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Diet in pregnancy prior to gestational diabetes diagnosis in women in Oslo, Norway

Food intake, diet quality and recommendations

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Abstract

Introduction: Diet during pregnancy is important for both the health of the mother and her offspring. A food intake in accordance with the national recommendations can reduce risk of non-communicable diseases such as type 2 diabetes and cardiovascular disease. Additionally, following the dietary advice can reduce risk of complications from gestational diabetes mellitus.

Objectives: The purpose of this study was to increase knowledge on the diet during pregnancy prior to gestational diabetes diagnosis in women in Oslo. Baseline data gathered from the on-going Pregnant+ study are used for analysis. The secondary objectives were to describe the food intake during pregnancy using a qualitative food frequency questionnaire, develop a scoring system to examine diet quality through adherence to dietary recommendations and evaluate diet using the scoring system.

Methods: This quantitative, cross-sectional study uses a 41-item food frequency questionnaire to describe diet, and a self-developed scoring system to further compare diet with recommendations. The score is based on national recommendations for food intake. Participants were recruited at their initial meeting in the diabetes outpatient clinic in five major hospitals in the Oslo area. The women recruited September 2015- April 2016 are included in this thesis. Background variables were added to the statistical program SPSS and score development and analysis were conducted by use of SPSS.

Results: 75 women participated in the study, 55% were born in Norway. The intake of vegetables, fruits and berries, wholegrain and low-fat milk were less frequent than recommended in the majority of the sample. The majority met the recommended frequency for intake of fish. The salt intake was most likely exceeding the amount recommended.

Conclusion: Dietary intake might not be met by recommendations in the majority of the categories, although it is not possible to conclude, as the amount per frequency could not be estimated accurately.

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Abbreviations

ACOG	American College of Obstetricians and Gynaecologists
ADA	American Diabetes Association
BMI	Body mass index
CTG	Cardiotocography
CHD	Coronary heart disease
DQI	Diet Quality Indicator
FFQ	Food frequency questionnaire
GDM	Gestational diabetes mellitus
HAPO	Hyperglycemia and Adverse Pregnancy Outcome study
HiOA	Oslo and Akershus University College of Applied Sciences
IADPSG	The International Association of Diabetes and Pregnancy Study Group
IGT	Impaired glucose tolerance
LGA	Large-for-gestational-age offspring
NFR	The Research Council of Norway
NSD	Norwegian Centre for Research Data
OGTT	Oral glucose tolerance test
PUFA	Polyunsaturated fatty acids
RCT	Randomized controlled trial
SD	Standard deviation
SGA	Small-for-gestational-age offspring
SPSS	Statistical Package for the Social Sciences
UNIK	University Graduate Center at Kjeller
USDA	United States Department of Agriculture
WHO	World Health Organization

1.0 Introduction

Diet and food intake have a large impact on health. When becoming pregnant, a mother's diet and nutritional status affects not ony her own health, but also that of her offspring. Furthermore, maternal nutrition during pregnancy can influence the future health of both mother and offspring (hartGeraghty, Lindsay, Alberdi, McAuliffe, & Gibney, 2015). The variation in the mother's proportion of fats, protein and carbohydrates in her diet have been shown to independently affect offspring outcomes such as growth, body composition and insulin sensitivity (Blumfield et al., 2012). Further, malnutrition in pregnancy can contribute to poor fetal growth, low birthweight and irreversible health impairments (Imdad & Bhutta, 2012).

A healthy, varied diet can reduce the risk of non-communicable diseases (NCDs), which were responsible for 68% of the world's 56 million deaths in 2012 ([WHO], 2014). The World Health Organization (WHO) member states have agreed on nine voluntary global noncommunicable diseases targets to be attained by 2025 ([WHO], 2014). Similarly, a Norwegian NCD-strategy plan was made in 2013 to reduce premature death from cardiovascular disease, diabetes, chronic obstructive pulmonary disease and cancer by 25% by 2025 (Helse- og omsorgsdepartementet, 2013). To reach this goal, it is essential to identify risk groups to be able to reduce risk of disease by implementing preventive measures (Helse- og omsorgsdepartementet, 2013).

The Norwegian national recommendations for diet and physical activity are developed to promote good health and reduce risk of cardiovascular disease, type 2 diabetes, high blood pressure, certain types of cancer, osteoporosis, tooth decay, overweight and obesity (Helsedirektoratet, 2014a). These dietary advice are also recommended for pregnant women and those with increased risk of diabetes and overweight (Helsedirektoratet, 2014a).

One of the major complications during pregnancy is gestational diabetes mellitus (GDM), which can lead to complications during pregnancy, risk of adverse foetal outcomes and an increased risk of later GDM, cardiovascular disease and type 2 diabetes in the mother (Reece, 2010). Gestational diabetes is defined as all types of diabetes and reduced glucose tolerance emerging during pregnancy (Helsedirektoratet, 2009). To reduce risk of the complications caused by GDM, blood sugar control through diet is important. The dietary advice for women with GDM in Norway are quite similar to the general dietary advice in Norway (Helsedirektoratet, 2011). Assessment of their diet in relation to recommendations can be of great value to be able to develop strategies and interventions to better the likelihood of adherence.

1.1 Delimitations

The thesis is based on data from the on-going project Pregnant+. The Pregnant+ research project "Prevention of hyperglycaemia in antenatal care using tailored communication strategies and mobile learning devices" is funded by the Research Council of Norway (NFR). The project aim is to develop and test a culture sensitive mobile application that entails information on diet and physical activity and can be connected to a glucose-measuring device. The app is meant to inform and motivate pregnant women with gestational diabetes to adapt their diet and physical activity to prevent hyperglycaemia. The on-going project that started in April 2014 will consist of 230 women at the end of the recruitment process. The consortium collaborating in the project includes the University College of Oslo and Akershus (HiOA) and the University Graduate Centre (UNIK).

This master thesis will investigate the diet of pregnant women prior to their gestational diabetes diagnosis, using baseline data from the Pregnant+ study including a questionnaire, a recruitment form and a food frequency questionnaire. Data from participants recruited through hospitals the Oslo area from September 2015 until mid April 2016 will be used in this cross-sectional study.

Limitations

The master thesis student has not been part of development of recruitment protocol, questionnaire or choice of dietary assessment method. Due to time restrictions, the main focus of this thesis is to describe the food intake and develop a score based on adherence to the national recommendations to further analyse food intake.

1.2 Objectives

The purpose of the study was to increase knowledge on diet during pregnancy prior to gestational diabetes diagnosis in women in and around Oslo.

Secondary objectives include:

1. Describe the food intake during pregnancy prior to diagnosis in women with gestational diabetes, assessed with a qualitative food frequency questionnaire.
2. Further develop a scoring system to examine diet quality through adherence to dietary recommendations.
3. Evaluate the pregnant women’s diet using the scoring system.

2.0 Theory

2.1 Diet in pregnancy

2.1.1 The importance of diet during pregnancy

Maternal diet can influence the pregnancy outcome as well as the long-term health of both mother and child (Brantsæter et al., 2014). Eating according to the official recommendations, with a regular intake of vegetables, fruit, whole grain and fish and reduced intake of processed meat, sugar-sweetened beverages and salty snacks is associated with lower risks of adverse clinical pregnancy outcomes and complications (Brantsæter et al., 2014).

According to a New Zealand case-control study with 1714 subjects, eating a "traditional" diet, consisting of root vegetables, fruits, potatoes, meat and dairy was associated with less likelihood of giving birth to a small-for-gestational-age (SGA) baby (Thompson et al., 2010). Further, a U.S. case-control study using the Mediterranean Diet Score and Diet Quality Index to measure diet quality, found that higher maternal diet quality was associated with reduced risk of neural tube defects and orofacial clefts (Carmichael et al., 2012). A cohort study of 1079 mother-offspring pairs investigated diet quality measured with the Healthy Eating Index (HEI), and concluded that poor diet quality during pregnancy increased neonatal adiposity independent of maternal pre-pregnancy BMI and total caloric intake (Shapiro et al., 2016).

2.1.2 Dietary advice in pregnancy

In 2014, the Norwegian Directorate of Health published a revised version of the Norwegian guidelines on diet, nutrition and physical activity (Helsedirektoratet, 2014a). The guidelines are based on the Nordic Nutrition Recommendations, developed by the Nordic Council of ministers (Nordic Council of Ministers, 2014), and the "Food-based dietary guidelines for public health promotion and prevention of chronic diseases – Methodology and scientific evidence" (Nasjonalt råd for ernæring, 2011), published by the Norwegian Nutrition Council.

The Norwegian Directorate of Health have developed dietary advice for the general population, and these are also valid during pregnancy (Helsedirektoratet, 2014a). These advice are given together with a few specific advice for diet during pregnancy in the pamphlet

"Good lifestyle habits before and during pregnancy" (Helsedirektoratet, 2016b), and are summarized in the paragraphs below.

It is recommended to eat a varied diet with at least five portions of vegetables, berries and/or fruit daily (at least half of these vegetables), fish 2-3 times per week and wholegrain products such as wholegrain bread, rice and pasta daily. Further, it is recommended to choose lean meat products and limit the amount of processed meat and red meat. It is advised to eat low-fat milk products, and use vegetable oils and soft margarine in place of butter. Finally, it is recommended to choose food products low in salt, limit foods high in sugar and choose water when thirsty (Helsedirektoratet, 2014a).

Additional recommendations for pregnant women include limiting caffeine intake to 1-2 cups of coffee per day (or 3-4 cups of tea) and eating regular portion sizes until the last trimester where it is adviced to increase intake with 300 kcal per day for women with normal weight gain, equivalent to a portion of oatmeal porridge and a piece of fruit. The need for certain micronutrients is increased during pregnancy, and iron, folic acid, calcium, iodine, vitamin D and vitamin B12 are mentioned specifically in the report. Recommended food sources for increased intake of these vitamins and minerals are wholegrain products and meat, broccoli and kale, low-fat milk products (calcium and iodine), fatty fish/cod liver oil, and red meat/fish/eggs, respectively. In addition, sources of protein such as lean meat, chicken, eggs, beans and lentils are suggested. It is further recommended to avoid foods that may contain toxoplasma or listeria, such as unpasteurised milk products and cured meat and fish (Helsedirektoratet, 2016b).

Recommendations are also given for recommended weight gain during pregnancy. Those who are underweight are advised to gain weight above the average of 11-16 kg during the pregnancy, and those overweight are recommended to limit their weight gain (Helsedirektoratet, 2016b).

2.1.3 Current diet in Norway compared to recommendations

In 2015, the Norwegian Directorate of Health published a report on the development in the general Norwegian diet based on food supply statistics and food frequency questionnaires (Helsedirektoratet, 2015b). Data show that the intake of salt was twice as high as recommended with an estimated 10 g per day in men (somewhat lower for women), and this is concerning - as there is a link between salt intake, blood pressure and increased risk of cardiovascular disease (Helsedirektoratet, 2015a). The total intake of vegetables, fruits and berries was estimated to 320 g per person per day, with around 20% of adults in Norway following the recommendation of at least 500 g of vegetables, fruits and berries per day. The average intake of red meat and processed products from red meat were 630 g per week for women and 1022 g per week for men. Among women, there were 67% who ate less than 500 g red meat/processed red meat per week. An estimated quarter of the population ate fish 3 times per week, and the average intake of fish was 310 g in women and 450 g in men, compared to the recommended 300-450 g per week. Of the specified recommendation of 200 g of fatty fish per week, 2% of the women reported to eat this. Further, the intake of sugary soda is 55 L per person per year, on average. Intake of chocolate and sugar products was estimated to be around 14-15 kg per person per year, not including what was purchased abroad, an estimated 8% of the total consumption (Helsedirektoratet, 2015b).

2.1.4. Socio-economic status and diet

Socio-economic factors such as education, income and profession can be connected to an individual's health status. Health and lifestyle habits such as diet and physical activity is connected to living conditions and environment, and these background factors can influence decisions and habits that can promote health - or increase risk of disease (Folkehelseinstituttet, 2014). There are considerably large differences in health and lifestyle habits in Norway, and studies have shown that lifestyle habits often follow education and income levels.

From the Norwegian Directorate of Health's report on food intake in 2015, we find that the number of people who ate fruit, berries and vegetables at least twice a day was lower in those with shorter education (*videregående*) compared to those with higher education (*høgskole/universitet*) (Helsedirektoratet, 2015b). Further, an intake of fruits and berries twice a day were found in 20% of those with shorter education compared to 33% in those with longer education. A similar trend was found in vegetables where the percentages were 10% and 20%, respectively (Helsedirektoratet, 2015b).

There is a higher number of those with shorter education who report of generally bad health compared to those with longer education (Folkehelseinstituttet, 2014). The social differences in health are valid for almost all diseases and age groups in society (Folkehelseinstituttet, 2014). Diet and lifestyle can affect the risk of non-communicable diseases such as type 2 diabetes, cardiovascular disease and stroke increase with overweight (Ezzati & Riboli 2013). Further, diabetes in parents or siblings, overweight and physical inactivity are some of the main risk factors for gestational diabetes (Zhang, Rawal, & Chong, 2016).

2.2 Gestational diabetes

Gestational diabetes mellitus is defined as all types of diabetes and reduced glucose tolerance emerging during pregnancy (Helsedirektoratet, 2009). It can lead to complications during the pregnancy and after birth, both for the mother and the offspring.

2.2.1 Gestational diabetes complications and consequences

The majority of women with GDM who control their blood sugar levels give birth to healthy babies, whereas in some cases GDM can negatively affect the pregnancy, the child or the long-term maternal and child health (Reece, 2010). Consequences of gestational diabetes include an increased risk of complications during pregnancy, risk of adverse foetal outcomes and an increased risk of later GDM, cardiovascular disease and type 2 diabetes (Reece, 2010).

Maternal complications

During pregnancy, gestational diabetes is an independent risk factor for preeclampsia, together with obesity (Indorf, Schmidt, Barop, & Beyer, 2014). Preeclampsia is the presence of hypertension (>140/90 mmHg) together with proteinuria (Schneider, Freerksen, Röhrig, Hoeft, & Maul, 2012). Preeclampsia is a leading cause of maternal deaths worldwide, and is also associated with increased risk of perinatal mortality (Allen, Rogozinska, Sivarajasingam, Khan, & Thangaratinam, 2014). A meta-analysis of randomized controlled trials found that dietary and lifestyle interventions in pregnancy may reduce the risk of preeclampsia (Allen et al., 2014).

Complications of GDM can also arise during labour. In a recent population-based Danish study, the risk of both planned and emergency caesarean section was increased in GDM women, with a proportion of 15.2% and 15.8%, respectively (Ovesen, Jensen, Damm, Rasmussen, & Kesmodel, 2015). Women with GDM also have an increased risk of the infant's shoulder obstructing the labour (*shoulder dystocia*), and complicating the childbirth (Hiersch & Yogev, 2014). Studies indicate a 2-fold increase in prevalence of shoulder dystocia in GDM pregnancies compared to non-GDM pregnancies (Ovesen et al., 2015). Planned caesarean section is also used as an intervention to reduce the risk of shoulder dystocia complications (Ovesen et al., 2015).

After delivery, there is an increased risk of cardiovascular morbidity later in life for women with GDM (Kessous, Shoham-Vardi, Pariente, Sherf, & Sheiner, 2013). There is also an increased risk of developing diabetes type 2 (Reece, 2010). A systematic review suggests that compared to women with normoglycaemic pregnancies, women with GDM have a seven-fold increased risk of developing type 2 diabetes in the future (Bellamy, Casas, Hingorani, & Williams, 2009). In a recent case-control study the risk of subsequent diabetes was five times higher in women with a 2-hour 75 g oral glucose tolerance test (OGTT) value ≥11.1 mmol/L compared to those with a 2-h OGTT value ≥9.5 mmol/L (Wahlberg et al., 2016).

Foetal complications

The main GDM complications for the foetus are at birth and post-delivery (Mitanchez, Burguet, & Simeoni, 2014). Macrosomic, or large for gestational age (LGA) offsprings are more common in GDM pregnancies, and can further lead to an increased risk of shoulder dystocia in vaginal births (Reece, 2010). If the infant is macrosomic (often defined as 4000-4500 g), there is a higher risk of hypoglycaemia after delivery (Mitanchez et al., 2014). There is no direct established link between GDM and respiratory distress syndrome, however there is a higher risk of respiratory distress syndrome with birth weight above 4000 g (Mitanchez et al., 2014). Furthermore, jaundice in newborns is also related to maternal GDM (Reece, 2010).

