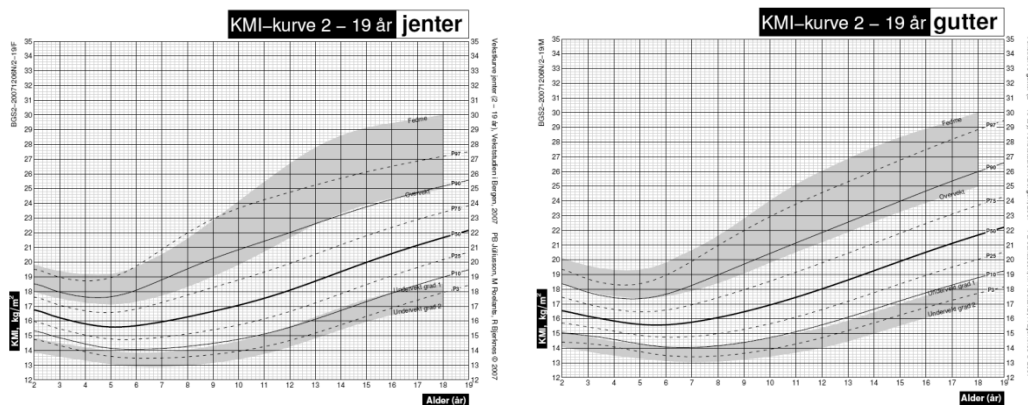


Figure 2: BMI chart for 2-19-year-old girls and boys. From the Bergen growth studies

Offspring adherence to health recommendations

Adherence to general health recommendations was based on the same questions as the mothers and calculated in the same manner. The following questions were asked about the mother's subjective understanding of the child's PA level, time spent in sedentary activities and diet.

- *The national health authorities recommend children to be physically active in a minimum of 60 minutes each day. The activity level should be moderate to high. Would you say your child follow these recommendations? (yes/no/don't know)*
- *How many hours does your child watch TV or use a computer/videogames/tablet?
On weekdays? (___ h/daily)
In weekends? (___ h/daily)*
- *The health recommendations are that children have a varied diet with fruit, vegetables and fish several times a week. How varied is your child's diet? (0-not at all, 10 – very varied)*
- *The recommendation from the Directorate of Health is five units of fruits and vegetables daily. Approximately how many units does your child eat per day? (___ units)*

PA level and fruit consumption gave 1 point each for following the recommendations. Diet was reported on a 0-10 scale and gave as many points as reported. For the time spent in sedentary activity four groups were made for hours spent in weekdays and weekends combined. The least amount of time was 0-4.9 hours per week and gave 1 point, while the most amount of time spent was more than 15 hours per week total which gave 4 points. This was then subtracted from the sum calculated.

The total score from these questions placed them in one of three groups, poor, average or good adherence. Highest score possible was 13 points.

4.5 Statistical analyses

Background variables are presented as frequencies, percentages or means with standard deviation (SD). Due to skewed data, MET-values are presented as median with interquartile range. Differences between groups were examined using two-sided independent sample t-test for continuous variables and chi-square test for categorical variables. Normality was assessed by Kolmogorov-Smirnov, and a log transformation was done for total exercise and daily PA MET-value. Difference in MET-values were compared using two-sided independent sample t-test, group levels assessed with chi-square. To assess the impact of the intervention on the participant's BMI, Analysis of Variance (ANOVA) was conducted with current BMI as the dependent value, and group allocation and pre-pregnancy BMI as independent values. The same procedure was done for current weight as a dependent with both weight retention and group allocation and GWG and group allocation as independents. All variables for adherence, motivation and barriers, self-perceived health and offspring were examined using two-sided independent sample t-test and chi-square test as appropriate. Correlations were assessed with Spearman's Rho. Level of statistical significance was set at $p < 0.05$. All statistical analyses were conducted using SPSS Statistical Software Version 21 for Windows (SPSS, SPSS Inc., Chicago, IL, USA).

4.6 Research group

This project's research group consists of master student Iselin Haugland Kissel, primary supervisor PhD, Associate Professor Lene A. H. Haakstad and PhD, Professor Kari Bø. The project was organized under the Department of Sports Medicine at the Norwegian School of Sport Sciences (NSSS).

4.7 Ethics

The study was approved by The National Committee for Medical Research Ethics, South-East Norway, Oslo (Appendix 2). In addition, the Norwegian Social Sciences Data Services (NNT) provided license to store and register individual health information (Appendix 1). The clinical trial is listed in the ClinicalTrials.gov Protocol Registration System (NCT006171149) and the procedures followed the World Medical Association Declaration of Helsinki. All participants were given oral and written information about the interview and the study aims (Appendix 3).

5. Results

Out of 105 initially enrolled, a total of 80 women (76.2 %) participated in the present follow-up study, and completed the standardized interview six years after their first pregnancy. Background variables at inclusion of RCT is described elsewhere (139), table 2 shows the participants current background characteristics. Mean age was 38.19 (± 3.87), with a total mean BMI of 24.38 (± 3.90). The women in both groups had on average two children each, and 90 % were still living with the father of their firstborn child. Two women in the CG were pregnant during the time of their interview. In terms of BMI ≥ 25 , 22.5 % were categorized overweight and 10 % as obese, and 18.4 % overweight and 10.5 % obese in the EG and CG, respectively. There were no significant differences in background and health variables between the EG and CG at follow-up.

Table 2: Participant characteristics (n=80). Data are presented in mean with SD and frequency (n) with percentage (%).

Characteristics	Exercise group (n = 40)		Control group (n = 40)		p-value
Age (years)	38.7	(± 3.5)	37.6	(± 4.1)	0.581
Weight (kg)	68.5	(± 11.3)	70.8	(± 11.8)	0.534
BMI (kg/m ²)	24.0	(± 3.8)	24.8	(± 4)	0.781
Offspring BMI (kg/m ²)	15.3	(± 1.3)	15.5	(± 2.3)	0.071
Pregnancies	2.6	(± 1.1)	2.4	(± 0.9)	0.445
Children (n)	2	(1)	2	(1)	0.123
Physically active*	21	(52.5%)	23	(57.5%)	0.659
Exercise weekly	27	(67.5 %)	31	(77.5 %)	0.565
Daily smokers (n)	0	0	3	(7.5%)	0.120
Marital status					0.358
Married/living together	37	(92.5%)	37	(92.5%)	
Other	3	(7.5%)	3	(7.5%)	
Higher education (n)					0.568
≤ 4 years college/university	15	(37.5 %)	20	(50 %)	
> 4 years college/university	22	(55 %)	17	(42.5%)	
Occupation					
Employed outside home (n)	35	(90 %)	32	(80%)	0.292
Sick-leave (n)	4	(10 %)	6	(15%)	0.737

*If they consider themselves active in reference to the health recommendations

5.1 Physical activity level

In total 52.5 % in the EG and 57.5 % in the CG reported to be physically active according to the recommendations from the Norwegian Directorate of Health (2). Exercising regularly was reported by 67.5 % in the EG and 77.5 % in the CG, with 35 % and 50 % exercising more than 2 times per week ($p=0.377$). Out of the women reporting exercising regularly 51.7 % and 70 % included strengthening activities in the EG and CG respectively ($p=0.121$).

In total, half of the women in the EG met the minimum recommendation of MET-minutes through exercise only, compared to 57.5 % in the EG. Fifty-seven and a half percent in the EG met the minimum recommendations for total PA weekly compared to 47.5 % in the CG.

There was not observed a significant difference for either total PA level or total exercise level between the EG and the CG. Nor was there any difference observed when divided into MET-groups, both the groups showed in table 3 and when divided into two groups, over or under 600 MET-minutes per week ($p=0.654$) for exercise and 4000 MET-minutes for total PA ($p=0.502$). No differences were found analyzing per protocol and attendance at 24 exercise sessions.

The EG had a higher mean of both daily PA level and total level of PA weekly. When comparing the group of women attending all 24 exercise sessions during the intervention, there was an even higher mean for both daily PA (845.6 (± 489.2)) and total PA weekly (4904.5 (± 2402.2)), and bigger difference, though not significant, compared to both the CG's daily PA (679.0 (± 445.3) $p=0.258$) and total PA weekly (4127.8 (± 2251.0) $p=0.293$) and the non-completers' daily PA (651.1 (± 317.5) $p=0.142$) and total PA weekly (4047.4 (± 1687.5) $p=0.203$) in the EG.

Table 3: Physical activity levels measured in MET-minutes per week.

Outcome	Exercise group	Control Group	p-value
	Median (IQR)		
Daily PA (transportation, work and household)	665 (498)	540 (550)	0.599
Total Exercise (weekly)	630 (1290)	720 (1005)	0.877
Total PA (weekly)	4167 (2638)	3925 (3075)	0.668

Table 4: MET-levels divided in groups. Reported in frequency (n) and percentages (%)

Outcome	Group level	Exercise group (n=27)	Control Group (n=30)	p-value	Total % (n=57)
Total Exercise	1 (≤ 449)	3 (11.1 %)	3 (5.3 %)	0.873	10.5 %
	2 (450-899)	9 (33.3 %)	12 (40 %)		36.8 %
	3 (≥ 900)	15 (55.6 %)	15 (50 %)		52.6 %
		(n=40)	(n=40)		(n=80)
Total PA	1 (600-3999)	17 (42.5 %)	20 (50 %)	0.656	46.2 %
	2 (4000-7999)	21 (52.5 %)	17 (42.5 %)		47.5 %
	3 (≥ 8000)	2 (5 %)	2 (5 %)		5%

5.2 BMI and body weight

There was no difference between the groups in current BMI ($p=0.372$). Mean BMI was 24.0 (± 3.8) in the EG and 24.8 (± 4.0) in the CG, giving a between-group difference of 0.148 (95% CI -0.707 to 1.004 $p = 0.731$). As shown in Table 5 BMI had increased with 0.4 (± 1.5) and 0.5 (± 2.3) in the EG and CG respectively ($p=0.951$).

Table 5: Difference in BMI from pre-pregnancy to follow-up.

Variable	Group	Pre-pregnancy	Follow-up	Difference	p-value of difference in change
BMI (kg/m ²)	Exercise (n=40)	23.7 (± 3.8)	24.0 (± 3.8)	0.4 (± 1.5)	0.951
	Control (n=38)	23.8 (± 4.6)	24.8 (± 4.0)	0.5 (± 2.3)	

Mean weight was 68.5 (± 11.3) and 70.8 (± 11.8) in the EG and CG respectively. The between-group difference in mean weight was 0.486 (95 % CI -0.000 to 2.972 $p = 0.389$).

When analyzing the results for completers of the exercise intervention there was a significant difference in current weight between the women completing 24 exercise sessions during intervention and both the controls ($p=0.029$) and the rest of the EG ($p=0.021$).

There was a positive correlation for current BMI between both GWG and weight retention in the EG ($r=0.322$ $p=0.43$ $n=40$).

Table 6: Adjusted mean change between groups for BMI and weight.

Variable	Group	Pre-pregnancy	Follow-up	Mean adjusted difference in change (95% CI)	p-value
BMI (kg/m ²)	Exercise (n=40)	23.7 (±3.8)	24.0 (±3.8)		
	Control (n=38)	23.8 (±4.6)	24.8 (±4.0)	0.148 (-0.707 to 1.004)	0.731
Weight (kg)*	Exercise (n=40)	67.8 (±11.4)	68.5 (±11.3)		
	Control (n=38)	68.3(±14.6)	70.8 (±11.8)	0.486 (-0.000 to 2.972)	0.389
Weight (kg)**				1,939 (-3290 to 7,167)	0.462
Weight (kg)***				2,368 (-2.877 to 7.614)	0.371

*adjusted for pre-weight

**adjusted for GWG

***adjusted for weight retention

Table 7: Difference in mean for BMI and weight, analyzed for women attending 80 % of exercises classes and for women attending all exercise sessions.

	Exercise (n=40)	Control (n=38)	p-value
Per protocol	(n=18)	(n=38)	
Weight (kg)	66.5 (±9.2)	70.8 (±11.8)	0.180
BMI (kg/m ²)	23.4 (±3.1)	24.8 (±4.0)	0.224
Attendance at 24 exercise sessions	(n=13)	(n=38)	
Weight (kg)	62.8 (±7.9)	70.8 (±11.8)	0.029
BMI (kg/m ²)	22.5 (±3.1)	24.8 (±4.0)	0.072

5.3 Adherence to health recommendations

An overview of the adherence to the different health recommendations is found in table 8. As shown, the EG group had less smokers ($p=0.120$) and a higher average of reported healthy diet ($p=0.099$). As previously stated, adherence to PA recommendations was

lower in the EG compared to the CG (p=0.820). Hours of daily sedentary activity was higher in the EG (p=0.099)

Total calculated adherence was average for 60 % and 52.5 %, and good for 40 % and 47.5 % in the EG and CG respectively (p=0.652).

Table 8: Variables for adherence to health recommendations.

	Exercise Group (n=40)	Control Group (n=40)	p-value
Daily Smoker			
Yes	0	3 (7.5%)	0.120*
No	0	0	
Physically active [^]			
Yes	21 (52.5 %)	23 (57.5 %)	0.820*
No	18 (45.0 %)	16 (40.0 %)	
I don't know	1 (2.5 %)	1 (2.5 %)	
Daily sedentary activity			
1-3 hours	3 (7.5 %)	7 (17.5 %)	0.535
4-6 hours	10 (25.0 %)	11 (27.5 %)	
7-9 hours	19 (47.5 %)	15 (37.5 %)	
10+ hours	8 (20.0 %)	7 (17.5 %)	
Healthy diet ^{^^}			
Not good	0	0	0.099*
Average	5 (12.5 %)	12 (30 %)	
Good	35 (87.5 %)	28 (70 %)	

*calculated with Fisher's exact test

[^] self-reported adherence to recommendations for MVPA

^{^^} self-reported diet variation on a 0-10 scale. 4-6 = average, 7-10 = good

5.4 Barriers and motivation

Table 9 shows the motives and barriers towards PA. The most reported motivation for PA was “prevention of health complaints/increasing physical fitness” for both EG (89.3 %) and CG (90 %), while “insufficient time” was the main reason for not exercising regularly.

Table 9: Motivations and barriers towards PA presented in frequency (n) and percentages (%).

	Exercise group (n=28) n(%)	Control group (n=30) n(%)
Motives		
Fitness/prevents health problems	25 (89.3)	27 (90.0)
Mental issues/pleasurable/gives me energy	13 (46.4)	12 (40.0)
Weight management	7 (25.0)	9 (30.0)
Improves appearance	7 (25.0)	4 (13.3)
It is fun	2 (7.1)	2 (6.6)
Reduces pain	0	2 (6.6)
Increases self-confidence/self-esteem	0	1 (3.3)
It's social	0	1 (3.3)
It relaxes me		
Participation in competitions		
I feel like I should		
It prevents anxiety and depression		
Barriers		
	(n=12)	(n=10)
I don't have time	6 (50.0)	7 (70.0)
Does not fit with family duties	5 (41.6)	2 (20.0)
Requires too much to get started	2 (16.6)	2 (20.0)
Handicap/medical issues	2 (16.6)	1 (10.0)
Enough exercise through work/home	1 (8.3)	2 (20.0)
Difficult to combine with occupation	2 (16.6)	0
Lack of exercise companion	0	1 (10.0)
Economic issues	1 (8.3)	0
Negative experiences with PA		
I'm not interested		
Lack of experience		
Lack of motivation		
Lack of availability of exercise options		

*percentage does not add up to 100 percent because participants gave two reasons each.

Social support

Most women in both group belonged to a circle of acquaintance where PA was common and a regularly practiced activity. More women in the EG (51.5 %) reported to always exercising alone than in the CG (48.5 %). Full social support from spouse was lower in the EG group

5.5 Self-perceived health

Table 10 shows the group means of the basic self-perceived health variables as well as the combined sum for both measures of self-perceived health.

For basic self-perceived health, the EG scored a mean of 20.40 (± 3.6) and the CG scored a mean of 19.97 (± 3.7) ($p=0.604$). For the expanded grouping of self-perceived health, quality of life and well-being, there was a two-point difference in mean ($p=0.327$)

Table 10: Overview over the three variables for basic self-perceived health. Grouped average for basic self-perceived health and self-perceived health, quality of life and well-being

	Exercise group mean(SD)	Control Group mean(SD)	p-value
Variable*			
Physical form	6.0 (± 1.6)	5.8 (± 1.7)	0.740
Physical health	6.5 (± 1.5)	6.4 (± 1.6)	0.675
Mental health	7.8 (± 1.7)	7.7 (± 1.4)	0.725
Grouped outcome			
Basic self-perceived health ^a	20.40 (± 3.6)	19.97 (± 3.7)	0.604
Self-perceived health, quality of life and well-being ^b	54.3 (± 8.1)	52.3 (± 10.1)	0.327

*measured on a 0-10 scale

^amaximum score = 30

^bmaximum score = 90

There were 60 % of the women in EG that were over average satisfied with their total physical form, compared to 62.5 % in the CG. For both EG and CG 67.5 % were above averagely happy with their current weight, while 75 % and 65 % were above averagely happy with their current physical appearance.

In the EG group, a higher MET-level of exercise was correlated with a better self-perceived health ($r=0.494$, $p=0.001$). There was a negative correlation between “self-perceived health, quality of life and well-being” and both current weight ($r=-0.383$, $p=0.018$) and BMI ($r=-0.436$, $p=0.006$) for the CG, meaning that a higher weight or BMI results in lower scores for “self-perceived health, quality of life and well-being”.

5.6 Physical activity level of offspring

Mean age of the children was 6.95 (± 0.23), with an average BMI 15.45 (± 1.85). The mother's reported 77.5 % and 85 % of the children to be physically active according to current health recommendations in the EG and CG respectively. Active school transportation, where the child walks or bikes to school was reported by 60 % in the EG and 45 % in the CG ($p=0.223$).

Table 11: Basic variables and variables for physical activity. Reported in mean with SD and frequency (n) with percentages (%).

	Exercise group (n=40)	Control group (n=40)	p-value
Age	6.9 (± 0.3)	7.0 (± 0.2)	0.392
BMI (kg/m ²)	15.3 (± 1.3)	15.5 (± 2.3)	0.652
Physically active* (n)	31 (77.5 %)	34 (85.0 %)	0.568
Active school transportation (n)	24 (60.0 %)	18 (45.0 %)	0.223
Positive towards PA [^]	7.7 (± 2.1)	7.5 (± 2.3)	0.682
Enjoys PA [^]	8.38 (± 1.5)	7.85 (± 2.4)	0.240

[^]EG (n= 32) CG (n=33)

*self-reported adherence to meeting recommendations for daily PA

[^]measured on 0-10 scale

Offspring in the EG were reported to have higher average numbers of times per week playing sports, hours spent in MVPA and hours spent outside. Adherence to recommendations for PA was the only measure where the CG reported higher levels than the EG (Table X). Only one mother (EG) said she did not encourage her child to be physically active. When asked why, she said there was no need because the child was already very active by own will.