Compliations for the offspring after birth

Later in life, the child of a GDM mother can have nearly double the risk of childhood obesity compared to children born to nondiabetic mothers (Reece, 2010). However, a systematic review from 2011 mentions that in the few studies that adjusted for confounders and pre-pregnancy obesity, there were no statistically significant relation between GDM and childhood overweight or obesity (Kim, England, Sharma, & Njoroge, 2011). Furthermore, a cohort study comparing women with and without GDM found no association between childhood obesity at age 2-4 and GDM, but there was an association between higher prepregnancy maternal BMI and LGA in the offspring (Pham, Brubaker, Pruett, & Caughey, 2013). According to Metzger and associates, there is an association between maternal glucose levels and neonatal adiposity, even with levels lower than the GDM diagnostic criteria. This relationship suggests a link by foetal insulin production, which influences foetal growth (Metzger et al., 2008). Increased size at birth is associated with an increased likelihood of adiposity, alterations in glucose metabolism and function (Burguet, 2010). Studies have also suggested an increased risk of diabetes type 2 in the child of a mother with GDM (Burguet, 2010; Clausen et al., 2008). A Caucasian cohort study of GDM offspring aged 7-11 years found at least one marker of insulin restistance in 34% of the children, but comparable numbers for non-GDM offspring in the same type of population was not available, and the authors conclude that there may be an increased risk of insulin resistance in GDM offspring and that this should be investigated further (Keely et al., 2008).

2.2.2 Risk groups and risk factors

The established GDM risk factors are high age at pregnancy (>35), type 1- or 2-diabetes in parents or siblings, pre-pregnant body mass index (BMI) over 25 kg/m^2, previous GDM, and non-Caucasian ethnicity (Pons, Rockett, de Almeida Rubin, Oppermann, & Bosa, 2015; Zhang et al., 2016). Cigarette smoking has also been mentioned as a possible risk factor (Zhang et al., 2016). In addition, physical activity before and during pregnancy is related to a lowered risk of GDM of 20-50% (Zhang et al., 2016). At least 210 minutes of moderate to vigorous activity, including brisk walking, has shown a reduced risk of GDM in a part of the Nurses' Health Study II (Zhang et al., 2014).

Ethnicity plays a role in GDM risk, and especially South Asians and black Africans have an increased risk of GDM compared to white Europeans, irrespective of BMI (Makgoba, Savvidou, & Steer, 2012; Sommer et al., 2015). A study found that compared to white Europeans, black Carribeans, black Africans and South Asians have a significantly higher incidence of GDM at an equal normal body mass index range (Makgoba et al., 2012). Further, the statistics showed that a non-white woman at 25-29 years of age had a similar risk of developing GDM as a white European woman aged 40 years (Makgoba et al., 2012), indicating that age has a different risk depending on ethnicity.

There is an increased risk of GDM for those with pre-pregnant overweight and obesity (Heude et al., 2012; Morisset et al., 2010), and this risk increases with BMI over 25, an 8% increase per 1kg/m^2 was found in a large study from the US (Singh et al., 2012). Independent of GDM, overweight and obesity is associated with increased foetal growth and foetal adiposity (Metzger et al., 2008). Studies have also found that a gestational weight gain above recommendations is positively associated with GDM (Pons et al., 2015; Sommer et al., 2014).

Previous GDM leads to higher risk of GDM in later pregnancies, and the risk is associated with weight gain between pregnancies, insulin use and multiparity (Schwartz, Nachum, & Green, 2016). Multiparity is found to be a risk factor in itself, but there is still discussion whether the link is affected by higher BMI and advanced age as this is more common in women with previous pregnancies (Dode & Santos, 2009). GDM recurrence is influenced by ethnicity; a study found that non-Hispanic white primiparous women have a 39% lower recurrence rate compared to other ethnicities (56%), and primaparous women had a recurrence rate of 40% compared to multiparous women with 73% (Schwartz, Nachum, & Green, 2015).

Cigarette smoking has been mentioned as a possible risk factor in some studies (Zhang et al., 2016), but not others (Terry, Weiderpass, Östenson, & Cnattingius, 2003; Wendland, Pinto, Duncan, Belizan, & Schmidt, 2008). There is, however, a recent study that found a link between heavy maternal smoking during pregnancy and an increased risk of GDM in the daughter (Bao et al., 2016).

2.2.3 Prevalence and diagnostic criteria

Different diagnostic criteria and screening procedures makes it difficult to establish the GDM prevalence (Hartling et al., 2012). Because of the uncertainty of which threshold of blood glucose values have constituted a risk of perinatal complications, the cut-off values for diagnosing GDM have varied, and there is still no worldwide consensus (Agarwal, 2015; Ecker & Greene, 2008; Hunt & Schuller, 2007). Reviews of prevalence studies show a range of 1.7-11.6% in Europe (S. Schneider, Bock, Wetzel, Maul, & Loerbroks, 2012), and 1 to 14% in the U.S, according to the American Diabetes Association (ADA, 2009). In Norway, a population-based cohort study by Jenum and associates found a prevalence of 11-31%, varying with diagnostic criteria and ethnicity (Jenum et al., 2012). However, the nationwide birth registry in Norway showed a 2% prevalence in 2011 (Folkehelseinstituttet, 2014). The authors of the report mention that the difference in percentage between studies is probably related to the use of standardized risk-group screening (Folkehelseinstituttet, 2014), as opposed to universal screening of all pregnant women. Prevalence rates vary with ethnicity, and the numbers can be complex to compare in and between populations when the screening and measuring criteria are so varied (Jenum et al., 2012; Makgoba et al., 2012).

In 2010, The International Association of Diabetes and Pregnancy Study Group (IADPSG), suggested a change of screening procedures and diagnostic criteria based on the findings in the Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study (Coustan, Lowe, Metzger, & Dyer, 2010; International Association of Diabetes Pregnancy Study Groups Consensus Panel [IADPSG], 2010). The HAPO study was performed to better be able to estimate thresholds and thus diagnostic criteria for GDM, however they found that there is no clear threshold between maternal glucose levels and subsequent adverse pregnancy outcome (Coustan et al., 2010). Yet, their findings have resulted in a lower cut-off than previous levels, and they conclude that this will be helpful in reaching a part of the population previously undiagnosed with GDM (Coustan et al., 2010).

In 2013, the WHO recommended the IADPSG criteria for diagnosing GDM ([WHO], 2013), whereas ADA had already adapted these criteria in 2011. Due to a disagreement from the American College of Obstetricians and Gynaecologists (ACOG), ADA additionally reintroduced their formerly used ACOG criteria (Agarwal, 2015). Table 1 presents the widely accepted GDM diagnostic criteria, including the former ADA and WHO cut-offs adapted from Hunt and Schuller (Hunt & Schuller, 2007), in addition to the IADPSG diagnostic thresholds.

Table 1: Gestational diabetes mellitus diagnostic criteria, adapted from Hunt & Schuller (Hunt & Schuller, 2007). The IADPSG diagnostic thresholds are added to the final row (International Association of Diabetes Pregnancy Study Groups Consensus Panel [IADPSG], 2010).

	Glucose load (g)	Duration (hours)	Abnormal values (n)	Fasting, 1-, 2- and (3-hour) OGTT thresholds (mg/dL)
O'Sullivan and Mahan, 1964*	100	3	≥2	90, 165, 145, 125
NDDG, 1979	100	3	≥2	105, 190, 165, 145
Carpenter and Coustan, 1982	100	3	≥2	95, 180, 155, 140
JSOG, 1984	75	2	≥2	100, 180, 150
WHO, 1985	75	2	≥1	140, N/A, 140
EASD, 1991	75	2	≥1	108, N/A, 162
ADA and ACOG, "post 1997 4th International Workshop Conference on GDM"	75 or 100	2 or 3	≥2 ≥2	95, 180, 155 95, 180, 155, 140
WHO, 1999	75	2	≥1	N/A, N/A, 140
ADIPS, 1998	75	2	≥1	99, N/A, 144
IADPSG	75	1	≥1	92, 180, 153

OGTT: oral glucose tolerance test; NDDG: National Diabetes Data Group; JSOG: Japanese Society of Obstetrics and Gynaecology; WHO: World Health Organization; EASD: European Association for the Study of Diabetes; ADA: American Diabetes Association; ACOG: The American Congress of Obstetricians and Gynaecologists; ADIPS: Australasian Diabetes in Pregnancy Society, IADPSG: International Association of Diabetes and Pregnancy Study Group.

All criteria use venous plasma except for O'Sullivan and Mahan's, which was defined using venous blood.

Screening

There are different screening procedures to identify women in need for GDM treatment. There is no clear consensus on what types of screening are ideal and when to perform screening (Tieu, McPhee, Crowther, & Middleton, 2014). The use of universal screening reduces the chance of a significant proportion of women with serious outcome remaining undiagnosed (Avalos, Owens, & Dunne, 2013). However, the increased cost and demand of universal screening remains a debated subject. A common screening method for specific screening is a 1-hour 50 g glucose challenge test with a cut-off point at 140 mg/dL (Prutsky et al., 2013). Other screening methods use pre-defined variables for increased risk to establish who are in the GDM risk group and should be tested.

In Norway, women with increased risk of GDM are screened in gestational week 26-28, or earlier if glucosuria (excretion of glucose in urine) is detected and/or the patient has had diabetes in a previous pregnancy (Helsedirektoratet, 2011). Increased risk of GDM is defined as women >38 years of age, diabetes type 1 or 2 in parents or siblings, body mass index (BMI) over 27 kg/m^2, previous GDM, glucosuria or immigrants from countries outside Europe with a high prevalence of GDM (Helsedirektoratet, 2011). The screening is performed through a 2-hour oral gluocose tolerance test (OGTT) with 75 g glucose, where those with values above 7.8 mmol/L are diagnosed with GDM (Helsedirektoratet, 2011). The discussed draft on the new Norwegian guidelines on GDM suggest screening in gestational week 24 in those with BMI > 25kg/m^2, >25 years of age (or >40 if previously pregnant and no other risk factors), diabetes in close family and/or those with ethnic background from countries outside Europe (Helsedirektoratet, 2016a). The proposed new diagnostic criteria are a 75 g 2-hour OGTT between 9,0 and 11,0 mmol/L (Helsedirektoratet, 2016a).

2.2.4 Dietary advice for women with gestational diabetes

Some studies show that regulating GDM has a potentially large impact on the consequences of some of the GDM complications. The U.S Agency for Healthcare Research and Quality has reviewed 11 studies that compared diet modification, glucose monitoring and insulin if needed with no treatment of GDM. Moderate evidence showed fewer cases of preeclampsia, shoulder dystocia and macrosomia in those who received GDM treatment compared to those untreated, however there was insufficient evidence for long-term metabolic outcomes in the offspring (Agency for Healthcare Research and Quality, 2012). A randomized trial of treatment for GDM found a reduction in fetal overgrowth, shoulder dystocia, cesarean delivery and hypertensive disorders (Landon et al., 2009). This study used dietary interventions, self-monitoring of blood glucose and insulin therapy if necessary (Crowther et al., 2005; Landon et al., 2009). Finally, a systematic review including randomized controlled trials that compared intervention (dietary modification, glucose monitoring and insulin if required) to usual antenatal care concluded that treating GDM decreased incidence of macrosomia, shoulder dystocia and gestational hypertension (Poolsup, Suksomboon, & Amin, 2014).

New guidelines for management and treatment of gestational diabetes in Norway have been proposed (Helsedirektoratet, 2016a). Currently, women with gestational diabetes diagnosed through a 75 g 2-hour oral glucose tolerance test (OGTT) with values between 7,8 and 9,0 mmol/L, recieve the same dietary advice as those with diabetes type 2 (Helsedirektoratet, 2011). Additionally, they are taught how to measure blood glucose levels and encouraged to measure 3-5 times per day. The treatment aim is blood glucose values below 7,0 mmol/L two hours after meals, and if the values are above 8,0 mmol/L at any point during the day, they are referred to a special care unit (Helsedirektoratet, 2011). The dietary advice for diabetes type 2 in Norway are quite similar to the general dietary advice in Norway (Helsedirektoratet, 2011). Further, it is recommended to focus on regular meals throughout the day, and adapt the dietary advice to the individual based on body composition, risk of cardiovascular diease and glycaemic control (Helsedirektoratet, 2011).

The dietary advice for those with gestational diabetes focus on avoiding foods and drinks with high sugar content, such as certain yoghurt types, and additionally limiting fruits to one piece at a time and maximum three fruits per day (Helsedirektoratet, 2014b). There is emphasis on choosing wholegrain versions of bread, pasta and rice, eating plenty of vegetables and legumes such as beans, peas and lentils, and choosing fish, chicken and lean meats in addition to low-fat milk and milk products (Helsedirektoratet, 2014b).

2.3 Diet quality scoring systems

Diet quality scores are made to assess the overall diet, and estimate to which extent an individual's eating behaviour is "healthy" (Waijers, Feskens, & Ocke, 2007). Food scores can be made from assessing the frequency of consumption of certain food groups, and e.g.

national recommendations that list the optimal number of servings of the major food groups can serve as a basis for a score (Gibson, 2005). Several scores or indexes based on dietary guidelines exist. The most commonly used are the Healthy Eating Index (HEI), developed by USDA, the Diet Quality Index, based on the U.S. Diet and Health recommendations, and the Healthy Diet Indicator (HDI) developed by WHO (Gibson, 2005). There are three main types of diet quality indicators (DQIs); nutrient-based, food or food group based and a combination index which often includes diet variety measures, adequacy of nutrients and/or food groups and an overall balance of macronutrients (Gil, Martinez de Victoria, & Olza, 2015). Food group components that are normally included in a DQI are fruits and vegetables, meat and meat products, milk and dairy products, fish, and additionally legumes, nuts and seeds (Gil et al., 2015).

Waijers and associates have reviewed predefined indexes of overall diet quality, where most of the indexes originated from the HEI, the Diet Quality Index, the HDI and the Mediterranean Diet Score (MDS) (Waijers et al., 2007). They point out the importance of designing the scoring ranges so the score is proportional to recommended intake instead of using simple cut-offs values, especially for foods that have a U-shaped correlation with health outcome (Waijers et al., 2007). Further, they mention aspects such as adjusting for energy intake to avoid confounding and taking into account the culture and dietary habits of the population when the index items and cut-offs are chosen. Key issues in the construction of a diet quality score are choice of the index components to include, assigning the food to food groups, choice of cut-off values, quantification of index components and the component's contribution to the total score (Waijers et al., 2007).

3.0 Method

As mentioned, this thesis is based on data from the on-going Pregnant+ project “Prevention of hyperglycaemia in antenatal care using tailored communication strategies and mobile learning devices”. The Pregnant+ project aim is to develop and test a culture sensitive mobile application that entails information on diet and physical activity and can be connected to a glucose-measuring device. The app is meant to inform and motivate pregnant women with gestational diabetes to adapt their diet and physical activity to prevent hyperglycaemia.

3.1 Research design and method

This thesis is a quantitative, cross-sectional study using baseline data from the Pregnant+ study with the intention to describe the diet of women with GDM during pregnancy prior to diagnosis using data from a food frequency questionnaire. The research design is descriptive, and uses a self-developed scoring system to further evaluate food intake in the sample**.** The main focus is on the development of the score and description of the diet. The score is based on national recommendations for food intake and preventing disease, and is described further in chapter 3.3.

3.2 Data collection

This chapter will firstly describe the instruments used for collecting data. Further, the preparation and data collection procedure will be described in detail before moving on to the sampling and finally running through a pilot study by the Pregnant+ project.

3.2.1 Instruments for gathering data

The baseline data in the Pregnant+ project used for this thesis consisted of information collected from the recruitment form (appendix 2) and through the first questionnaire filled in by the sampled pregnant women (Questionnaire 1, appendix 1). The questionnaire included questions on dietary intake generated from a food frequency questionnaire (FFQ).

Recruitment form

The recruitment form contained questions on age, need for interpreter, self-reported height, pre-pregnant weight, gestational week, number of years lived in Norway and birth country (see appendix 2). The pre-pregnant weight was self-reported, however, most of the women retrieved their noted body weight measured early in the pregnancy from their health card. As a part of the recruitment form, there was a checklist for the inclusion and exclusion criteria, see chapter 3.2.4 for detailed information.

Questionnaire 1

The questionnaire was made up of questions regarding the pregnancy, gestational diabetes knowledge, general health, blood glucose measurements, background information, motivation for eating healthy, dietary intake (FFQ), motivation for physical activity and frequency of activities (see appendix 1). The questionnaire was completed on an iPad (*Apple Inc*) at the hospital, and was available in Norwegian, Somali and Urdu.

Food frequency questionnaire

The dietary data were collected through the food frequency questionnaire (FFQ). The FFQ had been slightly modified from a previous population-based study in Norway, “Fit for Delivery” (Sagedal et al., 2013). Details on the modifications can be found in appendix 3.The modified food frequency questionnaire consisted of 41items, with 39 questions about food intake and two questions on dietary habits. The FFQ investigated frequency of intake with 8 to 9 possible alternatives, from ”Never” and ”Less than once a week” to ”Daily” or ”Several times per day”. Food frequency intake covered the period from the start of pregnancy until the gestational diabetes diagnosis, 16-32 weeks depending on the respondent’s time of diagnosis. The food items were exemplified with both products found in Norwegian food stores (e.g. types of milk or cereal), and foods common in ethnic groups that were expected to be part of the sample (e.g. ghee, naan, chapati, roti and injera). Some of the questions in the FFQ were adapted particularly to the Pregnant+ study’s end point measurements. The Pregnant+ study investigates blood glucose values, hence the food items’ impact on the blood glucose values is important. One example is the distinguishment of fruit intake into two separate questions, as some fruits have a significantly higher sugar content and thus it is recommended to limit intake of these (banana, mango, litchi and grapes vs. other fruits and berries). Information on portion size of the food items was not collected.

3.2.2 Methods of dietary assessment

Dietary assessment methods can be population-based, household-based and based on an individual level (Gibson, 2005). Assessing diet on an individual level can be done through repeated 24-hour recalls, food diary, diet history, weighed registration and food frequency questionnaires (FFQ) (Gibson, 2005).

A food frequency questionnaire uses food item lists to record intake over a given period of time, either through interview or self-administered questionnaire (Gibson, 2005). It is designed to obtain descriptive data on usual intakes of food over a long time period, and is useful for ranking subjects into broad categories of low, medium and high intakes of specific foods or food components and can also identify food patterns associated with inadequate intakes (Gibson, 2005). This retrospective, often closed method has low respondent burden and high response rate, but accuracy is lower than for other methods (Gibson, 2005), thus it should not be used to evaluate the diet of an individual. It is relatively quick to complete and gives data on the regular diet (in the time period measured) (Laake, Hjartåker, Thelle, & Veierød, 2013). An important limitation of an FFQ is that it only includes the foods that are in the questionnaire, thus it is important the FFQ covers the food items that are used in as high a degree as possible to be able to see the variation in the diet (Laake et al., 2013). Additionally, it is not possible to estimate accurate amount per frequency, and therefore it is important to have knowledge on the food patterns and portion sizes consumed by the population investigated.

When including ethnic minority groups and immigrants in a dietary assessment method, there can be challenges related to food culture and language barriers. It is therefore important with culture-specific assessment tools and involvement of translators to facilitate recruitment and data collection (Garduno-Diaz, Husain, Ashkanani, & Khokhar, 2014). Varied reading and writing skills can potentially be a methodical challenge. The assessment method should therefore be achievable across various levels of literacy, and it is especially advantageous to delevop tools to assist the ethnic target population (Garduno-Diaz et al., 2014)

3.2.3 Preparation and training

The master student's role was to participate in meetings, recruit and train new recruiters, and cooperate with midwives and staff, in addition to collecting data through the recruitment process. Many aspects of the Pregnant+ project had already been completed and recruitment had been planned before the master student entered into the project (Garnweidner-Holme, Borgen, Garitano, Noll, & Lukasse, 2015). Further information on recruitment and sampling is presented in chapter 3.2.5.

3.2.4 Data collection procedure

Data was collected using the recruitment form and Questionnaire 1 at the womens' initial meeting at the diabetes outpatient clinic. A recruiter from the Pregnant+ project filled out the recruitment form together with the informant. The informant filled out the online questionnaire in private, with the recruiter nearby. One of the women in the sample used an interpreter. The majority of the women filled out the questionnaire in Norwegian, whereas two women used the Somali version and two used the Urdu version of the questionnaire. The questionnaire normally took less than a half hour to fill in, and the rest of the forms took approximately five minutes to complete overall.

The identity of the participants was only known by a limited number of members from the project group. These members filled out and signed a confidentiality agreement. All completed forms were kept in a secure location, and the online-based questionnaire, which used the participant's telephone number, was connected to a separate Internet connection with a login only used for the Pregnant+ project. The completed questionnaires had been coded with reference numbers in place of phone numbers when the master student received the data in excel format.

The execution of the procedures mentioned above worked well, and overall according to plan. There were, however, a few challenges that affected the recruitment. During the first two months, it was only possible to recruit women with iPhones as the application for android mobile phones was delayed. There were also a few difficulties with the Internet connection and range of the wireless router, possibly due to the construction of the solid hospital walls. The short-term solution was to use the Eduroam Internet connection, which required the recruiter to log in with his/her private university username and password. This challenge was solved with the use of an extender for the wireless router.

3.2.5 Sampling

Setting

In Norway, health care during pregnancy is free of charge and almost all women receive prenatal care through their general practitioner or a midwife at a local clinic (Sagedal et al., 2013). Participants were recruited through the collaborating hospitals in the Oslo area: Drammen, Bærum and Ullevål hospital, Rikshospitalet and Akershus University Hospital. Recruitment was carried out by members of the Pregnant+ project group, in collaboration with midwives and diabetes nurses in the respective hospitals. The master student participated in recruitment at Rikshospitalet. The recruitment was conducted at the five hospitals mentioned, which are all located either in or on the outskirts of Oslo. Thus, the participants could be from both an urban and a rural background.

Participants

The participants consisted of women who had attended a diabetes outpatient clinic at one of the collaborating hospitals after they had been diagnosed with GDM at their prenatal health care check.

The criteria for inclusion and exclusion in this master thesis were equal to those in the Pregnant+ project. The criteria for inclusion were a gestational diabetes diagnosis (75 g 2-h OGTT ≥ 9.0 mmol/L), and in addition, the woman needed a private smart phone. She could not have exceeded gestational week 33 (maximum 32 weeks + 6 days) and had to be above the age of 18 and understand Norwegian, Urdu or Somali. The exclusion criteria were celiac disease, lactose intolerance or similar conditions that required an adapted diet. In addition, if the woman was pregnant with twins or several children or had attended a clinic for women with diabetes early in the pregnancy, she was not included in the study.

Early in the recruitment process, one of the exclusion criteria was previous GDM. The inclusion and exclusion criteria were changed in January 2016, where women with previous GDM were included in the study and a question of previous GDM was added to the online questionnaire. Additionally, the gestational week limit of inclusion was changed from week 32 (31+6 days) until week 33 (32+6 days).

Recruitment

Before the recruitment began, there was an information meeting where a representative from each of the participating hospitals was given information about the project and recruitment process. The recruiters consisted of nutrition students, midwives and staff at the diabetes outpatient clinics. All of the recruiters had been trained and given a protocol for recruitment (appendix 5). The PhD student at Pregnant+ was responsible for recruitment and training, including supply of equipment and forms and updating where needed. In addition to recruiting, she made sure procedures were followed, data was accurately sent and received from the online questionnaire, and monitored the recruitment process through feedback from recruiters and midwifes.

In preparation for the recruitment and data collection process, the Pregnant+ project members made sure the equipment was installed and training was completed. Visits to the hospitals included meeting the midwifes, looking for suitable areas for recruitment, setting up a secure internet connection with a portable router for the online questionnaire, and making sure that data entered was accurately saved and folders with sensitive information could be securely stored.

The recruiters went through the procedure for recruitment with the midwifes and allocated tasks between themselves, ensuring the midwifes were informed on how to set and use the blood glucose meter and how to fill out forms when there was an eligible candidate who did not want to participate. The recruiters made sure the hospitals had sufficient information brochures in different languages, blood glucose meters, measuring strips and forms.

When new members of the recruitment team were added, they followed an experienced recruiter for one day. It was made sure they were trained in the procedure, knew how to locate and use the equipment and what to say at the initial meeting with the possible participant. The detailed, standardized protocol for recruitment was run through with all recruiters and added to the folders at the hospitals (appendix 5). This protocol ensured all forms were filled in and that the information about the project was given to the participants.

The recruitment was set to one or two specific days at each hospital, corresponding to the opening hours of the hospitals' diabetes clinic. One day in advance of the recruitment, the recruiter would contact the midwife to check for eligible women and the time of their appointments. At the day of the recruitment, the recruiter would prepare the information brochures in Norwegian, Somali and Urdu, the forms, blood glucose meter and equipment. The secure Internet connection was set up and it was made sure the tablet and glucose meters were set and charged. The women were approached at the time of their scheduled appointment with a diabetic nurse or midwife at the diabetes outpatient clinic at each of the hospitals. After the midwife had informed about the project to the eligible women, they were given an information brochure and asked to volunteer to participate. Those who agreed to this sat down with one of the trained recruiters.

The recruiter, following the set procedure, began with double-checking that the participant satisfied the inclusion and exclusion criteria, and made sure she had received sufficient information regarding the study in addition to the information brochure. If there was anyone who satisfied the criteria and did not wish to participate, they were added anonymously to a list and reason for not wanting to participate was noted. Those who agreed to join the study signed a consent form and received a copy, and were informed of their right to withdraw and who to contact if they had any questions during the study.

Further, the recruitment form was filled out together with the participant. The participant was then added as a user with her phone number so she had access to the web-based Questionnaire 1 on a tablet (*iPad, Apple Inc.),* which used a separate and secure Internet connection. The recruiter moved further down the hall or around the corner to be accessible if there were any questions regarding the questionnaire.

The recruiter would stress that it was important that the participant finished the questionnaire and paperwork during the day. The diabetes outpatient clinic had scheduled several appointments (e.g. cardiotocography, blood tests, blood glucose meter training and endocrinologist), and thus the recruiter tried to adapt to this if they had to change waiting rooms and had the opportunity to continue filling out the questionnaire.

Those who were randomized to receive the app in the Pregnant+ study were further guided through how to download and use the app. It was also made sure that all of the participants knew how to use their glucose meter “Diamond Mini” (*ForaCare Suisse AG*) and that they had all the equipment needed for their blood glucose measurements until their next appointment at the hospital. At the end of the recruitment day, the project worker made sure there was sufficient equipment and forms and reported to the recruitment leader. At the end of the recruitment for this thesis, the sample consisted of 75 women. Description of the sample is provided in chapter 4.1.

The total number of participants that were included, excluded or declined to participate in the time period between September 2015 and mid April 2016 was difficult to find as the Pregnant+ recruitment is continuous and will not gather these numbers until their recruitment has been completed. After the master thesis student received the data, a total of 3 women were excluded after recruitment, 2 from withdrawal and 1 due to lack of data. Through the master thesis student's experience at one of the hospitals, there were 2 women who declined to participate due to time constraints and 1 due to illness, and 1 person that was eligible but was not asked to participate due to lack of available tablets at the time of her appointment. As for the remaining hospitals, the numbers unfortunately cannot be determined.

3.2.6 Test study

A test study of the recruitment process and the online questionnaire has been successfully completed. Questionnaire 1 was tested in a feasibility study that was carried out in all of the participating hospitals. The PhD student at Pregnant+ conducted the feasibility study. All of the women included were in the target group and satisfied the inclusion and exclusion criteria. The participants provided feedback on the questionnaire and the recruitment process. A total of 13 women were asked to participate, where 2 declined because there was too much information and checkups that day, 1 had forgotten her phone and 1 withdrew as she thought there was too much information that day. The 9 remaining participants filled out the questionnaire as usual. The majority of the participants said that it was "no problem" to fill out. There were two comments regarding wording on the physical activity part of the questionnaire, but they did not result in any changes. The majority of the women spent 30 minutes filling out the questionnaire.

Other relevant challenges included network issues that required the participant to move further down the hallway, log in again or repeatedly having to add the participant's phone number. One of the questionnaires was also interrupted on several occasions by consultations (doctor, midwife and blood sampling). The feasibility study provided valuable information to be able to optimize the recruitment process further.

3.3 Data processing and analysis

Data processing and statistical analysis were conducted using Microsoft Office Excel for Mac 2011 (*Microsoft)* and the statistical software Statistical Package for Social Sciences (SPSS) version 23 (*IBM).* The online questionnaire was automatically imported to Excel by a member of the Pregnant+ group. The master student received the Excel file of the questionnaire and imported this to SPSS. Some of the columns with additional text from comments were removed to be able to import the Excel file to SPSS. New subjects were added at several points during the process, using the same method as mentioned above, or manually importing a new column from Excel to the SPSS file. Information from the recruitment form was added manually to Excel and the columns were then imported to the SPSS file. The manually inserted data were double-checked for typing errors. Data from the recruitment forms were coded and handled by a member of the project group, and reference numbers were used to ensure anonymity of the participants when manually handling data.

The SPSS file was coded with the same variable names as the questionnaire. The response alternatives were labelled the same way as in the questionnaire, using a code form. All variable labels and responses were translated to English for the purpose of this thesis.

Several variables were computed or grouped in the SPSS file, for the purpose of describing the sample and conducting tests. Pre-pregnant BMI (weight in kg/height in meters^2) was calculated, based on pre-pregnancy weight and self-reported height. Age, number of years of education, BMI, gestational week, number of children, mother tongue, job status, birth region and income were divided into groups of three to five to more easily describe the sample. The variable “birth region” was computed and the participants divided into groups based on birth country region.

For the purpose of developing the score, several variables were recoded or computed. The variables corresponding to one question in the FFQ were recoded so that the frequencies matched the scoring system of that variable, see chapter 3.3.1. The variables that corresponded to two questions in the FFQ were recoded into a new variable using conditional transformation. As an example, the wholegrain variable was recoded so that those who had eaten either wholegrain bread or wholegrain pasta/rice more than once daily received a score of 10, those who had eaten either on a daily basis received a score of 5, and the remaining participant received a score 0 (see chapter 3.3.1). The sugar variable was made by adding the 7 questions that made up the score and evaluating total frequency from the sum of these questions.

3.3.1 Development of scoring system

The score is based on the Fit For Delivery study (Øverby, Hillesund, Sagedal, Vistad, & Bere, 2015), where they developed a scoring system to evaluate adherence to principles of a healthy weight gain in pregnancy. In this master thesis, the score is based on the Norwegian recommendations for a healthy diet with the intention of describing the quality of the food intake rather than merely looking at frequency alone. Hence, as the items are made to reflect the dietary guidelines, the score is made to give an indication of compliance to the recommendations. The score is made up of 12 food groups or categories, selected *a priori* based on scientific evidence. Each category has a cut-off corresponding to the recommended amount or frequency per week or day, where this exists.

As presented in table 2, all of the categories correspond to one or more questions from the FFQ. The possible answers to these questions on frequency of intake in the FFQ range from 0 (never) to 9 (several times daily), and has been recoded to 0-8 for all of the categories except one, so that the number equals the frequency per week. The "never" and "less than once a week" have been recoded to 0, 1 equals once a week, etc, and 8 represents several times daily. The participants are given scores according to the recommended frequency of intake, which varies between the different categories. The specific intake frequency decides the participant's score in that category. For an intake very close to or at the recommended frequency, a score of 10 is rewarded. If the intake is close to the recommendation, the participant is given a score of 5, and if the frequency is far off the recommendation the participant is given a score of 0. The recommendation for each category is covered below.

Foundation for the 12 categories in the score

The scoring system is based on the Norwegian guidelines on diet, nutrition and physical activity as presented in chapter 2.1.2. The recommended amounts are for adults with a normal physical activity level. For the purpose of the development of this score, there have not been made adjustments for increased energy intake, which is normally recommended for parts of the pregnancy. The reason for this is that in the 2nd trimester, it is recommended to eat an additional 329 kcal for normal-weight women (Nordic Council of Ministers, 2014). The gestational week at recruitment was on average around 20-30 weeks, and the majority of the participants in the sample were overweight. The recommended weight gain and thus energy need in the 2nd trimester is reduced for those with a BMI over 25 (Nordic Council of Ministers, 2014). According to the Nowegian Ministry of Health, pregnant women can use the same dietary advice as the remaining population, covering their need for nutrients through wholegrains, vegetables, fruits and berries, low-fat milk products, fish, beans and lentils and limiting processed meat, red meat and foods with high amount of fat, sugar and salt (Helsedirektoratet, 2016b).

Wholegrain

Intake of wholegrain reduces risk of cardiovascular disease and type 2-diabetes (Aune et al., 2016), and is likely to reduce cancer in the large intestine (Nasjonalt råd for ernæring, 2011). Further, a review of cohort studies has found that a greater intake of wholegrains (2.5 servings/day vs 0.2 servings/day) has been associated with a 21% lower risk of cardiovascular disease events (Mellen, Walsh, & Herrington, 2008). Female adults are recommended an intake of 70 g of wholemeal grains per day, exemplified as 4 portions, for example 4 slices of wholegrain bread (Nasjonalt råd for ernæring, 2011).

As described in table 2, the wholegrain category corresponds to two questions in the FFQ: "How often did you eat wholegrain flour or wholegrain items?" and "How often did you eat wholegrain pasta and/or wholegrain rice?" The recommended intake is 4 portions per day, and eating at least one of the categories more than once daily gave a top score of 10. Eating at least one of the categories daily was a score 5, and not eating wholegrain bread/flour nor wholegrain pasta/rice on a daily basis gave a score of 0. In this way, those who have a higher intake frequency will be rewarded with a higher score. As we do not know the exact frequency within "more than once daily", it is assumed that this is at least 2 portions per day, if not more. Eating several portions of bread daily is common in Norway (Helsedirektoratet, 2015b), and it is not uncommon that more than one meal contains one or several slices of bread.

Vegetables

The Norwegian Directorate of Health recommends at least 5 portions of fruit and vegetables per day, equivalent to 500 g, where about half the amount should consist of vegetables (Nasjonalt råd for ernæring, 2011). A high consumption of fruit and vegetables is associated with a lower risk of cardiovascular mortality (Wang et al., 2014). It is also probable that it reduces the risk of cancer in the mouth, pharynx, larynx, esophagus and stomach (Nasjonalt råd for ernæring, 2011). Morover, there is a convincing causality between eating fruits, berries and vegetables and a reduced risk of coronary heart disease, stroke and high blood pressure (Nasjonalt råd for ernæring, 2011).