Table 12: Variables for time spent in physical activity reported in frequency and standard deviation.

	Exercise group	Control group	p-value
PA/Sports times/week	6.4 (± 3.8)	5.8 (± 2.3)	0.381
MVPA h/day summer	2.4 (± 1.3)	2.2 (± 1.3)	0.431
MVPA h/day winter	1.6 (± 1.0)	1.4 (± 1.0)	0.414
Hours outside summer	3.8 (± 1.1)	3.4 (± 1.2)	0.113
Hours outside winter	2.2 (± 1.1)	1.8 (± 1.0)	0.108

Table 13 shows the offspring's most common activities reported. Playing outside on a playground/soccer field was the most frequent activity reported in both groups (75%).

Table 13: Overview of the children's most common activities

Frequent activities	Exercise group (n=40)	Control Group (n=40)
Playing on a playground or soccer field	30 (75 %)	30 (75 %)
Soccer	16 (40 %)	20 (50 %)
Bicycling	15 (37.5 %)	12 (30 %)
Swimming	14 (35 %)	11 (27.5 %)
Other activities	9 (22.5 %)	10 (25 %)
Gymnastics	9 (22.5 %)	5 (12.5 %)
Handball	4 (10 %)	8 (20 %)
Dancing	7 (17.5 %)	5 (12.5 %)
Cross-country skiing	3 (7.5 %)	6 (15 %)
Running/orientation	1 (2.5 %)	2 (5 %)
Martial Arts	1 (2.5 %)	1(2.5 %)
Ice hockey	0	1 (2.5 %)

Total percentage does not add up to 100 percent because they were all given up to three responses

5.7 BMI of offspring

By group, the mean BMI for children was 15.3 (± 1.3) in EG and 15.5 (± 2.2) in the CG ($p=0.652$). There was no difference between women attending all exercise classes and the controls. A small correlation was found between the total group of women's GWG and the children's BMI ($r=0,253$, $n=65$, $p=0.42$).

Table 14: BMI for the children analyzed for all participants, mothers who attended 80 % of exercises during pregnancy and mothers who attended all exercise classes

	Exercise	Control	p-value
Principal analysis	(n=32)	(n=33)	
BMI child	15.3 (± 1.3)	15.5 (± 2.2)	0.652
Per protocol	(n=15)	(n=33)	
BMI child	15.1 (± 1.3)	15.5 (± 2.2)	0.484
Attendance at 24 exercise sessions	(n=10)	(n=33)	
BMI child	14.5 (± 1.2)	15.5 (± 2.2)	0.172

A total of four children from the CG were in the overweight or obese group compared to one in the EG. The underweight group counted six children from the CG and three from the EG. The BMI groups is shown in table 15.

Table 15: BMI groups for offspring.

	Exercise group (n=27)	Control group (n=32)	p-value*
Girls	(n=15)	(n=14)	
Underweight	1 (6.7 %)	4 (28.6 %)	0.473
Normal weight	13 (86.7 %)	8 (57.1 %)	
Overweight	1 (6.7 %)	2 (14.2 %)	
Boys	(n=12)	(n=18)	
Underweight	2 (11.2 %)	2 (11.2 %)	0.352
Normal weight	10 (83.3 %)	14(77.8 %)	
Overweight	0 (0 %)	2 (11.2 %)	

*calculated from Fischer's exact test – over or under the respective BMI value for overweight

5.8 Offspring's adherence

For the offspring's adherence to health recommendations only 5 % in both groups were placed in the high adherence group, meaning that they had few hours spent in sedentary activity in front of TV/iPad/smartphone, a healthy diet, were physically active and ate fruit and vegetables as recommended. The average group were the biggest group, 75 % and 72.5 % in the average group for EG and CG respectively. Low adherence was found among 20 % in the EG and 22,5 % in the CG. The mean hours in sedentary activity for the children was 9.7 (± 3.6) in the EG and 10.5 (± 3.4) in the CG ($p=0.284$). There was a positive correlation between the women's adherence and the children's adherence ($r=0.616$ $p=0,021$ $n=40$) in the CG, but none were found in the EG.

Table 16: Total adherence for the children and variables of adherence, reported in frequency and percentages or mean with standard deviations.

	Exercise group (n=40)	Control Group (n=40)	p-value
Total adherence to health recommendations*	6.2 (± 2.2)	5.7 (± 2.6)	0.352
Physical activity [^]	31 (77.5 %)	34 (85.0 %)	0.284
Sedentary activities			
Daily h/week day	0.9 (± 3.4)	1.0 (± 0.4)	0.295
Daily h/weekend	2.6 (± 0.8)	2.4 (± 0.8)	0.424
Fruit and vegetables (n)	3.6 (± 1.5)	3.7 (± 1.3)	0.731
Diet [^]	7.3 (± 1.9)	7.2 (± 2.0)	0.775

*PA in accordance with the IOM recommendations

[^]measured on a 0-10 scale

6. Discussion

6.1 *Methodological considerations*

6.1.1 Study design

As far as we know, the present study is the first long-term follow up after a PA intervention during pregnancy on a group of sedentary primiparous women.

A well-designed RCT is considered the best scientific study design to detect a cause-effect relationship between an intervention and an outcome, and the efficiency of the intervention (159). The main outcome from the mother study was not the same as for this follow-up, but it was performed in the same manner as baseline, post-intervention and first follow-up (postpartum), using a standardized questionnaire interview.

6.1.2 Participants

For the first study, a priori power calculation for the effect on maternal weight gain was done. A post-hoc test revealed that the number of participants included in the RCT gave a small to medium effect size (< 0.44). Hence, the sample size may have been too small to detect all the hypothesized effect of exercise on the outcomes (type II error) (160). Though the outcomes are different, this may also include this follow-up.

In the mother study the analysis were based on ITT, so everyone was included regardless of the participant's adherence or compliance to the intervention. A requirement for an ideal ITT-analysis is a complete dataset, as noncompliance may increase risk of underestimating the treatment effect (type II error). Hence, the number of losses to this follow-up may have reduced the ability to draw any conclusions. However, the participants lost to follow-up were not significantly different in the two groups.

From the total of 25 participants lost to this follow-up, 10 decided not to participate. The main reason for this was lack of time and not being comfortable about their physical or mental situation. This is also reported in Clapp et al., where women that were unsatisfied with own health and body declined participation in long-term follow-up (40).

Attendance to PA intervention prescribed in trials is commonly a challenge. The mean adherence to the exercise sessions in the primary study was 17.2 out of 24. To adjust this, a per protocol analysis (>80 % exercise adherence) was made, in addition to a 100 % adherence analysis. There might be a difference in the participants who followed the prescribed exercise and those who did not, making it hard to generalize the results of the present study where the comparison of results is based on these analysis methods.

As stated in the main paper, there is a possibility of selection bias interacting with the intervention. The average age of the participants in the intervention was higher than of the Norwegian primiparous women (139). Moreover, they had a higher education level, which is found to be a correlation to PA (139). Hence, the results in this follow-up may have a limited external validity and may not be representative to the population at large. The participants also volunteered for a study on exercise during their pregnancy and therefore it is likely to believe that there is a risk of this group having a higher general interest in PA and health than non-participants may have (161). This was partly seen in the control group, where some of the participants disappointed with the randomization of group placement reported to have started being more physically active and exercising during their pregnancy (139). It is therefore likely to expect that the treatment effect related to the intervention was hard to detect.

As to the measures of the children of the participants, all information was given by the mothers. A recent meta-analysis found that half of all parents underestimated their overweight or obese children's weight (162). In that light, there could be a risk of bias here with results being underestimated.

6.1.3 Study intervention

The PA guidelines for pregnant women at the time of the planning of the intervention were 30 minutes or more of moderate intensity exercise on most days of the week (1,139). The intervention was planned with an assumption that it would be easier to recruit sedentary pregnant women if the required amount of exercise was limited to two days a week, with encouragement to exercise on your own the rest of the week. There are no records of the participant's adherence to the self-imposed PA. As discussed in the main paper after the intervention, it could be speculated that the recommended PA level in the intervention was too low to see an effect after the intervention. Past studies have

not found a lasting effect of PA interventions on PA levels, but it has been speculated that promotion of programs to increase daily moderate to vigorous PA could have a larger effect than class-based interventions (163). Also, behavioral change is often seen to work better when the participants is an active agent in the transition (164). During this past intervention, the participants were fed information and asked to participate and follow instructions in a class based exercise. It's possible that there could have been a bigger change in behavior if individual responses and communication were included (89,164). This again would result in a bigger and more time-consuming trial for both investigators and participants. As for this follow-up, the thought is that pregnancy is a time of change in a woman's life, and that the study intervention with the exercise classes, as well as the advices and information on daily PA, would affect the women's life beyond the intervention period.

6.1.4 Assessments procedures and outcome measures

In the current follow-up, a standardized interview was conducted based heavily on the interviews used during the first part of the trail. The questionnaire (PAPQ) used at baseline, post-intervention and first follow-up have previously been validated to give a close estimate of total PA level for pregnant women and was concurrent with the ActiReg system in classifying participants into being insufficiently or sufficiently physically active (165). In difference to the previous interviews, the current follow-up was conducted over telephone, to make it less time-consuming and to lower the cost for both investigator and participants.