The vegetable category corresponds to two questions in the FFQ: "How often did you eat vegetables for dinner?" and "How often did you eat vegetables at other meals?"
The range of frequency (0-8) and score is identical to the wholegrain category described in the previous paragraph. A score of 10 was given for eating at least one of the categories more than once daily, a score of 5 was given if at least one of the categories were eaten daily, and if neither of the categories were eaten daily, the participant received a score 0, see table 2. As mentioned, the exact frequency of "several times per day" cannot be estimated, however as the recommended amount is at least 2 portions per day, and the score reflects this in awarding a consumption of vegetables of at least twice a day. One of the questions refers to vegetables at dinner, and only one of the participants reported eating vegetables for dinner more than once per day. It is therefore likely to assume that the participants who were given a score 10 for the highest frequency (several times per day), were eating vegetables at other meals several times per day.

Fruit and berries

Half of the recommended 500 g of fruits and vegetables per day should consist of fruits, equivalent to 200-250 g (Nasjonalt råd for ernæring, 2011). An increased intake of fruits and berries is significantly associated with a lower risk of type 2 diabetes (Muraki et al., 2013). Convincing causality is found between intake of fruits/berries and reduced risk of coronary heart disease, stroke and high blood pressure (Nasjonalt råd for ernæring, 2011). It is also probable that it reduces risk of cancer in the mouth, throat, oesophagus, lungs, stomach and bowel (Nasjonalt råd for ernæring, 2011).

The fruits and berries category has two corresponding questions in the FFQ, divided into high glycaemic index fruits (banana, litchi, mango and grapes) and other fruits and berries. As this score is based on recommendations for the general population and not entirely on foods that can affect the blood sugar levels, the two questions are combined into one category to be able to look at the fruit intake as a whole. The questions in the FFQ are 1:"How often did you eat banana, litchi, mango or grapes?" and 2: "How often did you eat other fruits and berries (other than banana, litchi, grapes or mango?" The recommended intake is 2-3 portions per day. This category has the exact same range and scoring system as the wholegrain and vegetable categories mentioned above, as the minimum recommended intake is 2-3 portions per day. An intake of one of the fruit groups more than once daily rewards a score of 10, one daily gives a score of 5 and a lower intake than one of the fruit/berry groups daily gives a score 0.

Milk

A daily intake of low-fat milk (defines as milk with 0.7% fat or less) and milk products is important to ensure an adequate intake of certain nutrients, particularly calcium and iodine (Nasjonalt råd for ernæring, 2011). Intake of milk is likely to reduce risk of cancer in the bowel (Nasjonalt råd for ernæring, 2011). Ther is no clear recommendation regarding amount of milk per day (Nasjonalt råd for ernæring, 2011). However, a moderate intake of ¼ to ½ litre per day is recommended by the Danish Food Institute (DTU fødevareinstituttet, 2010). Considering the fact that there were no specific questions regarding other milk products in the FFQ, this score considers a consumption frequency of milk with less than 0,7% fat once a day as a top score. The milk category corresponds to one question in the FFQ: "How often did you drink extra light or skimmed milk?" An intake of 3 times per week or less gave a score of 0, four to six times per week gave 5, and once or more daily gave a score of 10 for this category.

Fish for dinner

In addition to milk products, fish is an important source of iodine in Norway (Nasjonalt råd for ernæring, 2011). A regular intake of 200 g fatty fish per week is likely to reduce death from heart disease and risk of cardiovascular disease in women, and it is recommended to eat fish equivalent to 2-3 dinner portions per week (Nasjonalt råd for ernæring, 2011). Fish intake recommendations have been discussed, particularly due to high mercury levels in certain types of fish. However, the benefits of fish intake outweight the potential risks, as one to two servings of fish per week reduces risk of coronary death by 36% (D. Mozaffarian & Rimm, 2006).

The fish category corresponds to one question in the FFQ: "How often did you eat fish for dinner?" As it is recommended to eat a dinner-size portion of fish 2-3 times per week, those who reported a frequency of twice or more per week got a score of 10, those who ate fish for dinner once a week got a score of 5, and a score 0 was given to those with a frequency of less than once a week.

Beans and lentils

Beans and lentils are high in fibre and have a high content of nutrients (e.g. iron), and are thus recommended as a replacement for white pasta and rice (Nasjonalt råd for ernæring, 2011). Legume consumption can improve glycaemic control and reduce risk factors for the metabolic syndrome in overweight and obese adults (Mollard, 2012). An intake of 25-35 g of dietary fibre per day is advised for adults in general, and further it is recommended to include legumes as part of a varied diet (Nasjonalt råd for ernæring, 2011).

The intake of beans and lentils corresponds to the question "How often did you eat beans and/or lentils?" in the FFQ. As it is recommended to include legumes as a part of a varied diet and they have a high content of fibre and iron, the estimated recommendation is an intake of twice per week. A frequency of less than once a week was given score 0, once a week was given score 5, and twice or more per week was given a score of 10.

Ready-made meals

It is recommended to limit the intake of products with high amounts of fat, salt and sugar, for example sweet bakery goods, cereals, pizza and snacks, and to choose boiled or baked potatoes instead of French fries and chips (Nasjonalt råd for ernæring, 2011). Processed foods and ready-made meals contribute with an average of 70-80% of the daily salt intake, and some types of pizza contain 11-14 g of salt per portion (Nasjonalt råd for ernæring, 2011).

The category "ready-made meals" corresponds to the question "How often did you eat ready-made meals for dinner (pizza, French fries, etc.)?" in the FFQ. This category is the only one which has kept the 0-9 frequency when estimating the score, as it was reasonable to separate those who said they never ate these foods with those who ate them less than once a week. A frequency of 0 is thus given a score of 10, less than once a week is given a score of 5 and a frequency of once or more per week scores 0.

Salt

It is advised to limit salt intake to maximum 6 g per day (Nasjonalt råd for ernæring, 2011). The Norwegian Nutrition Council recommends limiting the intake of products with high salt content, for instance processed food and ready-made meals, which contribute with 70-80% of the salt intake for most people. Potato chips sold in Norway contain from 1-3.3 g of salt per 100 g, and popcorn contains 0.8 to 2 g per 100 g (Mattilsynet, Helsedirektoratet, & Universitetet i Oslo, 2016). Norwegians eat an average of 10 g of salt per day, however women have a slightly lower intake (Helsedirektoratet, 2015b). A high intake of sodium, typically from salt, increases blood pressure, which is a risk factor for cardiovascular disease. One teaspoon of salt corresponds to 2300 mg of sodium (American Heart Association, 2016).

Salty snacks and table salt is combined in the "salt" category, which consists of two questions from the FFQ: "How often did you use table salt on your food?" and "How often did you eat potato chips or other salty snacks?" It is difficult to estimate the amount of table salt used, as this differs per individual (Helsedirektoratet, 2015a). However, salty snacks can contribute with an average of 0.5g of salt if we estimate a portion is 50g of nuts, potato chips or popcorn (Mattilsynet et al., 2016). It should be taken into consideration that there are many food items which can contribute to salt intake that are not embedded into these two questions, for instance ready-made meals as mentioned above. Thus, the cut-off between score 5 and 10 are a frequency of twice a week. An intake of both categories less than once a week gave a top score (10), consuming at least one of the categories twice a week (maximum frequency per week 2) gave score 5, and using table salt and/or eating potato chips more than twice a week in total gives a score of 0.

Red and processed meat

Meat and meat products contribute with around 20% of the saturated fatty acids in the average Norwegian diet (Helsedirektoratet, 2015b). It is recommended to choose lean meat/meat products and limit the intake of red meat and processed meat (Helsedirektoratet, 2011). Further, it is advised to eat a maximum of 500 g per week of red meat, equivalent to 2 dinners per week, as there is convincing evidence that both red and processed meat can increase risk of cancer in the colon (Nasjonalt råd for ernæring, 2011). A systematic review of cohort studies concluded that processed meat consumption appears to be associated with a higher risk of diabetes type 2, whereas the effect was weaker for red meat (Derbyshire & Ruxton, 2015). However, as the majority of the studies in this review used FFQs, the conclusions can only be viewed as speculative. Another review of cohort studies including adults between 35-70 years of age found associations between long-term consumption of increasing amounts of red meat and particularly processed meat and a certain increase in the risk of cardiovascular disease, colon cancer and type 2 diabetes (Richi et al., 2015). Further, an Australian study found an association between red and processed meat consumption and risk of cardiovascular disease risk in women, and the results suggested a stronger association for processed meat alone (Bovalino, Charleson, & Szoeke, 2016). However, it is possible that other dietary factors play a role as confounders, as suggested by a large cross-sectional Finnish study that investigated this possible relationship (Fogelholm, Kanerva, & Mannisto, 2015). The authors of this study concluded that the association between meat consumption and a lower-quality diet might complicate studies on meat and health.

The category named red and processed meat corresponds to the following question in the FFQ: "How often did you eat red and/or processed meat (e.g. sausages, minced meat)?" As this question combines both red and processed meat and is exemplified with products of debatable amount of red meat and the recommendation is based on an upper limit, the score is made to reward those who minimizes this intake. An intake of less than once a week was given score 10, once a week was given 5, and twice or more per week gave a score of 0.

Sugar

A Finnish study conducted on pregnant women found that a diet with sweets, sugary drinks and junk food was associated with weight-gain (Uusitalo et al., 2009). It is recommended to avoid products with added fat and sugar such as cakes, biscuits and sweet cereals, in addition to limit drinks with added sugar such as soda and cordial/lemonade (Nasjonalt råd for ernæring, 2011). Total sugar intake should consist of maximum 10% of total energy intake per day (Nasjonalt råd for ernæring, 2011). Thus, if an average woman needs 2000 kcal per day, maximum 200 kcal should come from sugary foods per day. This equals 100 g of full-fat ice cream, 40 g of milk chocolate or half a litre of sugary soda or cordial (Mattilsynet et al., 2016).

The sugar category is made up of the following 7 questions:

"How often did you put sugar on the food you ate?

How often did you eat chocolate/sweet candy?
How often did you eat sweet biscuits, baked goods, ice cream, pudding (e.g. cake, sweet rolls, etc.)?
How often did you eat sweet breakfast cereals (granola, corn flakes, frosties)?
How often did you eat yoghurt with added sugar?
How often did you use sugar in tea/coffee?
How often did you drink soda/cordial/lemonade with sugar?"
The food items comprising this category are generally low in micronutrients per kcal. It is also likely to assume that there are other foods in the diet containing sugar, such as ready-made meals, and possibly foods not included in the FFQ such as chocolate milk and milkshakes, chocholate spread or jam, ready-made coffee/ice tea drinks where the participants are maybe not aware of the sugar content, and candy that is not categorised as sweet but still contain sugar. To be able to estimate what one frequency could contribute with to the maximum recommended intake of 10 E% (here estimated 200 kcal), all of the questions were evaluated in terms of estimated regular portion size.

The question regarding sugar on foods could for instance be sugar on oatmeal porridge, where a tablespoon of sugar weighing 12 g would contribute with 48 kcal from sugar. It could potentially be sugar used in sauces, soups and stews and thus contribute with more than one tablespoon per portion. Chocolates and sweet candy contain about 50% sugar. If we use the intake of chocolate and candy per year for an average Norwegian (14-15 kg), mentioned in chapter 2.1.3, the average daily intake is 38 g, calculated to around 76 kcal from sugar. For the question on biscuits, ice cream and cake, the estimation is based on a regular size cream-based ice cream with chocolate (*Kroneis, Diplom*), which would equal 72 kcal from sugar. The cereal with sugar-item is based on a 44 g portion of corn flakes (11 kcal from sugar) or Frosties (42 kcal from sugar). Fruit yoghurt with sugar has an average of 12% sugar, and the regular portions sold in Norway are 180 g, which would estimate around 86 kcal from sugar. A popular yoghurt type in Norway (*Go'morgen, Tine*) weighs 195 g and has 15% sugar, which would equal to around 117 kcal from sugar. Sugar used in tea or coffee is harder to estimate, as we do not know the amount per cup or the number of cups per day. The amount could be less than one teaspoon (6 g, 24 kcal from sugar) per cup to a ready-made iced coffee drink from Starbucks with 52 g sugar, which would equal to 208 kcal from sugar. A soda with sugar contains 11% sugar, and could be a 0.25 L glass, which would give 110 kcal from sugar, or a 0.5 L bottle, which would equal to around 220 kcal. On average, these estimates indicate that one of the food items could contribute with anything from 1-220 kcal per portion, with most estimated portions contributing with 40-70 kcal from sugar which would equal to less than 5% of the recommended maximum intake for an intake of 2000 kcal per day. However, one portion could also consist of around 220 kcal, which would exceed the maximum recommended intake of 200 kcal (10 E%) for a 2000 kcal diet. As these food items have relatively low nutritional value, the optimal intake would be lower than 10 E%. The sugar content per 100g was found in the official Norwegian food table (Mattilsynet et al., 2016), on the producers' websites or by consulting the label on the product directly.

The range per question is 0-8, from less than once a week (0) to once a week (1) and every number up to 7 equally frequencies per week. A daily frequency is 7, and more than once daily is 8. These frequencies are added up to total frequencies for sugar items, where less than once a week in total gives score 10, a total sum frequency of 1-7 gives score 5, and a total frequency of 8 or more indicating more than one sugary item per day on average gives a score 0.

Saturated fat

Saturated fat should make up a maximum of 10% of the total energy intake per day, as a diet with a saturated fat content below 7% can reduce risk of coronary heart disease (Nasjonalt råd for ernæring, 2011). It is recommended to choose cooking oils and margarine with a low content of saturated fatty acids and a high content of unsaturated fatty acids such as rapeseed, sunflower, olive and soy oil, and limit the use of butter as it has a high content of saturated fat (Nasjonalt råd for ernæring, 2011). A diet low in fat and especially saturated fat is likely to reduce risk of cardiovascular disease and can reduce high blood pressure (Nasjonalt råd for ernæring, 2011).

There are many sources of saturated fat other than what is used for cooking, namely in processed meats, ready-made meals and some of the components covered in the sugar category such as baked goods, ice cream and biscuits. Thus, this category is an addition to these categories, and is added in to be able to look at the saturated fat separately from other food items or macronutrients. The saturated fat category corresponds to the question "How often did you use butter/ghee when cooking?" in the FFQ. As the saturated fats used for cooking comes in addition to other sources of saturated fats, those who used butter or ghee for cooking less than once a week were given a score of 10. For a frequency of once a week, they were given a score of 5, and for use twice a week up to several times daily, participants were given a score of 0.

Vegetable oils

It is recommended to choose soft margarine or oils instead of hard margarine or butter (Nasjonalt råd for ernæring, 2011). Of the total energy intake, 5-10% should be polyunsaturated fats, and 10-15% unsaturated fats. A review of effect of dietary fat on insulin sensitivity suggests that there may be a positive effect of changing some of the saturated fat to unsaturated fats in terms of increased insulin sensitivity (Galgani, Uauy, Aguirre, & Diaz, 2008). A systematic review of RCTs investigating the effects of increasing polyunsaturated fat PUFA) in place of saturated fat, found that this reduces coronary heart disease (CHD) events by 19%, and each 5%E greater PUFA consumption reduced CHD risk by 10% (Dariush Mozaffarian, Micha, & Wallace, 2010).

The category vegetable oils corresponds to the following question in the FFQ: “How often did you use vegetable oil (rapeseed, sesame, olive, sunflower) when cooking?” There is no clear recommendation for the amount of vegetable oils one should use, however it is recommended to use vegetable oils in place of butter and ghee when cooking, hence a high frequency is rewarded. An intake of three times a week or less was given a score of 0, 4-6 times per week was given 5, and daily to several times daily was given a score of 10.

Total score

The final score is a total of all the scores per category. The highest score indicates the highest adherence to the recommendations and the lowest score indicate the lowest adherence to the recommendations. The score represents an estimated amount, as the FFQ was not quantified with portion sizes. The highest score per category is 10, and the lowest is 0. With 12 categories, the highest total score possible is 120, and the lowest is 0.

Table 2. Description of the diet scoring system, by categories. Based on national recommendations and questions in the food frequency questionnaire.

Category	Question in FFQ	Recommendation	Range	Frequency	Score
Wholegrain	How often did you eat wholegrain flour or wholegrain items (bread, naan, chapatti/roti, paratha, injera with wholegrain flour)? How often did you eat wholegrain pasta and/or wholegrain rice?	4 portions/day	0=Never or less than once a week 1=Once a week 2=Twice a week 3=Three times per week 4=Four times per week 5= Five times per week 6=Six times per week 7=Daily 8= Several times daily	Neither category daily	0
				One of the categories daily	5
				One of the categories more than once daily	10
Vegetables	How often did you eat vegetables for dinner? How often did you eat vegetables at other meals (for example a carrot as a snack or for lunch)	3+ portions/day	Never to several times a day (0-8)	Neither category daily	0
				One of the categories daily	5
				One of the categories more than once daily	10
Fruits and berries	How often did you eat banana, litchi, mango or grapes? How often did you eat other fruit and berries (other than banana, litchi, grapes or mango)?	2+ portions/day	Never to several times a day (0-8)	Neither category daily	0
				One of the categories daily	5
				One of the categories more than once daily	10
Milk	How often did you drink “extra light” or skimmed milk?	Estimated: 1 portion/day	Never to several times a day (0-8)	0 to 3 times per week	0
				4 to 6 times per week	5
				Once or more daily	10

Fish	How often did you eat fish for dinner?	2-3 times per week	Never to several times a day (0-8)	Less than once a week	0
				Once a week	5
				Twice a week to several times daily	10
Beans and lentils	How often did you eat beans and/or lentils?	Estimated: 2 times per week	Never to several times a day (0-8)	Less than once a week	0
				Once a week	5
				Twice a week to several times daily	10
Ready-made meals	How often did you eat ready-made meals for dinner? ("Bagged food", pizza, French fries)	Not recommended/ limit intake	0=Never 1=Less than once a week 2=Once a week 3=Twice a week 4=Three times per week 5=Four times per week 6= Five times per week 7=Six times per week 8=Daily 9= Several times daily	Never	10
				Less than once a week	5
				Once a week to several times daily	0
Salt	How often did you use table salt on your food?	Limit intake, 6g of salt total/day	Never to several times a day (0-8)	Both categories less than once a week	10
	How often did you eat potato chips or other salty snacks?			One of the categories twice a week/ total 2	5

				frequencies/week	
				One of the categories more than twice a week/ over 2 total frequencies /week	0
Red and processed meat	How often did you eat red and/or processed meat (sausages, minced meat)?	Limit intake	Never to several times a day (0-8)	Less than once a week	10
				Once a week	5
				Twice a week to several times daily	0
Sugar	How often did you put sugar on the food you ate? How often did you eat chocolate/sweet candy? How often did you eat sweet biscuits, baked goods, ice cream, pudding (cake, sweet rolls, etc.)? How often did you eat sweet breakfast cereals (granola, corn flakes, frosties)? How often did you eat yoghurt with added sugar? How often did you use sugar in tea/coffee? How often did you drink soda/cordial/lemonade with sugar?	Max 10% of total energy intake	Never to several times a day (0-8) per question	Less than once per week in total	10
				1-7 frequencies per week in total	5
				Over 8 frequencies per week in total	0
Saturated fat	How often did you use butter/ghee when cooking?	Max 10% of total energy intake	Never to several times a day (0-8)	Less than once a week	10
				Once a week	5
				Twice a week to several times daily	0

Vegetable oils	How often did you use vegetable oil (rapeseed, sesame, olive, sunflower) when cooking?	5-10% polyunsaturated and 10-20% unsaturated fats of total energy intake	Never to several times a day (0-8)	Never to three times a week	0
				4 times per week to 6 times per week	5
				Daily to several times daily	10

3.4 Research ethics

The Norwegian Centre for Research Data (NSD) has approved the Pregnant+ research project (see appendix 4). If the eligible participants agreed to take part in the study, they were given a leaflet with information regarding the study. Prior to filling out Questionnaire 1, they were asked to fill out a written consent. A detailed privacy policy is available for the participants on the project website (gravidpluss.no). The participants were not offered any compensation or payment to be part of the study.

The NSD application is also valid for this master thesis student. Only data gathered through the Pregnant+ study has been used in this thesis. All of the informants were given a reference number to ensure anonymity. Only reference numbers were used when importing and processing data, and info that could identify participants were coded and known to only a few selected members of the Pregnant+ study. The participants were allowed to withdraw at any point during the study and informed of this before being included in the study.

4.0 Results

4.1 Sample

This master thesis is based on data from participants recruited through the Pregnant+ project from September 2015 until mid April 2016. The sample consisted of 75 women recently diagnosed with gestational diabetes mellitus (GDM). Background information can be found in Table 3. The majority of the women were in gestational week 29-32 (50%). Three out of four (75%) had previously been pregnant, and 53% had one or two children, see table 3. Most of the women were between 25 and 35 years of age (59%). The education levels were spread throughout the sample, with 32, 30% and 38% in the respective groups of 6-13 years, 14-15 years and above 15 years of education. A majority of the women were working (76%), other were students (7%), unemployed (7%), housewives (5%) or on maternity leave (4%). The sample consisted of 55% Norwegians, whereas 16% of the sample were born in other parts of Europe or America, 16% were from Asia, and 13% from Africa. About half of the women had parents of siblings with diabetes (49%). Pre-pregnant BMI was varied within the sample, where 37% of the women were normal-weight (18.5-24.9 kg/m^2), 30% were overweight (25-29.9 kg/m^2), 21% were obese class I (30-34.9 kg/m^2), and 12% were obese class II (35 kg/m^2 and above).

Table 3. Background characteristics of the participants (n=75)[1]

	%	n
Gestational week[2]		
≤24	27	20
25-28	23	17
29-32	50	37
Previously pregnant		
Yes	75	56
No	25	19
Age in years		
≤24	3	2
25-35	59	44
≥36	38	29
Number of children		
0	43	32
1-2	53	40
3 or more	4	3
Education in years[3]		
6-13	32	23
14-15	30	22
>15	38	28
Occupational status		
Working	76	57
On maternity leave	4	3
Student	7	5
Housewife	5	4
Unemployed	7	5
Disability benefits	1	1
Household income in NOK per year[4]		
<400-599.000	33	21
600-899.000	30	19
≥900.000	37	23
Mother tongue		
Norwegian	56	42
Somali, Urdu or Punjabi	12	9
Other	32	32
Birth country region		
Europe & America[5]	16	12
Norway	55	41
Asia	16	12
Africa	13	10
Diabetes in parents/siblings		
Yes	49	37
No	51	38
Pre-pregnant BMI categories (kg/m^2) [6]		
18.5-24.9	37	28
25-29.9	30	22
30-34.9	21	16
≥35	12	9
Previous gestational diabetes mellitus[7]		
Yes	18	13
No	82	61

[1]Percentages are calculated from number of participants who have given information, a total number of 75 except from the following missing:
[2]1 [3]2 [4]12 [7]1

[5]Europe and North + South America with the exclusion of Norway
[6]Body mass index (BMI, kg/m^2) categories (none were below 18.5):

Normal weight:	BMI 18.5-24.9
Overweight:	BMI 25-29.9
Obesity I:	BMI 30-34.9
Obesity II:	BMI 35-39.9

4.2 Description of food intake

The frequency of consumption of food items and meals is presented in table 4. The frequency of intake of vegetables for dinner was daily for 45% of the women, whereas 24% ate vegetables for dinner 5-6 times per week and 31% 4 times per week or less. The frequency of intake of vegetables at other meals was lower, 16% of the women ate vegetables at other meals at lest once daily, 12% of the women 5-6 times per week, and a total of 72% had vegetables at other meals 4 times per week or less.

Almost a third of the women (32%) ate fruits other than banana, litchi, mango and grapes daily or several times daily, whereas 17% reported an intake of these fruits 5-6 times per week, and 51% ate fruits other than banana, litchi, mango and grapes 4 times per week or less. The higher glycaemic index fruits (banana, litchi, mango and grapes) were eaten daily by 17% of the women, 5-6 times per week by 11%, and 73% of the women had the higher glycaemic index fruits 3-4 times per week or less.

Red and processed meat was eaten 1-2 times per week by 42% of the women, 37% ate this 3-4 times per week and 10% ate red and/or processed meat more than 5 times per week, whereas 12% had red or processed meat less than once a week. The majority of the women (66%) had fish for dinner once or twice a week, 20% ate fish for dinner more than 3 times per week, and 14% had fish for dinner less than once a week.

Intake of soda (*brus*) or cordial (*saft*) with sugar was reported as less than once a week in 56% of the women, whereas 7% drank this daily or several times daily and 37% had soda or cordial 1-6 times per week. Intake of juice and nectar was daily or more in 23%, 3-6 times per week in 28%, and 49% had juice or nectar twice a week or less. A majority of the women (80%) said they ate sweet cereals less than once a week, 11% once or twice a week and 9% 3-6 times a week. Cereal with no sugar was eaten less than once a week in 77% of the women, whereas 8% had this 1-2 times per week and 14% ate cereal with no sugar 3 times per week or more. A total of 47% of the women had biscuits, cake, ice cream or similar once or twice per week, 32% had an intake of 3-4 times per week or more, and 22% ate this less than once a week. As table 4 shows, 4% of the women had chocolate or sweets daily, 10% had this 5-6 days a week and 87% ate chocolate or sweets 4 times per week or less.

The frequency of use of butter/ghee when cooking was 3-4 times per week in 33% of the sample, whereas 36% used this 5 times per week or more and 33% used butter/ghee when cooking 2 times per week or less. Vegetable oils were used daily or more frequently by 41% of the women, 5-6 times per week by 19%, and 4 times per week or less by 41%. The intake of ready-made meals such as pizza and French fries was less than once a week in 53% of the women, whereas 33% had this once or twice per week and 15% ate these foods 3-6 times per week.

Wholegrain bread or wholegrain flour was eaten daily or several times daily by 57% of the sample, whereas 13% had this 5-6 times per week and 29% ate wholegrain bread/flour 4 times per week or less. White bread/flour was eaten daily by 8% of the participants, 36% reported to eat this less than once a week and 56% ate white bread/flour 1-6 times per week. Intake of wholegrain pasta/rice frequency was categorised as less than once a week by 41% of the women, 1-2 times per week by 37% and 3 times per week or more by 21% of the sample. White pasta or rice was eaten daily or several times daily by 8% of the sample, 42% had this 3-6 times per week and 50% ate white rice/pasta twice a week or less.

As table 4 shows, 57% of the women said they drank skimmed milk (0.1-0.7% fat content) less than once a week, 24% had this daily and 19% drank skimmed milk 1-6 times per week. The intake of low-fat milk (1-1.2% fat) was reported as less than once a week in 49%, daily in 21% and 1-6 times per week in 28% of the participants. The intake of whole milk (3.5-3.9% fat) was less than once a week in 80% of the sample, 9% reported an intake of once or twice per week and 10% drank whole milk 3 times per week or more. Salty snacks and potato chips were eaten once or twice per week by 53% of the sample, 15% had salty snacks or potato chips 3-6 times per week, and 33% ate this less than once a week. A majority of the sample (68%) ate beans and lentils less than once a week, 15% ate beans and lentils once or twice a week and 17% had beans and lentils more than 3 times per week.

The frequency of meals per day in the sample can be found in table 4. A daily intake of breakfast was reported in 77% of the women, whereas 8% had breakfast 5-6 times per week and 15% had breakfast 4 times per week or less. Lunch daily was reported in 80% of the sample, 8% ate lunch 5-6 days per week and 12% had lunch 4 times per week or less. The majority of women had dinner daily (93%), 4% had dinner 5-6 days a week and 2% had dinner 1-4 times per week. An evening meal was eaten daily by 35% of the participants, 16% had evening meals 5-6 times per week, and 50% ate an evening meal 4 times per week or less. The intake of snacks was daily in 40% of the women, 8% had snacks 5-6 times per week and 52% ate snacks 4 times per week or less.

Table 4. Frequency of consumption of food items and meals in the sample.

Food item in FFQ	Frequency peer week in % of sample (n=75)				
	Never/less than 1	1-2	3-4	5-6	Daily/several times daily
Vegetables with dinner		8	23	24	45
Vegetables with other meals	16	25	31	12	16
Fruits (low GI)	9	17	24	17	32
Banana, litchi, mango or grapes	23	23	27	11	17
Red or processed meat[1]	12	42	37	7	3
Fish for dinner[1]	14	66	15	4	1
Soda/cordial with sugar	56	20	13	4	7
Juice and nectar	20	29	19	9	23
Sweet cereals	80	11	4	5	
Cereal with no sugar	77	8	9	1	4
Biscuit, cake, ice cream, etc. [1]	22	47	19	10	3
Chocolate/sweets[1]	19	37	31	10	4
Butter/ghee in cooking[1]	18	15	33	14	22
Vegetable oils in cooking[1]	10	7	24	19	41
Ready-made meals (pizza, French fries, etc.) [1]	53	33	14	1	
Yoghurt with added sugar	57	19	16	5	3
Yoghurt with no added sugar	51	23	15	8	4
Beans and lentils	68	15	12	4	1
Wholegrain bread/flour	9	5	15	13	57
White bread/flour	36	33	15	8	8
White pasta/rice	17	33	35	7	8
Wholegrain pasta/rice	41	37	17	3	1
Salty snacks, chips[1]	33	53	14	1	
Skimmed milk 0,1-0,7%[2]	57	8	7	4	24
Low fat milk 1-1,2%[2]	49	11	13	5	21
Whole milk 3.5-3.9%[2]	80	9	4	1	5
Breakfast	5	3	7	8	77
Lunch	5		7	8	80
Dinner		1	1	4	93
Evening meal	12	11	27	16	35
Snack	5	16	31	8	40

[1]n=74

[2] % fat

4.3 Description of diet using scoring system

The distribution of the three values of the score in the sample is presented in table 5, by categories. The mean score for each category and standard deviation (S.D) is also presented in table 5. The categories making up the score are previously presented in table 2 (chapter 3.3.1).

The saturated fat category had the highest percentage of a score of 0 in the sample, where 76% said they used butter/ghee when cooking at least twice a week. The red and processed meat category had the second lowest score overall, where 72% of the sample scored 0 for an intake of twice a week or more. In the wholegrain category, only 13% of the sample scored 10, the score given for an intake of either wholegrain bread or wholegrain pasta/rice several times daily. The most frequently reported intake was once daily (44%) of one of the wholegrain sources mentioned.

The fish category had the highest percentage of the sample with a score of 10 (68%). Over two thirds of the sample had fish for dinner twice or more frequently per week, and 19% had fish for dinner once a week (score 5). The majority of the sample (52%) reported that they neither had vegetables for dinner or at other meals on a daily basis (score 0). A top score (10) was given to 47% of the sample for eating vegetables for dinner or at other meals more than once daily.

The majority of the women (58%) scored 0 for eating food items from the sugar category 8 times per week or more. Those who ate these foods 1-7 times per week (38%) scored 5. In the milk category, 69% of the women had an intake of low-fat milk (0.1-0.5% fat), from 0 to 3 times per week (score 0), whereas 24% drank low-fat milk once or more daily. The score in the beans and lentils category had a similar result, with 68% of the sample saying they ate beans and lentils less than once a week, whereas 25% had an intake of twice or more per week. Almost half of the women (47%) had ready-made meals twice or more per week (score 0). A frequency of once a week (score 5) was found in 37% of the sample. For the fruits and berries category, 64% of the women scored 0 for an intake of neither category daily, and 31% reported an intake of one of the categories daily (score 5).

As table 5 shows, 48% of the women scored 0 for using table salt or eating potato chips/salty snacks more than twice a week in total. A lower frequency of both salt categories less than once a week (score 10) was found in 15% of the sample. The final category describes use of vegetable oils when cooking. The top score of 10, indicating use daily or several times daily was found in 41% of the women, whereas 31% used vegetable oils 4-6 times per week when cooking (score 5).

The mean score was highest for vegetables, fish and vegetable oils, at 4.7 (4.9 S.D), 7.7 (3.6 S.D) and 5.6 (4.1 S.D), respectively. The mean score was 3.5 in the wholegrain (3.5 S.D) and ready-made meals (3.7 S.D) categories. Mean score for fruits and berries were 2.1 (2.9 S.D), milk was 2.7 (4.3 S.D), beans and lentils 2.9 (4.4 S.D), salt 3.3 (3.6) and sugar 2.3 (2.9 S.D). The lowest mean score values were found in saturated fat and red and processed meat, with 2.1 (3.9 S.D) and 2.0 (3.5 S.D), respectively. The mean value of the total score in the sample was 36.8, with a standard deviation of 17.5.

Table 5. Description of the sample's diet using the scoring system. Percentages of sample distributed by score, per category and mean score with standard deviations of each score component plus total score in the sample.

	Score			
Category	**0**	**5**	**10**	**Mean (S.D)**
Wholegrain[1]	43	44	13	3.5 (3.5)
Vegetables[1]	52	1	47	4.7 (4.9)
Fruits and berries[1]	64	31	5	2.1 (2.9)
Milk[1]	69	7	24	2.7 (4.3)
Fish[2]	13	19	68	7.7 (3.6)
Beans and lentils[1]	68	7	25	2.9 (4.4)
Ready-made meals[2]	47	37	16	3.5 (3.7)
Salt[1]	48	37	15	3.3 (3.6)
Red and processed meat[2]	72	16	12	2.0 (3.5)
Sugar[3]	58	38	4	2.33 (2.9)
Saturated fat[2]	76	7	17	2.1 (3.9)
Vegetable oil[2]	28	31	41	5.6 (4.1)
TOTAL[3]				36.8 (17.5)

[1]n= 75

[2]n= 74

[3]n=73

Figure 1 presents distribution of the total score within the sample, by percent. The range of the score is from 5 to 80 points scored.