An interview gives a cross-sectional measurement and knowledge about the current situation, and a limitation is that time of interview may affect the results. A majority of women were interviewed in spring leading up to the major joint public summer holiday in Norway, some in the middle of the summer, while some were interviewed early fall. This may have influenced the results; compared to if they all were interviewed during the same season, since season appears to have an effect on PA levels (166), which some participants also stated during their interview. To measure PA levels by questionnaire there is usually demand for an assessment of frequency, intensity, duration and seasonal variation to get adequate information. The current questionnaire did not include seasonal variations, other than adding the word usually to the question. E.g; which activity do you usually perform? This is though similar to many Norwegian studies in

the last years (167). To get a more accurate picture of the women's physical fitness we should have tested them physically, but this was unfortunately too time consuming for this thesis. Also, only a handful of the women who responded to the interviews were willing to get tested.

Another limitation of PA questionnaires is the individual interpretation of the term PA (168). In this study, all terms and activities were explained and defined to the participants prior to the questions. The questionnaires consisted mostly of closed questions which eased the analysis and the comparing of answers between the participants (168), but some of the questions for time and activity were open to get a more precise answer. Data was mainly collected through a telephone interview, and not a mailed self-report questionnaire, which may have contributed to more accurate answers because the participants could ask for explanations when they didn't understand. On the other hand, interviews are more associated with socially desirable responses. The risk of bias following socially desirable responses from the participants is usually always present when conducting a questionnaire or interview (161). Topics like PA, weight and diet are often subject to those responses (168). Weight was self-reported for both baseline and this follow-up, and could be a source of bias. Different measuring scales may provide varied measurements and some women, particularly underweight and overweight participants, might have over- or underestimated their current weight (169). Hence, total anonymity was indicated at the start of the interview, as well as before topics that can be sensitive for the participants, like health and well-being.

The food questionnaire is a simplified version of the "food frequency questionnaire" (FFQ) in the MoBa Study (170). That questionnaire was found a valid tool to rank pregnant women according to low and high energy, nutrient and food intakes (170). Due to the simplification, the current version may not be comparable to validation of the FFQ.

The primary investigator of this follow-up conducted all follow-up interviews, ensuring that questions were asked in the same manner and order. This reduced the risk of bias due to data collection differences. Primary investigator was blinded to group allocation during the data-collection, and all data are coded.

6.2 Results

Even though the Kolmogorov-Smirnov test for normality showed that some of the MET-values were not normally distributed, the values were analyzed using the student's t-test. This was because of only small changes when performing a log transformation that did not show any differences to the t-test. Analyzing using the t-test on not normally distributed values is a violation of one of the assumptions of the t-tests, but most continuous variables are tolerant to this if the sample size is large enough ($n > 30$) (171).

6.2.1 Primary outcomes

Physical activity levels, weight and BMI

The women in the EG attending 24 exercise classes had a significantly less GWG than the control group (139) and are currently weighing less than the rest of the participants. The correlation found in the EG between current BMI and both GWG and weight retention also supports this. This is consistent with previous research who found that high weight gainers weigh more at long-term follow-ups (46,58,62). Seeing as the attendance to the exercise classes during the intervention were low, and the prescribed volume of PA during the intervention was at the minimum of the recommendations, a long-term effect would be hard to detect. This indicates that PA during pregnancy only has an effect if the right dose is maintained throughout.

Though no significant effect from the intervention was seen in any current levels of PA, over half of the women in both groups reported to be physically active on a regular basis. Most studies on PA levels before and after pregnancy, reports a decline in PA both in the postpartum period and well into motherhood (11,172,173). In studies investigating PA levels prior to and during motherhood, they found only 11 % and 12.6 % of the women reporting to having started with PA after becoming mothers (11,172). One reason for this current group to show a different tendency, other than it being further in to motherhood than previously studied, might be that the overall level of PA increased in the Norwegian population the past years (2). It's seen that the age group these women were in, as well as higher education level, is associated with higher levels of PA (174). The participants in this study had a high percentage of women with higher education (≥ 4 years of college/university). A study on Swedish mid-life women found a tendency of positive changes in health-related behavior as the women went through

their mid-life period, without discovering the reasons for these changes, but variables like education, marriage/cohabitation and a least one child influenced change in health-related behavior, for example an increase in PA(178).

The percentage of women reporting MVPA in adherence to health recommendations and the percentage of women in the upper levels of MET-minutes per week was higher in both groups than the average percentage of adult men and women in Norway (2). The same was seen for strengthening exercise, which was found to only be exercised by 18 % of Norway's female population compared to 51.7 % and 70 % in the EG and CG, respectively (2).

The women in the EG scored lower on adherence, to the recommended minutes in MVPA and had more hours spent in sedentary activity, but still they had a higher mean of total PA activity throughout the week. Kuy et al. performed a meta-analysis on the dose-response associations between total PA and the risk of developing five different diseases using MET minutes/week, arguing that most current studies only focus on leisure time PA, when overall PA is just as, if not more important (152). In the current study, we found that over half of the women in the EG exceeded the minimum level, set to >4000 MET-minutes/week, of overall MVPA.

A limitation to this study was that there was no record of the women's total PA level before pregnancy and given the women's high educational level and age it is likely to believe that some of the women might have had a higher daily PA level than accounted for during inclusion. Still, studies have found that women expend a considerable amount of their daily energy from everyday life activities after pregnancy (42).

As shown in previous research, transitioning into parenthood after giving birth might be too life altering period for women to focus on exercise and activity (11). Studies on transitional events found that pregnancy and early motherhood did not appear to have lasting effects on weight and lifestyle practices on a long-term basis (21). Readiness for change may explain why some of the women in the EG group exercised throughout the intervention, but are currently no different than the rest of the individuals (163). They might have exercised throughout pregnancy for the well-being of their unborn child or

to reduce the weight gain, and not for the goal of becoming more physically active long-term.

6.2.2 Secondary outcomes

Surveys on the Norwegian population shows that women score higher in all aspects of adherence (175). The majority of women in this study reported average adherence, mainly negatively influenced by time spent sedentary, which is consistent with all recent knowledge about the population (174).

As previously stated, many women in this study had a higher education, and in addition to PA, higher education level is associated with higher aspects of adherence to general health recommendations, and higher levels of self-perceived health (175,176).

Educational level also reflects on offspring, as children then have better health than others. If parents also are married/cohabitating the children are less likely to be overweight and more likely to be physically active and have a better diet (89). This reflects findings in this study.

The correlation between exercise level and self-perceived health found in the EG were also found in health studies among the Norwegian population (176), where people reporting good or very good self-perceived health were more physically active than those reporting a bad self-perceived health.

A motivator for PA that was reported by the majority in both groups were social support from friends and family. Social support and availability for childcare are factors enabling mothers to be more active (11,173). The women in the CG reported to have a higher level of social support from spouse and a more women reported to exercise with others. This might be a reason to why both self-reported adherence to PA recommendations and total level of exercise measured in MET-minutes were higher for the CG compared to the EG.

A Hawaiian study stated that exercise partners might contribute to increased walking and PA in the postpartum period (11). The Norwegian health care system provides maternity groups for new mothers only a couple of months after delivery, were many groups spend time together walking with their strollers. This might be a contributor to increasing PA levels after pregnancy.

Common barriers for PA is lack of time, social support, childcare and fatigue (11,172,177). Some of these are also seen among the women in this study, but to a smaller extent than other studies. One reason for this might be that the children are older than in other studies, and with older kids it might be easier to find time to exercise when the kids are doing other activities or easier to find someone to look after them. Another reason might be the formulation of the questions asked in the interview. Women among those reporting to be physically active might like to have an even higher level of PA than they do currently, but the above mentions barriers might hinder them in this. If the question was asked of the overall barriers of PA for both the active and the inactive, the results most likely would have been different.

Some studies call for a better integration of clinical practice and theory, but emphasizes the difficulties with this integration (89,163). Motivation and barriers for PA during pregnancy might be very different from the ones for motherhood and therefore making it difficult to transfer one practice over on the other.

Offspring

There were no differences between the two groups for the children's PA measurements. This is consistent with the mothers PA level and studies that found that parental inactivity was a better predictor for children's inactivity than their activity level was on activity (126). Meaning it's less likely to see a difference in activity level with this group of mothers being over the average physically active. It's also found that encouragement and support influenced the children's PA level (126), which was reported by all but one. A limitation is that the children's PA measurements is second hand information from their mothers, and that the measurements could not be transformed in to MET-values. Children at the age of seven might often play without direct parental supervision and it's therefore hard for the mothers to know what their kids are doing and especially their intensity level. For example, when they are on the playground playing alone which was the most reported form of activity. Also, socially desirable answers might have influenced mothers of more inactive or overweight children (162).

A study found that mothers parenting mostly influenced their children's screen-time and diet (17) which is consistent with the correlation between the mother's and the child's adherence to health recommendations.

There was no difference found in BMI between the groups, which is consistent with the rest of the study where no differences were found. The small correlation between the totals group GWG and the children's BMI is consistent with numerous previous studies (46,48,58,96,117).

More research is needed to investigate if interventions towards PA can increase PA levels in motherhood. Research on motivations and barriers towards PA and strategies to promote an increase in moderate and vigorous PA, both during and after pregnancy should be implemented in future intervention research.