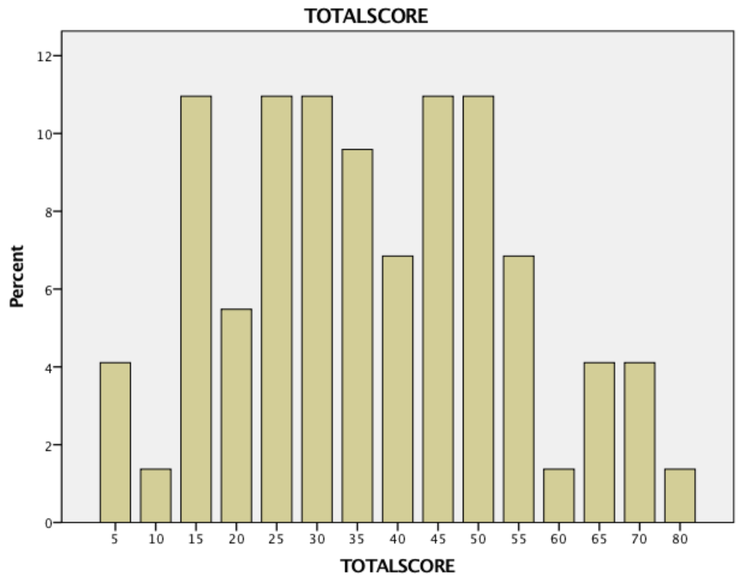

Figure 1. Distribution of total score in percentages of total sample (n=73).

5.0 Discussion

This chapter will begin with a discussion of the study design and method, before moving on to the sample and research questions in the discussion of results.

5.1 Discussion of study design and method

5.1.1 Discussion of study design

The data used for this thesis was part of an RCT where the information from the first questionnaire in the RCT was used, and in this way the thesis can be viewed as a cross-sectional study. The purpose of cross-sectional studies is to gather quantitiative data that can give a description of the population of which the sample has been drawn, however they cannot be used to establish causality (Ringdal, 2007). Advantages of using a cross-sectional study design are limited time requirements and costs, and outcomes can be used to create hypotheses for further studies. However, the measurement happens at one point in time, hence the results are not guaranteed to be representative, and it cannot be used to investigate a sample or behaviour over a longer time period.

The main aim of this study was to describe the diet of pregnant women prior to their GDM diagnosis using data from an FFQ, and further to describe this diet using a self-developed scoring system based on national recommendations for food intake. A diet during pregnancy may differ from the non-pregnant dietary intake. This will be discussed further in chapter 5.3.1.

5.1.2 Discussion of method

The methods used in this study were mainly based on data from the self-administered FFQ from Questionnaire 1. A food frequency questionnaire is a tool designed for obtaining descriptive data on food intake over a longer time period, and to rank subjects into high, medium and low intakes to identify food patterns and intake (Gibson, 2005). As this thesis inteded to describe and identify larger groups and/or patterns in the diet of the sample, the FFQ was an appropriate method. Choice of study design can reduce random and systematic errors, thus increasing validity. If we for example intend to find information of the long-term nutritional status of an individual, the dietary measurement we use should give a valid reflection of the true usual intake rather then the intake over a single day (Gibson, 2005). As we intended to find information on the usual intake of the individual and avoid a too large effect of the day-to-day variability, the FFQ is a suitable method in that it covers the food intake over a longer period of time. The benefits of the FFQ is the low burden of completion for the participants, and that it gives us data on the regular diet of the time period measured (Laake et al., 2013). This could have had a positive impact on the number of subjects who decided to volunteer for the study. The limitations of the FFQ are the grouping of the food items, and the fact that it only gives data on the foods included in the questionnaire, hence narrowing some of the data. For example, the red and processed meat category limits the ability to look at a food item (red meat) that is recommended to eat in small amounts because of its nutritional value, because it is grouped with another food item (processed meat) which is not directly adviced to eat as it has lower nutritional value. The discussion of the description of the diet and score is covered in chapter 5.3.

Validity

Validity describes in which degree a measurement, index or indicator reflects what it is intended to measure (Gibson, 2005). Ideally, valid measurements are both sensitive and specific and free from random and systematic errors. However, all dietary assessment methods have errors, and it is important to evaluate which of these that possibly can affect the study and its results. Avoiding systematic errors, random errors and confounding factors can increase validity.

External validity requires judgement about the degree of which the results can be applied to the wider universe, and external quality control of the measurements is needed (Gibson, 2005). If the results have external validity, or generalizability, they are valid when extrapolated to individuals in the greater population defined, and not only in the study (Gibson, 2005). External validity is dependent on internal validity and a large sample, which is limited in this study. Thus, the results of this study cannot be generalized to the wider universe.

Internal validity is linked to valid conclusions in the study population from which the sample is drawn (Laake et al., 2013). Internal validity is necessary for external validity (Gibson, 2005) and is threatened by selection bias, respondent bias and statistical validity (Laake et al., 2013). Statistical validity is dependent on using correct methods and tests, and adjusting for the possible confounding variables (Laake et al., 2013). Measures of sensitivity and specificity also relate to the validity of a measure, and ideally, valid measurements are both sensitive and specific and free from random and systematic errors (Gibson, 2005). Choice of study design is essential to be able to draw valid conclusions from a study, as this potentially reduces random and systematic errors, hence increasing the validity and reproducibility (Laake et al., 2013). The best way to assess internal validity is through a validity study. For reasons already mentioned, this was unfortunately not feasible for the score. The FFQ has not been validated in the Fit for Delivery study or in the Pregnant+ study.

Reliability

Many terms are used interchangeably with reliability: reproducibility, repeatability, consistency, agreement and stability (Medical Research Council, 2016). With respect to measurement instruments and tools, we can assess test-retest reliability - the degree to which a result with one instrument is equivalent to the result on the same or a parallel instrument across days – and internal consistency reliability: the degree to which items within an instrument correlate to each other or the consistency of an assessment tool across multiple trials (Medical Research Council, 2016). A method is reliable if we get the same results when we repeat the measurement on the same people under the same premises (Ringdal, 2007). For a discussion on test-retest study to assess reliability, see *random errors.*

Systematic errors and bias

The accuracy of a measurement describes the extent to which the measurement is close to the true value (Gibson, 2005). Accuracy can be reduced by bias and systematic errors, which can alter the mean or median value (Gibson, 2005). However, these errors have no effect on the variance and thus do not affect the reproducibility of the measurement (Gibson, 2005). Systematic errors can occur in any dietary assessment method, and causes a result to depart from the true value in a consistent direction, thus reducing the accuracy of the measurement by altering the mean or median value (Gibson, 2005). Moreover, measurement errors through the use of a food frequency questionnaire is difficult to rule out, as it is not possible to estimate the amount of the frequency reported. This is relevant for both the description of the diet and the scoring system as a whole. On the other hand, typing errors have been limited through the use of online questionnaire and importing of data, and double-checking the data punched from the recruitment form. In addition, the tests and changes in SPSS have all been double-checked for errors before and after running tests and descriptive statistics.

Systematic errors lead to bias and skewed estimates that threatens the validity of a study (Laake et al., 2013). Language barriers are one example of systematic error (Ringdal, 2007). The language and cultural differences in the sample can lead to a potential error. The FFQ and information brochures were developed in Norwegian, Somali and Urdu, and information was also available in English. Additionally, the recruiters had been trained in the sampling procedure and it was possible to use translators if needed. Still, it is possible that this may have led to errors.

Bias cannot be removed by subsequent statistical analysis, and thus care must be taken to reduce all sources of bias by choice of an appropriate design and careful attention to the equipment and methods selected (Gibson, 2005). As mentioned, bias leads to reduced accuracy and can influence the cause-effect relationship. There are several types of bias in dietary measurements, including non-response, selection, respondent, interviewer, dropout and recall bias.

Non-response bias arises when the sample may contain participants that have different characteristics than the rest of the population, causing the sample to not be representative (Gibson, 2005). If those who choose not to participate in the study are different from those who do, non-response bias is present (Sedgwick, 2015). *Volunteer bias* is a systematic difference between those who volunteer to participate in a study and the rest of the population. Studies have shown that those who volunteer to participate in studies have higher education and social class than those who do not participate (Sedgwick, 2015). Both non-response bias and volunteer bias will result in selection bias.

Selection bias occurs when the sample differs from the persons in the study population in such a way that they are not representative of the study population, and the conclusion would have changed if a different sample had been drawn (Laake et al., 2013). Simplifying the dietary assessment method to make it more appealing for potential respondents can reduce selection bias. Additionally, training of field workers is important, as they should appear trustworthy and understanding in interaction. Identifying dropouts and non-responders can ensure this group is not significantly different from the sample. *Dropout bias* is usually the result of ignoring possible systematic differences between those who fail to complete a study and the remaining participants (Gibson, 2005), and should be avoided. The presence of on-response bias, dropout bias and selection bias cannot be ruled out, as the people not included in this study sample could not be assessed because the recruitment from the main study had not been completed. However, the majority of the respondents the master thesis student recruited voluntarily joined the study, which potentially could have reduced the effect of this bias. A strength of the Pregnant+ study is that all of the potential candidates are accessible through their appointments at the hospitals, and this can reduce the non-response bias because the candidates are approached in person and can fill out the first questionnaire in between their appointments on the day of recruitment. Using a food frequency questionnaire as a dietary method is also relatively simple and quick compared to other dietary assessment methods.

Respondent bias is a systematic error caused by the respondent, for example systematically over- or underreporting of foods consumed, not necessarily by intention (Gibson, 2005). *Social desirability* by under- or over-reporting food intake can also lead to bias. Participants may want to give socially desirable answers, and underreporting is common, especially in women, older persons and as BMI increases (Gibson, 2005). Under- and over-reporting can be both random and systematic. Specific foods or beverages may be underreported, for instance those perceived as ”bad” such as cakes, cookies, candy and fats. Foods may also be over-reported, especially those percieved as ”good”, such as meat, fish, vegetables and fruits (Gibson, 2005). It may be beneficial to use a self-administered questionnaire instead of an interviewer to reduce the impact of social desirability, in addition to have emphasis on anonymity of the participants and their data. Errors can also be caused by cultural differences and if there is use of different languages. Good communication, use of translators and adapting the dietary assessment method to the potential sample can reduce these errors.

The use of a self-administered questionnaire instead of an interviewer and emphasizing anonymity has likely been beneficial to reduce over- or under-reporting and social desirability. However, this is more common in women and as BMI increases (Gibson, 2005), which are two factors present in the sample. Overall, it is not possible to rule out that respondent bias or over- or under-reporting may have taken place.

Interviewer bias is a systematic difference between how information is recorded in participants and later interpreted (Pannucci & Wilkins, 2010). This type of bias is particularly important to try to avoid when using interviews to gather information from informants. It can arise when using follow-up questions in the wrong way, if the participant is leaving out information, and in general bias associated with the interview setting. In this study, the impact of the recruiters was kept limited, and the recruiters made sure to give the participants room to fill out the questionnaire in private. The only data that was noted by the recruiter was on the recruitment form, which assessed height, pre-pregnancy weight, age, birth country and gestational week. Pre-pregnancy weight and gestational week could be found on the participant's health card. It is still possible that there have been typing errors, distractions or poor communication that can have affected the data.

Recall bias is especially important in retrospective case-control studies where there is different recall of information between groups, and can cause random errors. Similarly, respondent memory lapses can cause bias by the respondent unintentionally omissing or adding foods in recall methods. This can be reduced by minimizing the time period between the actual food intake and the time of investigation (Gibson, 2005). Recall bias and respondent memory lapses can cause random errors. As the FFQ is a retrospective dietary assessment method, it is possible that recall bias is present. However, it may have been limited as the FFQ referred to the period previous to diagnosis, which for the majority of the respondents was around a week prior to recruitment.

Confounding

Confounding is a type of bias that affects the validity of a study because it can intervene with the true effect of an outcome being assessed (Gibson, 2005). Statistical validity is dependent on adjusting for the correct confounding variables (Laake et al., 2013). Examples of confounding variables are age, gender or social class, or they can arise if a dietary assessment that measures amount is not adjusted for energy intake (Waijers et al., 2007). As time and other factors limited the possibility to adjust for energy intake, confounding factors may be present in this study and affect the validity.

Random errors

Random errors lead to measurement that are imprecise in an unpredictable way, resulting in less certain conclusions (Gibson, 2005). An example of random error is variation in the diet (Ringdal, 2007), which to some degree will always be present because people change their diets over time (Gibson, 2005). Random errors can be reduced by repeating all the measures on the whole sample or on a random subsample (Gibson, 2005). As this master thesis was part of a larger project, the recruitment and handling of the sample was not decided by the master thesis student, and thus it was not feasible to increase the sample or complete a test-retest reliability study. Random errors can also be reduced by increasing the number of observations, which was the intention when changing the inclusion criteria and additionally extending the master thesis period. However, the sample size is relatively small compared to many dietary assessment studies. In conclusion, it is possible that there are random errors affecting the reliability of this study.

Random errors lead to lower precision and greater variation, but does not necessarily threaten the validity (Laake et al., 2013). Variation is expressed through a confidence interval, where a 95% confidence interval will cover the unknown value of the measurement by 95% probability (Laake et al., 2013). High precision leads to short intervals, and low precision leads to longer intervals (Laake et al., 2013). Precision can be divided into repeatability – in which degree similar results are obtained when repeating the measurements at identical conditions - and reproducibility – the degree of variation when we change the conditions in the study (Laake et al., 2013). The reproducibility of an instrument can be discussed, such as a questionnaire repeated at two different points of time to be able to calculate the variation, which is in essence a measure of repeatability (Laake et al., 2013).

5.3 Discussion of results

5.3.1 Discussion of sample

The sample consisting of 75 women was smaller than what was estimated at the time of planning this thesis. As the respondents were recruited from the Oslo area and the sample was relatively small, the results from this master thesis cannot be generalized to all women with GDM in Norway. Previous gestational diabetes was present in only 18% of the women, however this was an exclusion criteria for parts of the recruitment process and is therefore likely that it has affected this variable. The pre-pregnant BMI in this sample was higher than in the average population, with 33% of the sample above BMI 30, categorized as obesity (see table 3). In Norway, around 20% of women over 30 years in Norway had obesity around year 2003, based on physical examinations (Statistisk sentralbyrå, 2007). As table 3 shows, 75% of the women had previously been pregnant, which could have affected their weight after the pregnancy. Additionally, it is likely that women with GDM have a higher pre-pregnant BMI, considering the association between BMI and increased risk of GDM.

5.3.2 Discussion of food intake frequency

From table 4 we find that 45% of the sample had vegetables for dinner daily, and 16% had vegetables at other meals daily or more often. The amount of vegetable for dinner could be from less than 100g to over double, thus the one frequency could still mean more than one portion per frequency. For fruits and berries, 32% of the sample had the low-GI fruits daily or several times daily, and 17% had banana, grapes, mango or litchi daily or more often. According to the Norwegian Directorate of Health report from 2015, 10% of those with shorter education and 20% of those with longer education had vegetables at least twice daily, whereas 20% (shorter education) to 33% (longer education) had fruits and berries at least twice daily (Helsedirektoratet, 2015b). The division into frequency groups in both this thesis and the report make the numbers somewhat difficult to compare. For the discussion of frequency compared to recommendations, see chapter 5.3.3.

Further, the red and processed meat intake for 1-2 times per week was found in 42% of the sample, whereas 37% had red and processed meat 3-4 times per week. In the report on food intake in Norway mentioned in the previous paragraph, 54% had meat or meat products for dinner at least 3 times per week (Helsedirektoratet, 2015b). However, the report measured total meat and meat products, whereas in the FFQ used in this thesis, the examples of red and processed meat products were minced meat and sausages. Nonetheless, the results in our sample are lower than for the total meat intake measured in a recent nationwide survey, if we are not to involve types of red meat and meat products.

The intake of salty snacks and/or potato chips was the highest for the frequency of 1-2 times per week (53%). To the author’s knowledge, there are no recent studies that include intake of salty snacks and potato chips. In a large New Zealand cohort study of pregnant women 45%

had French fries 1-2 times per week, and 36% had crisps (potato chips) or nuts 1-2 times per week (Morton et al., 2014). These findings tend to be similar to those found in the sample.

A total of 57% of the sample had wholegrain bread/flour daily or several times daily.
In a nationwide study on dietary intake, data from 2010-2011 show that around a quarter of the population had an intake of wholegrains according to the recommendations, however these numbers were based on a 2-day diet registration (Helsedirektoratet, 2012). As they used other methods to gather dietary data, it is not completely comparable, but can be used as an indication.

In the sample, 66% had fish 1-2 times per week. In the Norwegian Directorate of Health report, 54% had fish at least 3 times per week (Helsedirektoratet, 2015b). Around 15% of the sample had fish 3-4 times per week. It seems the intake numbers in the report is somewhat higher than what was found in the sample – at least for the frequency of 3+ times per week.