7. Conclusion

To our knowledge, this is the first long-term follow-up after a RCT on sedentary primiparous pregnant women. A 12-week supervised exercise intervention did not show any significant differences between groups on PA level, weight or BMI six years after pregnancy. An overall increase in PA was found, as a majority of the participants reported a PA level as recommended from the Directorate of Health, and two thirds were exercising on a regular basis. PA during pregnancy seems to have an effect of GWG and long-term weight if the dose is high enough. Attendance at all exercise sessions through the intervention resulted in a lower weight six years after giving birth than the controls and the women attending less sessions. Social support as motivation for PA might be a contributing factor to high levels of PA in this study. Motifs and barriers toward PA in different stages in life might be the key to understanding why it's hard for women to follow up at exercise through pregnancy and postpartum, but in later years are physically active and exercising on a regular basis.

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Appendix

Appendix1: Approval letter from the Norwegian Social Science Data Service

Norsk samfunnsvitenskapelig datatjeneste AS
NORWEGIAN SOCIAL SCIENCE DATA SERVICES



Havskil Hårfagen gate 29
N-5007 Bergen
Noreg
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nsd@nsd.uib.no
www.nsd.uib.no
Org.nr: 995 221 884

Lene A.H. Haakstad
Seksjon for idrettsmedisinske fag
Norges idretthøgskole
Postboks 4014 Ullevål Stadion
0806 OSLO

Vår dato: 17.12.2007 Vår ref: 17804 / 2 / KH Deres dato: Deres ref:

TILRÅDING AV BEHANDLING AV PERSONOPPLYSNINGER

Vi viser til melding om behandling av personopplysninger, mottatt 30.10.2007. All nødvendig informasjon om prosjektet forell i sin helhet 17.12.2007. Meldingen gjelder prosjektet:

17804	<i>Graviditet, fysisk aktivitet og arevekt</i>
Behandlingsansvarlig	<i>Norges idretthøgskole, ved institusjonens arente leder</i>
Daglig ansvarlig	<i>Lene A.H. Haakstad</i>

Personvernombudet har vurdert prosjektet, og finner at behandlingen av personopplysninger vil være regulert av § 7-27 i personopplysningsforskriften. Personvernombudet tilrår at prosjektet gjennomføres.

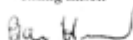
Personvernombudets tilrådning forutsetter at prosjektet gjennomføres i tråd med opplysningene gitt i meldeskjemaet, korrespondanse med ombudet, eventuelle kommentarer samt personopplysningsloven/-helseregisterloven med forskrifter. Behandlingen av personopplysninger kan settes i gang.

Det gjøres oppmerksom på at det skal gis ny melding dersom behandlingen endres i forhold til de opplysninger som ligger til grunn for personvernombudets vurdering. Endringsmeldinger gis via et eget skjema, http://www.nsd.uib.no/personvern/melding/pvo_endringskjema.cfm. Det skal også gis melding etter tre år dersom prosjektet fortsatt pågår. Meldinger skal skje skriftlig til ombudet.

Personvernombudet har lagt ut opplysninger om prosjektet i en offentlig database, <http://www.nsd.uib.no/personvern/register/>.

Personvernombudet vil ved prosjektets avslutning, 30.03.2009, rette en henvendelse angående status for behandlingen av personopplysninger.

Vennlig hilsen


Bjørn Henriksen


Kjersti Håvardstun

Kontaktperson: Kjersti Håvardstun tlf: 55 58 29 53
Vedlegg: Prosjektvurdering

Appendix 2: Approval letter from the Regional Committee for Research Ethics in Medical and Health research, South East Norway (REK Sør-øst)



Oppgitt: REK sør-øst	Saksbehandler: Vivi Opdal	Telefon: 22845526	Vår dato: 09.03.2015	Vår referansenummer: 2014/2034/REK sør-øst A
			Deres dato: 30.01.2015	Deres referansenummer:

Vår referanse må oppgis ved alle henvendelser

Norges idrettshøgskole
v/øverste administrative ledelse

2014/2034 Graviditet, fysisk aktivitet og overvekt - en oppfølgingsstudie

Forskningsansvarlig: Norges idrettshøgskole (NIH)
Prosjektleder: Lene A H Haakstad (tidligere oppgitt Iselin Johansen)

Det vises til vårt brev av 12.12.2014 der REK ba om en redegjørelse for eventuelt hjemmels-/behandlingsgrunnlag for fortsatt oppbevaring av koblingsnøkkel/navneliste i ovennevnte prosjekt (siden personidentifiserende opplysninger skulle ha vært slettet i 2009), og om en redegjørelse for hvorvidt deltakerne på noe tidspunkt ble informert om mulige oppfølgingsprosjekter ved deltakelse i det opprinnelige prosjektet i perioden 2005-2009. Komiteen ba også om en kort redegjørelse for virksomhetens rutiner og retningslinjer for datahåndtering.

I NIHs svar datert 30.01.2015 gjøres det kort rede for virksomhetens rutiner og retningslinjer for datahåndtering. REK tar dette til orientering. Vi kan imidlertid ikke se at spørsmålene om hjemmelsgrunnlag for fortsatt oppbevaring av koblingsnøkkel/navneliste i det konkrete prosjektet, og om deltakerne var informert om mulige oppfølgingsprosjekter, er besvart av forskningsansvarlig.

Prosjektleder viste imidlertid i sin tilbakemelding datert 16.12.2014 til at NIHs kvalitetssystem krever at forskningsdata skal være tilgjengelig i 10 år etter prosjektslutt for etterkontroll. Videre opplyste hun at data fra det opprinnelige prosjektet har vært oppbevart innelåst på prosjektleders kontor, og at koblingsnøkkel har vært oppbevart separat fra forskningsdata. Prosjektleder viste også til at man i det opprinnelige prosjektet i 2005 ga muntlig informasjon til deltakerne om at data skulle oppbevares i 10 år, og at de muligens ville bli kontaktet igjen for en oppfølgingsstudie.

Til dette vil REK bemerke at det verken etter gammel (før helseforskningsloven trådte i kraft i 2009) eller ny lovgivning har vært adgang til å oppbevare forskningsdata og koblingsnøkkel 10 år etter prosjektslutt i slike prosjekter. Etter tidligere lovgivning skulle forskningsdata og koblingsnøkkel i utgangspunktet slettes ved prosjektslutt. Helseforskningsloven § 38 første ledd annet punktum åpner for at REK kan bestemme at dokumenter som er nødvendig for etterkontroll av prosjektet, skal oppbevares i fem år etter at sluttmelding er sendt komiteen. Denne adgangen til oppbevaring av data etter prosjektslutt gjelder kun dersom REK eksplisitt har gitt uttrykk for dette i sitt vedtak, enten ved første gangs behandling av prosjektet eller ved senere behandling av en prosjektendring. Det er ikke adgang til å forske på dataene i denne 5-årsperioden.

REK vil også bemerke at det vil være en fordel ved senere søknader om lignende oppfølgings- eller etterundersøkelser at man har skriftlig dokumentasjon på at deltakerne er informert om mulig rekontakt. Muntlig informasjon av denne type lar seg ofte vanskelig dokumentere.

Etter REKs syn har oppbevaringen av prosjektets koblingsnøkkel derfor manglet hjemmelsgrunnlag. REK

Dato/adresse:
Gulhaugsveien 1-3, 0464 Oslo

Telefon: 22845511
E-post: post@helseforskning.etikk.com.no
Web: <http://helseforskning.etikk.com.no/>

All post og e-post som inngår i saksbehandlingen, bør adressert til REK sør-øst og ikke til enkelte personer

Kindly address all mail and e-mails to the Regional Ethics Committee, REK sør-øst, not to individual staff

har likevel funnet å kunne godkjenne den aktuelle oppfølgingsstudien. Dette fordi det angis at deltakerne er informert om mulig oppfølgingsundersøkelse, og for at det ikke er noe som tyder på at det har vært forsket på dataene siden prosjektslutt i 2009.

REK vil avslutningsvis bemerke at dersom NIHs praksis fortsatt er å oppbevare forskningsdata og koblingsnøkkel 10 år etter prosjektslutt, vil vi råde virksomheten til å endre på dette. Det bes også om at forskningsansvarlig virksomhet sørger å kontrollere at prosjektleder sletter personidentifiserende opplysninger om eventuelle deltakere som var med i første undersøkelse og som ikke blir med i oppfølgingsstudien, snarest mulig etter at de er forsøkt inkludert.

Med vennlig hilsen

Knut Engedal
Professor dr. med.
Leder

Vivi Opdal
seniorrådgiver

Kopi til: L.a.h.haakstad@nih.no; ihjohansen87@gmail.com

Appendix 3: Informed Consent

Forespørsel om deltakelse i forskningsprosjektet

What happens after an exercise intervention during pregnancy?

A 6-year follow-up study

Bakgrunn og hensikt

Dette er et spørsmål til deg om å delta i et oppfølgingsstudie for å kartlegge din fysiske helse og aktivitetsnivå i forbindelse med din deltagelse i et treningsforsøk gjennom din graviditet. Graviditet er ansett som et godt tidspunkt å endre vaner og livsstil, noe som ble forsøkt gjennom den første studien. Antall kvinner og barn som er fysisk inaktive og overvektige i dagens Norge har økt de siste årene, og fokus er på å finne måter som kan endre denne trenden.

Hensikten med denne oppfølgingsstudien er å undersøke om det er sammenheng mellom aktivitetsnivå under graviditet og nå. Kartlegging av fysisk aktivitetsnivå, kosthold og fysisk form vil brukes for å sammenligne de to gruppene fra morstudien med hverandre. I tillegg vil vi kartlegge barnets fysiske aktivitetsnivå for å undersøke en eventuell sammenheng mellom mors og barns aktivitetsnivå.

Hva innebærer studien?

Oppfølgingsstudien består av to deler.

Del 1 er et standardisert intervju som vil dekke aspekter av fysisk aktivitetsnivå, motivasjon og barrierer, helseplager og kosthold hos både deg og barnet ditt.

Del 2 består av testing av fysisk helse som vil foregå ved Norges Idrettshøgskole. Det innebærer måling av kroppssammensetning, styrke og utholdenhet.

Del 1 og del 2 er uavhengig av hverandre og du kan delta på del 1 selv om du ikke har mulighet for å delta på del 2.

Fysisk testing og undersøkelse skal ikke være ubehagelig eller medføre risiko for deg. Det er instruerte testledere som tar hånd om deg og alt blir utført etter hva du klarer å gjennomføre.

Hva skjer med informasjonen om deg?

Informasjonen som registreres om deg skal kun brukes slik som beskrevet i hensikten med studien. Alle opplysningene vil bli behandlet uten navn og fødselsnummer eller andre direkte gjenkjennerende opplysninger. En kode knytter deg til dine opplysninger og prøver gjennom en navneliste.

Det er kun autorisert personell knyttet til prosjektet som har adgang til navnelisten og som kan finne tilbake til deg. Det vil ikke være mulig å identifisere deg i resultatene av studien når disse publiseres.

Frivillig deltakelse

Det er frivillig å delta i studien. Du kan når som helst og uten å oppgi noen grunn trekke ditt samtykke til å delta i studien. Dette vil ikke få konsekvenser for din videre behandling. Dersom du ønsker å delta, undertegner du samtykkeerklæringen på siste side. Om du nå sier ja til å delta, kan du senere trekke tilbake ditt samtykke uten at det påvirker din øvrige behandling. Dersom du senere ønsker å trekke deg eller har spørsmål til studien, kan du kontakte:

Iselin Haugland Johansen – iselinhj@stud.nih.no – 926 87 216

Rett til innsyn og sletting av opplysninger om deg

Hvis du sier ja til å delta i studien, har du rett til å få innsyn i hvilke opplysninger som er registrert om deg. Du har videre rett til å få korrigert eventuelle feil i de opplysningene vi har registrert. Dersom du trekker deg fra studien, kan du kreve å få slettet opplysninger, med mindre opplysningene allerede er inngått i analyser eller brukt i vitenskapelige publikasjoner.

Studien er finansiert gjennom forskningsmidler fra Norges idrettshøgskole

Samtykke til deltakelse i studien

Jeg er villig til å delta i studien

Intervju

Fysiske tester

(Signert av prosjektdeltaker, dato)

Jeg bekrefter å ha gitt informasjon om studien

(Signert, dato)

INTERVJUGUIDE MOR

Vennligst svar på spørsmålene så presist som mulig. Noen av spørsmålene besvares på skala fra 0-10, hvor 0 er angitt med surt fjes og 10 er et smilefjes. Vennligst sett ring rundt det tallet du mener passer best for deg og din situasjon.

Eks:

Har du energi gjennom hele dagen til daglige gjøremål?



0	1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	---	----

I dette eksempelet tilsvare 0 – nei, aldri og 10 – ja, alltid

BAKGRUNNSOPPLYSNINGER

1. Alder

2. Antall graviditeter

3. a) Er du gravid nå?

 JA NEI

b) Hvis JA, hvor mange uker er du på vei?

4. Har du født i løpet av de siste 12 månedene?

 JA NEI

5. Hvor mange barn har du født?

6. Hvilken sivilstand har du nå?

Gift

Skilt/separert

Samboer

Enke

Enslig Annet

7. Bor du sammen med barnets far?

JA NEI

8. Hva er din høyeste fullførte utdanning?

Grunnskole Høgskole/universitet inntil 4 år
 Videregående yrkesfaglig Høgskole/universitet mer enn 4 år
 Videregående allmennfaglig Annen utdanning, hva.....

9. Hva er arbeidssituasjonen din?

Skoleelev/student Hjemmeværende
 Lærling/yrkespraksis Arbeidssøkende/permittert
 Attføring/ufør Ansatt i offentlig virksomhet
 Ansatt i privat virksomhet Selvstendig næringsdrivende
 I familiebedrift (gårdsbruk etc) Annet

10. Dersom du er i arbeid utenfor hjemmet,
hvor stor stillingsprosent har du på nåværende tidspunkt? _____ %

11. a) Er du for tiden fraværende fra ditt vanlige arbeid?

JA NEI

b) Dersom JA, hvor stor prosentandel er du sykemeldt? _____

c) Dersom JA, hva er årsaken til fraværet? (sett eventuelt flere kryss)

Sykemelding
 Permisjon
 Sykt barn
 Annet _____

HELSE OG LIVSTIL

12. a) Røyker du daglig?

JA NEI

b) Hvis JA, omtrent hvor mange sigaretter daglig? _____

c) Hvis NEI, har du røykt tidligere? JA NEI

13. Er du utsatt for passiv røyking i dagliglivet?

JA NEI

14. Vekt: kg Høyde: cm

15. Har du energi gjennom hele dagen til daglige gjøremål?



0	1	2	3	4	5	6	7	8	9	10
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16. Føler du deg trett eller søvning gjennom dagen?



0	1	2	3	4	5	6	7	8	9	10
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17. Hvor tilfreds er du med egen kroppsvekt?



0	1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	---	----

18. Er du tilfreds med egen kroppsform og –utseende?



0	1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	---	----

19. Hvor viktig er kroppsform for din selvfølelse?



0	1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	---	----

20. Hvor viktig er vekt for din selvfølelse?



0	1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	---	----

21. Hvilket av disse nivåene er det mest anstrengende du er i stand til å utføre i 30 min eller mer?

Marker vennligst det tallet som passer best til deg fra 1-20.

1	Sitte
2	
3	Gå rolig
4	
5	Gå normalt/sykle rolig
6	
7	
8	Jogge/sykle
9	
10	Løpe
11	
12	Løpe fort/sykle fort
13	
14	
15	Løpe veldig fort (mer en 15 km/t)
16	
17	
18	Utføre aerobic trening på elitenivå (kvinner)
19	
20	Utføre aerobic trening på elitenivå (men)

22. Alt i alt, tilfreds er du med din fysiske form?

Fysisk form er definert som din totale yteevne, inkludert utholdenhet og styrke.



0	1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	---	----

23. Hvor tilfreds er du med egen fysisk helse?

Fysisk helse er god kroppslig helse som oppnås gjennom en god balanse mellom regelmessig mosjon, sunn diett og hvile.



0	1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	---	----

24. Hvor tilfreds er du med egen mental/psykisk helse?

Psykisk helse bestemmes ut fra din evne til å bruke kognitive og emosjonelle ferdigheter, både til å fungere i samfunnet og i møte med hverdagslige krav.



0	1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	---	----

HELSEPLAGER

OBS! Vær oppmerksom at skalaene under «HELSEPLAGER» har omvendt rekkefølge i forhold til andre spørsmål. 0 tilsvarer ingen smerte, 10 tilsvarer verst tenkelig smerte

25. a) Er du plaget med smerter i ryggen?

JA NEI

b) Hvis JA, hvor er smertene lokalisert?

- Øvre del av ryggen
- I korsrygg uten utstråling til ben
- I korsrygg med utstråling til ben

c) Hvor sterke smerter har du generelt?



0	1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	---	----

26. Er du plaget med smerter i bekkenområdet?

JA NEI

b) Hvis ja, hvor sterke smerter har du generelt?



0	1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	---	----

27. a) Var du plaget med smerter i bekkenområdet under svangerskap?

JA NEI

b) Hvis JA, når sluttet plagene?

- | | |
|---|---|
| <input type="checkbox"/> Mindre enn 6 uker etter fødselen | <input type="checkbox"/> 5-10 måneder etter fødsel |
| <input type="checkbox"/> 6-20 uker etter fødselen | <input type="checkbox"/> Har fortsatt vedvarende plager |

28. a) Har du problemer med urin-lekkasje?

JA NEI

b) Hvis JA, når skjer dette?

- | | |
|---|--|
| <input type="checkbox"/> Når jeg er fysisk aktiv | <input type="checkbox"/> Når jeg hoster og/eller nyser |
| <input type="checkbox"/> Ved sterk vannlatingstrang | <input type="checkbox"/> Når jeg ler |

c) På en skala fra 1-10, hvor plaget er du av denne urinlekkasjen?



0	1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	---	----

29. Har du hatt en av følgende alvorlig sykdom eller plage som har oppstått de siste 5 årene?
(Hjertesykdom, kreft, muskelsykdom, alvorlig kronisk sykdom som diabetes, psykisk sykdom, funksjonshemming eller annet?)