The intake of sugary soda, cordial or lemonade had a frequency of less than once a week in 56% of the sample. However, the fact that 7% had this daily may result in a potentially large contribution to the total sugar intake. To compare, 19% of 16-24 year olds had soda or cordial daily in 2012 (Helsedirektoratet, 2015b). Additionally, a nationwide Norwegian study from 2010 found that 33% had soda weekly (Bugge, 2010). If we take into consideration that the sample in this thesis differs in terms of sex and a narrower age group, the intake for a weekly frequency was considerably lower, however the comparability of the studies and their varied dietary assessment methods must be taken into consideration.

The intake of chocolate and sweet candy 3-4 times per week was found in 31% of the sample, and 37% had chocolate and sweet candy 1-2 times per week. In a Norwegian study from 2010, 53% had chocolate once a week or more often, and 37% had sugary candy or sweets once a week or more often (Bugge, 2010). The numbers are somewhat similar, but the frequency and categorization makes it difficult to compare this thesis against the 2010 study.

For biscuits, cake, ice cream and bakery goods, 37% ate these 1-2 times per week, compared to 31% who ate sweet bakery goods weekly in a nationwide study (Bugge, 2010).
Considering that the latter did not include ice cream, the percentages are quite similar in the

sample compared to the nationwide study, although the results are difficult to compare as there were not many details on the dietary assessment method in the study mentioned.

5.3.3 Discussion of scoring system to describe diet

According to Waijers and associates, it is important to design the scoring ranges so the score is proportional to recommended intake instead of using simple cut-off values, and this is especially relevant for foods that have a U-shaped correlation with health outcome (Waijers et al., 2007). In the development of the score, this was attempted by use of the national recommendations as cut-off. However, as we cannot establish the amount per frequency, there is some uncertainty with regards to accuracy of the scoring system as it is based on a qualitative FFQ.

Further, it is recommended to adjust for energy intake to avoid confounding, and taking into account the culture and dietary habits of the population when the food items/categories and cut-offs are chosen (Waijers et al., 2007). Due to limitations of the study already mentioned, it was not possible to investigate accurate energy intake in the sample. However, the culture of the population was taken into consideration in the food items in the FFQ. Furthermore, the dietary habits of the population can be discussed, both in terms of food items and amount per frequency. It is difficult to establish whether the food items used in the FFQ covered the majority of the diet intake of the sample, because of the diversity in background, age, BMI and socioeconomic factors such as income and education level, which can all affect choice of foods and portion size. However, the FFQ had been previously used in a study with a similar population (pregnant women in Norway), and additionally, there were no questions or comments regarding the FFQ in the feasibility study.

Key issues in the development of a diet quality score are choice of the components to include, assigning the food to food groups, choice of cut-off values, quantification of index components and the component's contribution to the total score (Waijers et al., 2007). Choice of the components was based on the national dietary recommendations. For some recommendations, the FFQ items limited the possibility to investigate these items properly, for instance the recommendation of choosing water when thirsty. Assigning the foods to food groups was affected by the limitations of the FFQ and the score development complexity, e.g. assessing fruits and vegetables combined or separately. It was attempted to divide the categories to better measure each food component with regards to recommended frequency. The choice of cut-off values was, as mentioned, based on the recommended frequency. Where there were no clear recommendation, scientific evidence and justification for cut-off was used to establish the scoring ranges. The quantification of index components is a complex matter when using an FFQ, hence the detailed description of each component/category. As it is not possible to estimate portion sizes, the score indicates an estimation of quantity and should be used as such. Each component's contribution to the total score was evaluated through use of the recommendations. As mentioned, the score indicates an estimation of quality, and some of the categories included are complex. For instance, the sugar category is based on 7 questions from the FFQ, and cut-off is estimated from how much each of the food items making up each question can contribute to the daily sugar intake. There can be large individual variation per food item, thus large variations in the total intake. It was attempted to adjust for this by use of calculations, and choosing a strict cut-off because other foods not covered in this category also could contribute to the daily sugar intake. Additionally, the use of foods that are low in nutritional value and high in energy can substitute intake of other, more nutritious food items and contribute to a lower diet quality. However, the complexity of the sugar category indicates that the score should be interpreted with caution.

The distribution of the score in the sample was presented in table 5, by categories and in total. Over two thirds of the sample scored 0 in many of the categories, including saturated fats/butter (76%) red and processed meat (72%), milk (69%), beans and lentils (68%), and fruits (64%). Around half of the sample scored 0 for sugar (58%), vegetables (52%), salt (48%) and ready-made meals (47%). Further, 43% scored 0 on wholegrain intake.

To my knowledge, there have not been many studies published where a score developed on the basis of recommendations also includes the score divided into groups that are not based on grams per day. Therefore, comparison with similar reseach is difficult. The scoring system is made to reward those who follow the recommendations, and the score 0 is given to those who do not eat according to these. However, it is not a scoring system that can define those who eat the "wrong" foods, but rather one that can reward those who eat the recommended frequencies of the foods adviced. Still, this is an indication that the use of butter/ghee for cooking is quite frequent. The intake of red/processed meat is relatively high if we draw the conclusion that the exemplification of sausages and minced meat in the question covering this score would measure prosessed meat rather than red meat. However, the question and subsequent category covers both, so it is not possible to conclude definitively regarding this category. The milk category covered intake of low-fat milk only, an estimated one glass/frequency per day. As other dairy products were not covered in the FFQ, it is not feasible to draw conclusions regarding dairy products as a whole, but the results indicate that the frequency of intake of low-fat milk is low in the sample.

As for the recommended amounts, the categories where most participants scored 10 were fish (68%), vegetables (47%) and vegetable oils (41%). This indicates that the majority of the sample had fish 2-3 times per week, which is similar to nationwide statistics (Helsedirektoratet, 2015b). To score 10 in the vegetable category, the participants were required to eat one of the vegetable categories more than once daily. Compared to a nationwide study completed in 2013, a higher percentage of the participants in the sample ate vegetables more than once daily than the average Norwegian (10-20%) (Helsedirektoratet, 2015b). However, over half of the sample (52%) scored 0 for vegetable intake, showing diversity in the sample, which could be affected by socio-economic status or the cut-off of the vegetable score. The reason for this discrepancy could be due to the sample containing women only, as women eat more vegetables than men – or age, as vegetable intake tends to be higher in the age group 25-50 than the younger or older (Helsedirektoratet, 2015b). It is also possible that pregnant women are more motivated to eat healthy than non-pregnant women, considering the fact that their diet quality can affect both themselves and their offspring.

For the fruit component, 64% of the sample scored 0 for not eating either of the fruit categories daily. This indicates that the intake of fruit is below the recommended intake in the majority of the sample. For sugar, 58% of the sample scored 0. As mentioned, this is a complex category with a strict cut-off as the majority of the food items covered have low nutritional quality. The analysis of the sugar score should be used with caution, however it is likely that the frequency of the items making up the sugar score is high although we cannot be certain regarding the amount per frequency.

The salt intake was measured through eating salty snacks and using table salt, although other food items such as ready-made meals are likely to contribute with a large percentage of the salt intake. Almost half of the sample (48%) scored 0 for salt, and 47% scored 0 for ready-made meals, indicating that a large proportion of the sample might exceed the recommended intake of a total of 6 g salt per day. This is probable, as the statistics found in the Norwegian population indicate that the average intake is 10g per day, or somewhat lower in women (Helsedirektoratet, 2015a).

Further, 43% of the sample scored 0 on wholegrain intake for not eating wholegrain bread or pasta/rice daily, whereas 13% met the recommendation of either food group several times daily and scored 10. In the nationwide diet study from 2010-11, around a quarter of the population met the recommendations when the diet intake was based on a 2-day food registration (Helsedirektoratet, 2012). Thus, the numbers should be compared with caution. Overall, the wholegrain intake seems to be lower than recommended in the majority of the sample.

It is possible that the intake is over- or underestimated due to social desirability, which can occur in any dietary assessment method that does not adjust for this. As mentioned in the discussion of methods, it is not possible to rule out. See chapther 5.1.2 for further discussion of validity, reliability and bias which might have affected the results.

The total score in the sample was 36.8 on average, with the possible range from 0-120. The standard deviation for the total score was 17.5, indicating that the sample is not too widely distributed about the mean compared to the range of the scoring system. As seen from the previous paragraph and from table 5, the majority of the category scores tend to cluster around one or two scores, with the exception of wholegrain and vegetable oils that have a more even distribution of the sample over the three scores. This may indicate that there is a similarity in diet within the sample, or it could be that the cut-offs are too narrow and that a more detailed FFQ and cut-off would have distributed the sample differently. The highest score in the sample was 80 (see figure 1), and compared to the highest score possible at 120, there is a gap of 40 points that is not covered by any of the participants in the sample. This may show either that the scoring system is skewed or simply too "harsh" in terms of cut-off, or that no one in the sample had a diet that was very close to the recommendations. As the scoring system is not validated, it is not possible to conclude with certainty with regards to the former. As for the latter, it is shown that only 10% said they trust the government recommendations for diet (Bugge, 2012) hence it is imaginable that this is also somewhat true for the sample.

Overall, the recommended amounts per category were varying. For vegetables, the majority of the sample had a lower frequency of intake than recommended, however it is difficult to conclude, as we do not have information regarding the amount per frequency. The intake frequency for fruits and berries was lower than recommended, although there is some uncertainty with regards to amount. The majority of the sample had fish 2-3 times per week, as recommended. For wholegrain bread and rice/pasta, the results indicated that the majority of the sample had a lower frequency than recommended, but there are large uncertainties regarding amount. For red and processed meat, there was a higher frequency than the one recommended based on scientific literature, however the combination of red and processed meat in the same category makes it complicated to conclude. The low-fat milk intake in the sample was low in frequency, however no clear conclusions can be made with regards to recommendations, as there are no clear amounts recommended for this food group. The salt intake in the sample was most likely higher than recommended. Butter and ghee for cooking was used quite frequently in the sample, but the amounts are difficult to estimate and thus no clear conclusion can be made. The sugar score was high for a large proportion of the sample, however it is difficult to use such a complex variable to interpret clear intake with regards to recommendations.

6.0 Conclusion

Healthy eating, defined as following the official recommendations, is particularly important in pregnancy (Brantsæter et al., 2014). Adherence to the dietary guidelines was in this study described and evaluated by using a self-developed scoring system. In the sample, the results indicated that the dietary intake might not be met by recommendations in the majority of the categories. The results should be interpreted with caution, as they are not validated and cannot infer representability in the population as a whole. Further population-based studies including amount, adjustment for energy intake and validation of dietary assessment methods is recommended.

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Appendix 1 Questionnaire 1: Variables used in this thesis

Time/date

Gravid+ spørreskjema 1: Svangerskapsuke <32 Baseline

Velkommen til Gravid+!

Tusen takk for at du har takket ja til å være med i Gravid+ studien. Din deltagelse gir oss viktig informasjon om oppfølging av svangerskapsdiabetes.

Spørreskjema er helt anonymt og ingen vil spore svarene tilbake til deg. Det er viktig at du svarer oppriktig og ærlig. Det tar ca. 20 minutter å svare på alle spørsmål. Du kan enkelt ta pauser og kommer tilbake til spørreskjemaet på iPaden.

1.Spørsmål om svangerskapet ditt

1.1 **I hvilken svangerskapsuke er du nå?**

☐☐ Antall uker

1.2 Var dette svangerskapet planlagt

☐ Ja

☐ Nei

1.3 Har du vært gravid tidligere? (Dette gjelder også svangerskap som endte med abort eller dødfødsel)

☐ Ja

☐ Nei

1.4 Hvor mange barn har du født

☐☐ Antall barn

1.5 Hvor mange barn lever i dag?

☐☐ Antall barn

1.6 Har du noen gang hatt en spontanabort?

☐ Ja

☐Nei

☐☐ Hvis ja, antall ganger

1.7 Har du noen gang hatt en provosert abort?

☐ Ja

☐ Nei

☐☐Hvis ja, antall ganger

1.8 Har du/har du hatt noen av de følgende svangerskapskomplikasjonene (du kan sette flere kryss)?

Tidligere Nå

☐ ☐ Lekkasje av fostervann

☐ ☐ Blødning fra skjeden

☐ ☐ Høyt blodtrykk

☐ ☐ Svangerskapsforgiftning

☐ ☐ Bekkenløsning

☐ ☐ Kvalme/oppkast

☐ ☐ Kynnere

☐ ☐ Urinveisinfeksjon

☐ ☐ Soppinfeksjon

2. Spørsmål om svangerskapsdiabetes

2.1 Hva var verdien på ditt 2 timers glukose/sukker nivå ved glukosebelastningen du tok for noen dager siden?

☐☐,☐mmol/L

☐ Vet ikke

2.2 Siden jeg har svangerskapsdiabetes kan min baby være (du kan sette flere kryss)

☐ større enn vanlig

☐ mindre enn vanlig

☐ for tidlig født

☐ innlagt på spesialavdeling

☐ Vet ikke

2.3 Det er større risiko for å få svangerskapsdiabetes for kvinner som (du kan sette flere kryss)

☐ er overvektige

☐ har mer enn tre barn

☐ er over 38 år gammel

☐ er fra Pakistan, India, Sri Lanka, Nord–Afrika eller Bangladesh

☐ Vet ikke

2.4 Svangerskapsdiabetes fører til at jeg har (du kan sette flere kryss)

☐ regelmessige kontroller på sykehuset

☐ behov for keisersnitt

☐ en økt risiko for å utvikle diabetes senere i livet

☐ Vet ikke

	Ja, nesten hele tiden	Ja, av og til	Ikke særlig ofte	Nei aldri
Følt deg nedfor eller ulykkelig	☐	☐	☐	☐
Vært nervøs eller bekymret uten grunn	☐	☐	☐	☐
Vært så ulykkelig at du har hatt vanskeligheter med å sove	☐	☐	☐	☐
Bebreidet deg selv uten grunn når noe gikk galt	☐	☐	☐	☐
Kunnet glede deg til ting som skulle skje	☐	☐	☐	☐

3.10 Røyker du?

☐ Ja, daglig

☐ Av og til

☐ Nei

3.11 Snuser du?

☐ Ja, daglig

☐ Av og til

☐ Nei

3.12 Hvor mye veier du nå?

☐☐☐ Kg (i hele kilogram)

☐ Vet ikke

3.13 Har noen i din nærmeste familie (mor, far, søsken) diabetes?

☐ Ja

☐ Nei

☐ Vet ikke

3.14 Har du deltatt i et program for vektnedgang eller livsstilsendring (som f.eks. Grete Roede eller Libra)?

☐ Ja, jeg deltar akkurat nå i et program

☐ Jeg har tidligere deltatt i et program

☐ Nei, jeg har aldri deltatt i et program

4. Generelle spørsmål om deg

4.1 Hva er din sivilstand?

☐ Ektefelle/samboer

☐ Enslig

☐ Annet

4. 2 Hva er din høyeste fullførte utdanning?

☐ Grunnskole, ungdomsskole (6-9 år)

☐ Videregående, gymnas, yrkesskole eller realskole (10–13 år)

☐ Høgskole eller universitet, mindre enn 4 år (samlet inntil 15 år)

☐ Høgskole eller universitet, 4 år eller mer (samlet mer enn 15 år)

☐ Ingen fullført utdanning

4.3 Hva er din hovedaktivitet? (Sett ett kryss)

☐ Lønnsmottaker

☐ Selvstendig næringsdrivende

☐ Elev/student

☐ Svangerskapspermisjon

☐ Hjemmeværende

☐ Arbeidsledig

☐ Uføretrygdet

4.4 Er du fraværende fra ditt vanlige arbeid/ditt studiet nå?

☐ Ja

☐ Nei

☐ Hvis ja, hva er årsaken til fraværet?

Fyll inn: ____________________

4.5 Om du er sykemeldt. Hvor mye er du sykemeldt?

☐ ikke sykmeldt

☐ 20% eller mindre

☐ 21% - 49%

☐ 50% - 75%

☐ Mer enn 75%

4.6 Hva var brutto årsinntekt (før skatt) det siste året for deg og barnets far? (Inkl. barnebidrag, arbeidsledighetstrygd, kontantstøtte, osv.)

Felles brutte årsinntekt

☐ < 400.000 kr.

☐ 400-499.000 kr.

☐ 500-599.000 kr.

☐ 600-699.000 kr.

☐ 700-799.000 kr.

☐ 800-899.000 kr.

☐ 900-999.000 kr.

☐ over 1.000.000 kr.