37. Hvor mye tid vil du anslå at du er aktiv daglig?

timer min

--	--

AKTIVITET I HJEM OG NÆRMILJØ

38. Hvor lang tid bruker du på **lett til middels anstrengende** arbeid i hjemmet daglig?

(F.eks. støvsuge, vaske gulv, trappevask, innkjøp av mat, hagearbeid, lek med barn, pleie og omsorgsoppgaver)

Timer min

--	--

39. Hvor fysisk anstrengende er dine daglige omsorgsoppgaver og gjøremål i og rundt hjemmet?

OBS! 0 – Svært lett 10 – svært anstrengende



0	1	2	3	4	5	6	7	8	9	10
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FYSISK AKTIVITET; SPORT OG REKREASJON

MERK: Fysisk aktivitet defineres som 1 eller flere treningsaktiviteter per uke med minst 30 minutters varighet per gang.

40. Helsemyndighetenes anbefaling er fysisk aktivitet i minimum 150 min. av moderat intensitet i uken (tilsvarer ca. 30 min., 5 dager i uken).

I henhold til dette, vil du karakterisere deg selv som fysisk aktiv i dag?

JA NEI Vet ikke

41. Trening er definert som fysisk aktivitet som gjentas regelmessig og med målsetting om å øke fysisk form.

Hvor ofte trener du i henhold til dette?

Økter i uken Aldri

Hvis nei på spørsmål 41, gå direkte til spørsmål nr. 47

42. Hvor lenge har du drevet regelmessig fysisk aktivitet?

Mindre enn 6 måneder 5-10 år
 6 mnd -1 år Mer enn 10 år
 1-4 år

43. Ved hvilken arena utøver du trening/fysisk aktivitet?

Treningssenter Marka

- Idrettshall
- Parken
- Treningsrom på jobb

- Landeveien
- Hjemme/innendørs
- Annet _____

44. a) Driver du med utholdenhetstrening?

- JA NEI

b) Hvis JA, hvor mange timer i uken?

timer min

c) Hvilken type aktivitet gjør du vanligvis?

- | | |
|--------------------------------------|-----------------------------------|
| <input type="checkbox"/> Gå tur | <input type="checkbox"/> Sykling |
| <input type="checkbox"/> Løp/jogg | <input type="checkbox"/> Aerobic |
| <input type="checkbox"/> Dans | <input type="checkbox"/> Svømming |
| <input type="checkbox"/> Roing | <input type="checkbox"/> Langrenn |
| <input type="checkbox"/> Annet _____ | |

45. a) Driver du med styrketrening?

- JA NEI

b) Hvis JA, hvor mange timer i uken?

timer min

c) Hvilken type aktivitet gjør du vanligvis?

- | | |
|--|--------------------------------------|
| <input type="checkbox"/> Løfte vekter | <input type="checkbox"/> Crossfit |
| <input type="checkbox"/> Gruppetrening i sal | <input type="checkbox"/> Annet _____ |

46. a) Driver du med annen trening?

- JA NEI

b) Hvis JA, hvor mange timer i uken?

timer min

c) Hvilken type aktivitet gjør du vanligvis?

- | | |
|--|------------------------------------|
| <input type="checkbox"/> Lagidrett (ballsport) | <input type="checkbox"/> Pilates |
| <input type="checkbox"/> Yoga | <input type="checkbox"/> Kampsport |
| <input type="checkbox"/> | |

Turn

Annet _____

47. Hvor lang tid bruker du i gjennomsnitt når du trener?
(ikke medregnet tid til skift, dusj og reisevei)

min

48. På en skala fra 6-20 (Borgs skala), hvor 6 regnes som hvilenivå, på hvilken intensitet trener du vanligvis? Sett ring rundt passende trinn.

Borg-trinn	Opplevelse
6	Hvile
7	Det føles veldig lett
8	
9	
10	
11	Du kan merke at du trener – men det er ikke hardt
12	
13	
14	Snakkegrensen – du kan snakke, men setningene blir avbrutt av åndedrag
15	
16	Hyperventilering – du puster kraftig og kan kun svare med enkle ord
17	
18	Utmattelse – få minutter eller sekunder til du må stoppe
19	
20	

ROLIGE AKTIVITETER

49. a) Hvor mange timer bruker du totalt til stillesittende aktiviteter daglig (både i arbeid og fritid)?

(Se TV, slappe av, lese, internett, PC, høre på musikk, kontorarbeid m.m.)?

Hverdag

Helg

50. Hvor mange timer sover du vanligvis i løpet av et døgn?

Hverdag

Helg

51. Følger du vanligvis et jevnt søvnmønster?

JA

NEI

52. Når legger du deg vanligvis?
Når står du opp?

Hverdag	Helg
Kl:	Kl:
Kl:	Kl:

STØTTE, BARRIERER OG MOTIVASJON

53. Hvor vanlig er det å drive fysisk aktivitet i din nærmeste omgangskrets?



0 1 2 3 4 5 6 7 8 9 10

54. Trener du sammen med noen?



0 1 2 3 4 5 6 7 8 9 10

55. Har du støtte fra familie/samboer i forhold til fysisk aktivitet?



0 1 2 3 4 5 6 7 8 9 10

56. Hvilket av disse alternativene passer best for deg?

Jeg trener ikke, og jeg har ikke tenkt til å begynne

Jeg trener ikke, men det er mulig jeg begynner

Jeg trener noen ganger, men ikke regelmessig

Jeg trener regelmessig, men har akkurat startet

Jeg har trent regelmessig mer enn 6 måneder

57. Dersom du i dag **ikke er** regelmessig fysisk aktiv, hva er de to viktigste grunnene til dette?
(Sett maks to kryss)

- Har ikke tid
- Er ikke interessert
- Får nok mosjon gjennom min jobb og/eller i hjemmet
- Det krever for mye å komme i gang
- Passer ikke med barn/omsorg
- Har ingen å trene sammen med
- Vanskelig å kombinere med arbeid/utdanning
- Dårlige treningsmuligheter
- Negative opplevelser i forbindelse med fysisk aktivitet
- Sykdom/handikap
- Har aldri trent, ingen erfaring
- Ikke økonomi for å få den hjelpen jeg trenger for å starte opp

58. Dersom du i dag **er** regelmessig fysisk aktiv, hva er de to viktigste grunnene til dette?
(Sett maks to kryss)

- Det er gøy/opplevelse
- Gir bedre kropp/utseende
- Avreagerer/avkobler
- Trener til større eller mindre konkurranser
- Gir bedre fysisk form/forebygger helseplager
- Gir psyksik overskudd/velvære/glede
- Holder vekta nede
- Øker selvtilliten/selvfølelsen
- Reduserer smerter
- Motvirker angst og depresjon
- Fordi jeg føler jeg bør
- Det er sosialt

KOSTHOLD OG MATVANER

59. Hvordan vil du karakterisere egne matvaner/kosthold?



0 1 2 3 4 5 6 7 8 9 10

60. Helsedirektoratet anbefaler et variert kosthold som inneholder mye grønnsaker, frukt og bær, grove kornprodukter og fisk. Et begrenset inntak av bearbeidet kjøtt, rødt kjøtt, salt og sukker. Hvordan vil du si at du følger disse anbefalingene?



0 1 2 3 4 5 6 7 8 9 10

61. Spiser du 3 eller fler varierte og sunne måltider daglig?



0 1 2 3 4 5 6 7 8 9 10

62. Spiser du frokost daglig?



0 1 2 3 4 5 6 7 8 9 10

63. Spiser du små mellommåltid, som f.eks. frukt, nøtter eller en liten youghurt, mellom hovedmåltidene dine?



0	1	2	3	4	5	6	7	8	9	10
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64. Spiser du et varmt måltid dalig?



0	1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	---	----

65. Hvor ofte i en vanlig uke spiser du? (inkluder alle måltider)

	Antall ganger	Aldri
Fisk	<input type="text"/>	<input type="text"/>
Kjøtt	<input type="text"/>	<input type="text"/>
Jeg er vegeterianer	<input type="text"/>	

66. Velger du grove mel-/kornprodukter med høyt fiberinnhold?



0	1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	---	----

67. Velger du magre melk- og meieriprodukter?



0	1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	---	----

68. Anbefalingene fra Helsedirektoratet er 5 enheter med frukt og grønt daglig.
Hvor mange enheter får du i deg daglig?

69. Helsedirektoratet anbefaler inntak av 4 enheter kalsiumprodukt daglig. Det kan f.eks. være gulost til brødskiven, yoghurt, melk etc. Inneholder din daglige kost tilsammen 4 eller flere enheter av nevnte? JA NEI

70. Hvor ofte i en vanlig uke spiser du mat som pizza, kebab, pølse, hamburger etc.? Antall ganger Aldri

71. Hvor ofte i en vanlig uke spiser du søte matvarer, som feks. Syltetøy, nuggati, søt frokostblanding etc.? Antall ganger Aldri

72. Hvor ofte i en vanlig uke spiser du mat som potetgull, sjokolade, smågodt, kaker, is etc? Antall ganger Aldri

73. Hvor ofte i en vanlig uke drikker du søte drikkevarer som saft, fruktjuice, brus, energidrikk etc? Antall ganger Aldri

74. Hvor mange kopper kaffe drikker du daglig? Antall kopper Aldri

75. Helsedirektoratet anbefaler et redusert inntak av salt og sukker. Hvor bevisst er du på innhold av salt og/eller sukker i de produktene du bruker?



0	1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	---	----

76. Velger du produkter som er nøkkelhullsmerket?



0	1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	---	----

77. Følger du tallerkenmodellen når du forsyner deg med mat?





0	1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	---	----

78. Hvor ofte i en vanlig uke spiser du mat kjøpt i kantine, lunsjbar eller restaurant?

Antall ganger	Aldri
<input type="checkbox"/>	<input type="checkbox"/>

79. Hvor ofte i en vanlig uke spiser du mat kjøpt i kiosk, gatekjøkken, bensinstasjon eller fast-food restaurant?

Antall ganger	Aldri
<input type="checkbox"/>	<input type="checkbox"/>

80. a) Bruker du vitaminer, mineraler eller annet kosttilskudd?

JA NEI

b) Hvis JA, hvilken type?

Multivitamin-/mineraltilskudd	<input type="checkbox"/>
Tran/fiskeolje	<input type="checkbox"/>
Proteintilskudd	<input type="checkbox"/>

81. Hvor ofte drikker du alkohol?

Antall ganger pr. uke	Aldri
<input type="checkbox"/>	<input type="checkbox"/>

82. Hvor mange alkoholenheter drikker du vanligvis når du nyter alkohol?

	I helgen	Hverdager
10 eller flere	<input type="checkbox"/>	<input type="checkbox"/>
7-9	<input type="checkbox"/>	<input type="checkbox"/>
5-6	<input type="checkbox"/>	<input type="checkbox"/>
3-4	<input type="checkbox"/>	<input type="checkbox"/>
1-2	<input type="checkbox"/>	<input type="checkbox"/>
Færre enn 1	<input type="checkbox"/>	<input type="checkbox"/>

83. Bruker du eller har du brukt måltidserstatning for å kontrollere vekten?

JA NEI

84. a) Har du matvareallergi?

JA NEI

b) Hvis JA, hvilken?

	JA
Allergi mot melk	<input type="checkbox"/>
Allergi mot egg	<input type="checkbox"/>
Allergi mot peanøtter	<input type="checkbox"/>
Allergi mot andre nøtter	<input type="checkbox"/>
Allergi mot skaldyr	<input type="checkbox"/>
Allergi mot fisk	<input type="checkbox"/>
Allergi mot frukt	<input type="checkbox"/>
Allergi mot hvete	<input type="checkbox"/>
Allergi mot andre matvarer	<input type="checkbox"/>
Intoleranse	<input type="checkbox"/>

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INTERVJUGUIDE BARNET

Vennligst svar på spørsmålene så presist som mulig på vegne av ditt barn. Noen av spørsmålene besvares på skala fra 0-10, hvor 0 er angitt med surt fjes og 10 er et smilefjes. Vennligst sett ring rundt det tallet du mener passer best for ditt barn og barnets situasjon.

Eks:

Er barnet/barna positive og med på fysisk aktivitet igangsatt av deg og andre foresatte? (eksempelvis gå søndagstur i fjellet, dra på kanotur i marka, skitur om vinteren osv?)



0	1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	---	----

I dette eksempelet tilsvare 0 – nei, aldri og 10 – ja, alltid

GENERELT OM BARNET

85. Alder:

86. Hva er barnets vekt og høyde?

Vekt: kg

Høyde: cm

87. Her følger spørsmål om sykdom og helseproblemer hos barnet. Har barnet nå eller har det noen gang hatt følgende sykdommer eller helseproblemer?

	Nei	Ja, tidligere	Ja
Forsinket motorisk utvikling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Atferdsproblemer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Astma	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pollenallergi	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Matallergi	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Annen alvorlig sykdom	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

88. Har barnet en lærevanske?

JA NEI

89. Har barnet en psykisk utviklingshemming?

JA NEI

90. Har barnet et syndrom eller mistanke om at det kan ha det?

JA NEI

BARNETS FYSISKE AKTIVITETSNIVÅ

91. Utenom skoletid: Omtrent hvor mange ganger per uke er barnet fysisk aktivt/driver idrett slik at det bli andpusten eller svett? (SFO tas også med her)

ganger per uke

92. Helsemyndighetene anbefaler at barn er fysisk aktive minimum 60 minutter hver dag. Aktiviteten bør være av moderat til høy intensitet. Vil du si at ditt barn følger disse anbefalingene?

JA NEI Vet ikke

93. Utenom skoletid på en vanlig hverdag: Omtrent hvor mange timer per dag er barnet i fysisk aktivitet på moderat til høy intensitet? (SFO tas også med her)

Sommer timer per dag

Vinter timer per dag

94. Utenom skoletid på en vanlig hverdag: Omtrent hvor mange timer per dag er barnet utendørs? (SFO tas også med her)

Sommer timer per dag

Vinter timer per dag

95. Hvilken type fysisk aktivitet driver barnet/barna vanligvis med? (maks 3 kryss)

- | | |
|---|---|
| <input type="checkbox"/> Lek på lekeplass/fotballbane | <input type="checkbox"/> Løp/jogg/orientering |
| <input type="checkbox"/> Fotball | <input type="checkbox"/> Håndball |
| <input type="checkbox"/> Dans | <input type="checkbox"/> Ishockey |
| <input type="checkbox"/> Sykling | <input type="checkbox"/> Langrenn |
| <input type="checkbox"/> Turn | <input type="checkbox"/> Svømming |
| <input type="checkbox"/> Kampsport | <input type="checkbox"/> Annet: _____ |

96. Er barnet/barna positive og med på fysisk aktivitet igangsatt av deg og andre foresatte? (eksempelvis gå søndagstur i fjellet, dra på kanotur i marka, skitur om vinteren osv?)



0 1 2 3 4 5 6 7 8 9 10

97. Er ditt/dine barn glad i fysisk aktivitet/trening?



0 1 2 3 4 5 6 7 8 9 10

98. a) Har du et eller flere barn som ikke ønsker å være/ikke er fysisk aktiv?

JA NEI

b) Hvis JA, hvilke to alternativer passer ditt barn best?

- Liten interesse for fysisk aktivitet
- Negativ opplevelse med fysisk aktivitet generelt
- Barnets nærmeste venner er ikke fysisk aktive
- Ingen i familien er fysisk aktive
- Sykdom/medisinsk årsak
- Negativ opplevelse med organisert fysisk aktivitet
- Ingen tilbud om organisert aktivitet i området
- Mor/far har ikke tid til oppfølging av organisert fysisk aktivitet
- Økonomisk vanskelig med organisert aktivitet
- Ikke vanlig med deltakelse i fysisk aktivitet i familien

99. Oppmuntrer du ditt/dine barn til fysisk aktivitet?

JA NEI

100. Har ditt/dine barn mulighet til å leke alene utenfor huset?

(eksempelvis på en lekeplass, gårdsplass og lignende i gåavstand for barnet selv)

JA NEI

BARNETS HVERDAG

101. Har ditt/dine barn nettbrett, mobiltelefon og eller pc?

JA NEI

102. Har barnet TV på eget rom?

JA NEI

103. Hvor mange timer ser barnet TV/DVD eller spiller/benytter PC/nettbrett/TV-spill?

På en typisk ukedag? t/ daglig

På en typisk dag i helgen? t/ daglig

104. Går eller sykler barnet til skolen selv?



0	1	2	3	4	5	6	7	8	9	10
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105. Hvor lang er avstanden mellom hjem og skole? km

106. Omtrent hvor mange timer sover barnet per natt på hverdager? timer/natt

MAT OG KOSTVANER

107. Hvor ofte spiser barnet frokost (hjemme eller på skolen?)



0 1 2 3 4 5 6 7 8 9 10

108. Spiser barnet 3 eller fler måltider daglig?



0 1 2 3 4 5 6 7 8 9 10

109. Hvordan vil du karakterisere ditt barns matvaner/kosthold?



0 1 2 3 4 5 6 7 8 9 10

110. Helseanbefalingene er at barn har et variert kosthold med frukt, grønnsaker og fisk flere ganger i uken. Hvor variert er ditt barns kosthold?



0 1 2 3 4 5 6 7 8 9 10

111. Hvor ofte i en vanlig uke spiser barnet ditt?(inkluder alle måltider – pålegg på brød teller også)

	Antall ganger	Aldri
Fisk	<input type="text"/>	<input type="text"/>
Kjøtt	<input type="text"/>	<input type="text"/>
Barnet er vegetarianer	<input type="text"/>	

112. Anbefalingene fra Helsedirektoratet er 5 enheter med frukt og grønt daglig. Omtrent hvor mange enheter får barnet i seg daglig?

113. Helsedirektoratet anbefaler inntak av ca. 3 enheter kalsiumprodukt daglig. Det kan f.eks. være gulost til brødskiven, yoghurt, melk etc. JA NEI
Inneholder barnets daglige kost tilsammen 3 eller fler enheter av nevnte?

114. Hvor ofte i en vanlig uke spiser barnet ditt mat som pizza, kebab, pølse, hamburger etc.? Antall ganger Aldri

115. Hvor ofte i en vanlig uke drikker barnet ditt søte drikkevarer som saft, fruktjuice, brus, energidrikk etc? Antall ganger Aldri

116. Hvor ofte i en vanlig uke spiser barnet ditt søte matvarer, som f.eks. syltetøy, nugatti, søt frokostblanding etc.? Antall ganger Aldri

117. Hvor ofte i en vanlig uke spiser barnet ditt mat som potetgull, sjokolade, smågodt, kaker, is etc.? Antall ganger Aldri

118. Hvor ofte i en vanlig uke spiser barnet ditt mat kjøpt i kiosk, gatekjøkken, bensinstasjon eller fast-food restaurant? Antall ganger Aldri

119. Får barnet ditt kosttilskudd?

JA NEI

120. Hvis JA, hvilken type?

Multivitamin-/mineraltilskudd
Tran/fiskeolje
Sanasol/Biovit

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