☐ Vet ikke

4.7 Dersom du fikk en uventet regning på 25.000 kr, hvor lett ville det være å betale den i løpet av en uke?

☐ Ingen problem
☐ Litt vanskelig
☐ meget vanskelig

4.8 Hva er morsmålet ditt? (Sett et kryss)

☐ Norsk

☐ Somali

☐ Urdu/Punjabi

☐ Engelsk

☐ Annet: ___________________

4.9 Hvordan vil du beskrive dine norskkunnskaper?

☐ Svært gode

☐ Gode

☐ Litt dårlig

☐ Dårlig

4.10 Har du noen utenom din ektefelle/samboer/partner som du virkelig kan betro deg til?

☐ Nei

☐ Ja, 1-2 personer

☐ Ja, flere enn to personer

4.11 Hvor ofte har du i løpet av de siste seks månedene? (sett ett kryss for hver linje)

	Daglig	Ukentlig	Sjelden	Aldri
Lest aviser, blader eller nettsteder på eget språk	☐	☐	☐	☐
Lest norske aviser, blader eller nettsteder	☐	☐	☐	☐
Hatt besøk av en nordmann	☐	☐	☐	☐
Fått hjelp/støtte av en nordmann	☐	☐	☐	☐
Deltatt i møte arrangert av egne landsmenn	☐	☐	☐	☐

5.1 Er du motivert til å spise sunt?

☐ Ja

☐ Nei

5.2 Dine planer om å spise sunnere

☐ Jeg hadde ingen planer om å spise sunnere i de siste 6 månedene og har ingen planer om å gjøre det i de kommende 6 månedene

☐ Jeg hadde ingen planer om å spise sunnere i de siste 6 månedene, men vurderer å gjøre det i de neste 6 måneder

☐ Jeg prøver akkurat nå å spise sunnere, men ikke regelmessig.

☐ Jeg har prøvd å spise sunnere i de siste 6 månedene.

☐ Jeg har klart å spise sunnere i de siste 6 månedene.

☐ Jeg er fornøyd med mitt nåværende kosthold

5.3 Hvem gir deg mest støtte til å spise sunt?

☐ Ektefelle/kjæreste

☐ Familie

☐ Kollegaer

☐ Venner

☐ Helsepersonell

☐ Jeg føler ikke at noen støtter meg

Hva spiste du vanligvis før du fikk diagnosen svangerskapsdiabetes?

Når du fyller ut disse spørsmålene skal du tenke på hva du vanligvis spiste og drakk før du fikk vite at du har svangerskapsdiabetes. Tenk på både hva du spiste hjemme, på jobb og i fritiden i tiden etter at du har blitt gravid, men før du fikk diagnosen. Kryss av i den ruten du føler passer best for deg.

5.4 Hvor ofte spiste du frokost?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag

5.5 Hvor ofte spiste du lunsj?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag

5.6 Hvor ofte spiste du middag?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag

5.7 Hvor ofte spiste du kveldsmat?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag

5.8 Hvor ofte spiste du mellommåltider?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.9 Hvor ofte drakk du vann (inkl. fra springen, kjøpevann med/uten kullsyre og/eller smak)?

☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.10 Hvor ofte drakk du juice og/eller nektar?

☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.11 Hvor ofte drakk du brus/saft *med* sukker?

☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.12 Hvor ofte drakk du brus/saft *uten* sukker?

☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.13 Hvor ofte drakk du alkoholholdig drikke?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag

5.14 Hvor ofte drakk du te og/eller kaffe?

☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag
☐	Aldri

5.15 Hvor ofte brukte du sukker i te/kaffe?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.16 Hvor ofte brukte du suketter i te/kaffe?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.17 Hvor ofte drakk du h-melk *(rød kartong)*?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.18 Hvor ofte drakk du lettmelk *(mørkerosa kartong)*

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.19 Hvor ofte drakk du ekstra lettmelk*(grønn kartong)* og eller skummet melk *(lyserosa kartong)*?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.20 Hvor ofte spiste du yoghurt og/eller kefir tilsatt sukker?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.21 Hvor ofte spiste du yoghurt og/eller kefir naturell, uten tilsatt sukker?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.22 Hvor ofte spiste du fine/lyse brød- og kornvarer (brød, naan, chapati/roti, paratha, injera med fint mel)

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.23 Hvor ofte spiste du grove brød- og kornvarer (brød, naan, chapati/roti, paratha, injera med grov mel)?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.24 Hvor ofte spiste du hvit ris og/eller pasta?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.25 Hvor ofte spiste du fullkornsris og/eller fullkornspasta?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.26 Hvor ofte spiste du bønner og/eller linser?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.27 Hvor ofte spiste du søte frokostblandinger (type søt müsli, corn flakes, frosties)?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken

☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.28 Hvor ofte spiste du usøtede frokostblandinger (type 4-korn, All-bran flakes)?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.29 Hvor ofte spiste du grønnsaker til middag?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.30 Hvor ofte spiste du grønnsaker til andre måltider (for eksempel gulrot til mellommåltid, lunsj)

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.31 Hvor ofte spiste du banan, druer, mango eller litchi?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.32 Hvor ofte spiste du andre frukt og bær (andre frukter og bær enn banan, druer, mango eller litchi)?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.33 Hvor ofte spiste du søte kjeks, bakevarer, gjærbakst, iskrem, pudding (kake, baklava, bolle o.l.)?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.34 Hvor ofte spiste du sjokolade/annet søtt godteri?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken

☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.35 Hvor ofte spiste du potetgull/annet salt snacks?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.36 Hvor ofte spiste du rødt og/eller bearbeidet kjøtt (pølser, kjøttdeig)?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.37 Hvor ofte spiste du fisk til middag?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.38 Hvor ofte sukret du selv maten du spiste?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken

☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.39 Hvor ofte brukte du bordsalt for å salte maten du spiste?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.40 Hvor ofte brukte du smør/ghee i matlagingen?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.41 Hvor ofte brukte du vegetabilsk olje (raps, sesam, oliven, solsikke) i matlagingen?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.42 Hvor ofte spiste du ferdigretter til middag (mat fra poser, *pizza, pytt i panna, pommes frittes)?*

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.43 Hvor ofte spiste du så mye at du føler deg overmett (spist for mye)?

Før diagnosen	
☐	Aldri
☐	Sjeldnere enn 1 gang i uken
☐	1 gang i uken
☐	2 ganger i uken
☐	3 ganger i uken
☐	4 ganger i uken
☐	5 ganger i uken
☐	6 ganger i uken
☐	Hver dag
☐	Flere ganger hver dag

5.44 Når du handlet matvarer, hvor ofte sjekket du beskrivelsen av hva matvaren inneholder?

Før diagnosen	
☐	Aldri
☐	Av og til
☐	Som oftest
☐	Alltid

6. Fysisk aktivitet

6.1 Er du motivert til å være fysisk aktiv?

☐ Ja

☐ Nei

6.2 Dine planer om å være mer fysisk aktiv

☐ Jeg hadde ingen planer om å mosjonere mer i de siste 6 månedene og har ingen planer om å gjøre det i de neste 6 månedene

☐ Jeg hadde ingen planer om å mosjonere mer i de siste 6 månedene, men vurderer å gjøre det i de neste 6 månedene

☐ Jeg prøver akkurat nå å mosjonere mer, men ikke regelmessig.

☐ Jeg har prøvd å mosjonere mer i de siste 6 månedene.

☐ Jeg har klart å mosjonere mer i de siste 6 månedene.

6.3 Hvem gir deg mest støtte til å være fysisk aktiv?

☐ Ektefelle/kjæreste

☐ Familie

☐ Kollegaer

☐ Venner

☐ Helsepersonell

Appendix 2 Recruitment form

Gravid
Bedre helse for mor og barn

Rekrutteringsskjema for Gravid+ studien med sensitiv informasjon

Studiedeltagernes nummer:

Inklusjonskriterier **(hvis svaret er ja på disse spørsmålene kan kvinnen delta)**

	JA	NEI
Har kvinnen en egen smarttelefon?		
Er kvinnen diagnostisert for svangerskapsdiabetes?		
Er kvinnen under svangerskapsuke 33?		
Er kvinnen over 18 år?		
Kan kvinnen norsk, urdu eller somali?		

Eksklusjonskriterier **(hvis svaret er ja på disse spørsmålene kan kvinnen ikke delta)**

	JA	NEI
Har kvinnen cøliaki, laktoseintoleranse eller lignende som krever en tilpasset diett?		
Er kvinnen gravid med tvillinger eller flere barn?		
Kvinnen har vært på diapol tidligere i svangerskapet		

Dersom alle inklusjonskriteriene er oppfylt, gå videre i skjema:

Bakgrunnsinformasjon:

Alder:	
Fødeland:	
Antall år bodd i Norge:	
Høyde:	
Vekt før svangerskapet:	
Svangerskapslengde i uker i dag:	
Telefonnummer:	
Behov for tolk:	

Appendix 3 Modifications from the FFQ in the Fit For Delivery study

Oversikt over modifiseringer i Fit For Fødsel spørreskjemaet om kosthold

Før svangerskapet/nå ble endret til Før diagnosen (runde 1) og Nå (runde 2 og 3)

Liste over hva du spiste i går tas ikke med i runde 1, men i runde 2 og 3

Nye spørsmål:

- To nye spørsmål om sukker/suketter i te/kaffe (spm 7.15 + 7.16)
- To nye spørsmål om fine/grove kornprodukter (spm 7.17 + 7.18)
- To nye spørsmål om hvit ris, pasta/fullkornsris, fullkornspasta (spm 7.19 + 7.20)
- Nytt spørsmål om bønner og linser (spm 7.21)
- Nytt spørsmål om rødt kjøtt og bearbeidet kjøtt (spm 7.35)
- Nytt spørsmål om fisk til middag (spm 7.36)
- To nye spørsmål om bruk av smør/ghee, planteolje i matlagingen (7.39 + 7.40)

Ekskluderte spørsmål:

- Spørsmål om poteter
- Spørsmål om grønnsaker på brødskiven
- Spørsmål om frukt og grønnsaker som mellommåltid (inkluder i 7.23)
- Spørsmål om hurtignudler
- Spørsmål om pølser på bensinstasjon
- Spørsmål om «hvor ofte spiser du usunn mat selv om du ikke synes det er veldig godt»
- Spørsmål om «hvilke størrelse velger du vanligvis»
- Spørsmål om kjeks (inkludert i 7.27 – søte bakevarer etc)

Mindre endringer/Språklige endringer/presiseringer:

- Ekstra lettmelk ble slått sammen med skummet melk (istedenfor lettmelk) Spm 7.7 + 7.8.
- Juice og nektar slåss sammen i ett spørsmål (spm 7.9)
- Vann, kjøpevann, vann med kullsyre med/uten smak slåss sammen i ett spørsmål (spm 7.10)
- Inkludert te (spm 7.14)
- Andre lavglykemiske frukt (spm 7.24 + 7.25)? jfr informasjon på Ullevål sykehus og Maria Aas
- Presisering «søte» kjeks (spm 7.27)
- Slått sammen søte gjærbakst, kake, muffins etc. (spm 7.28)
- Nye formuleringer for frokostblandinger med/uten tilsatt sukker jfr spørreskjema fra InnvaDiab (spm 7.29 + 7.30)
- Inkludert kefir sammen med yoghurt (spm 7.31 + 7.32)
- Pommes frittes slåss sammen med ferdigretter (spm 7.41)
- Ny formulering for å tilsette salt til maten (spm 7.38)
- Ny formulering for industrifremstilt mat (spm 7.41)

Appendix 4 Copy of Norwegian Centre for Research Data (NSD) approval

Norsk samfunnsvitenskapelig datatjeneste AS
NORWEGIAN SOCIAL SCIENCE DATA SERVICES

Harald Hårfagres gate 29
N-5007 Bergen
Norway
Tel: +47-55 58 21 17
Fax: +47-55 58 96 50
nsd@nsd.uib.no
www.nsd.uib.no
Org.nr. 985 321 884

Mirjam Lukasse
Institutt for helse, ernæring og ledelse Høgskolen i Oslo og Akershus
Postboks 4, St. Olavs plass
0130 OSLO

Vår dato: 22.07.2014 Vår ref: 38942 / 3 / SSA Deres dato: Deres ref:

TILBAKEMELDING PÅ MELDING OM BEHANDLING AV PERSONOPPLYSNINGER

Vi viser til melding om behandling av personopplysninger, mottatt 03.06.2014. Meldingen gjelder prosjektet:

38942	*Gravid + Kost og mosjonsveiledning for kvinner med svangerskapsdiabetes*
Behandlingsansvarlig	*Høgskolen i Oslo og Akershus, ved institusjonens øverste leder*
Daglig ansvarlig	*Mirjam Lukasse*

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

Personvernombudets tilråding forutsetter at prosjektet gjennomføres i tråd med opplysningene gitt i meldeskjemaet, korrespondanse med ombudet, ombudets kommentarer samt personopplysningsloven og 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/meldeplikt/skjema.html. 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://pvo.nsd.no/prosjekt.

Personvernombudet vil ved prosjektets avslutning, 31.12.2018, rette en henvendelse angående status for behandlingen av personopplysninger.

Vennlig hilsen

Vigdis Namtvedt Kvalheim

Sondre S. Arnesen

Kontaktperson: Sondre S. Arnesen tlf: 55 58 33 48
Vedlegg: Prosjektvurdering

Dokumentet er elektronisk produsert og godkjent ved NSDs rutiner for elektronisk godkjenning.

Personvernombudet for forskning

Prosjektvurdering - Kommentar

Prosjektnr: 38942

Formålet med prosjektet er å utvikle en app som gir kvinnene informasjon om kosthold, mosjon og svangerskapsdiabetes. Kvinnene kan overføre blodsukkerverdier automatisk til appen for å få en enkel fremstilling samt tilpassede råd. Appen skal være tilgjengelig på ulike språk og tilpasset forskjellige kulturer. Appen skal testes i en multisenter randomisert kontrollert studie som utføres på 5 diabetespoliklinikker.

Prosjektet gjennomføres i samarbeid med Universitetssenter Kjeller (Unik), Oslo Universitetssykehus (OUS) og Nasjonalt kompetansesenter for minoritetshelse (Nakmi). Høgskolen i Oslo og Akershus er behandlingsansvarlig institusjon. Personvernombudet forutsetter at ansvaret for behandlingen av personopplysninger er avklart mellom institusjonene. Vi anbefaler at det inngås en avtale som omfatter ansvarsfordeling, ansvarsstruktur, hvem som initierer prosjektet, bruk av data og eventuelt eierskap.

Utvalget informeres skriftlig og muntlig om prosjektet og samtykker til deltakelse. Informasjonsskrivet er godt utformet.

Viser til e-post mottatt den 21.07.2014. Det vil ikke bli innhentet opplysninger om tredjeperson i form av registrering av diabetes i nærmeste familie fra journal.

Det behandles sensitive personopplysninger om etnisk bakgrunn og helseforhold.

Personvernombudet legger til grunn at forsker etterfølger Høgskolen i Oslo og Akershus sine interne rutiner for datasikkerhet. Dersom personopplysninger skal sendes elektronisk eller lagres på mobile enheter, bør opplysningene krypteres tilstrekkelig.

Forventet prosjektslutt er 31.12.2018. Ifølge prosjektmeldingen skal innsamlede opplysninger da anonymiseres. Anonymisering innebærer å bearbeide datamaterialet slik at ingen enkeltpersoner kan gjenkjennes. Det gjøres ved å:
- slette direkte personopplysninger (som navn/koblingsnøkkel)
- slette/omskrive indirekte personopplysninger (identifiserende sammenstilling av bakgrunnsopplysninger som f.eks. bosted/arbeidssted, alder og kjønn)
- slette lyd- og videoopptak

Appendix 5 Recruitment protocol

Gravid+ … på ditt sykehus

BEDRE HELSE FOR MOR OG BARN

1. Du har første kontakten med kvinnen og sjekker om hun tilfredsstiller inklusjonskriteriene. Hvis ja: gå videre til punkt 2.
2. Informer kvinnen kort om Gravid+ studien og gi henne informasjonsbrosjyren. Spør henne om hun vil være med. Hvis ja, gå videre til punkt 3. Hvis hun tilfredsstiller inklusjonskriteriene og ikke vil være med spør du henne om hvorfor hun ikke ønsker å delta. Du fyller ut «skjemaet for begrunnelse for å ikke delta». Det er viktig at du registrerer antall på alle som ikke ønsker å være med og grunnen til dette.
3. Hvis kvinnen ønsker å delta gir du henne samtykkeskjemaet. Kvinnen beholder en del selv. Den andre delen sparer du på.
4. Alle kvinner som ønsker å være med i Gravid+ studien får et klistremerke på helsekortet slik at det er enklere for dere å minne kvinnen på å fylle ut spørreskjema 2 (Q2) i uke 36.
5. Deretter fyller du ut skjema «Rekrutteringsskjema for Gravid+studien med sensitiv informasjon» og «Gravid+ oversiktsskjema» sammen med kvinnen.
6. Nå går du inn på iPaden og trykker på «Add user». Legg inn avdelingens telefonnummer og deretter kvinnenes telefonnummer slik at kvinnen får tilgang til spørreskjemaet, Q1.
7. Du gir kvinnen iPaden og viser henne spørreskjema (Q1) og hjelper henne med å taste inn hennes mobilnummer slik at hun kan fylle ut skjemaet. Etter at hun har fylt ut spørreskjema (Q1) vil det komme opp en melding på iPaden om hun har tilgang til appen eller ikke. Hvis ja: gå videre til punkt 8. Hvis nei: Fortell at hennes bidrag er viktig og minne henne på spørreskjema 2 i uke 36. Det er viktig at du sier til kvinnen at hun skal vise deg den siste siden på iPaden (dvs om hun er med eller ikke).
8. Du gir kvinnen som skal få tilgang til appen koden slik at kvinnen kan logge seg inn på vårt BasicInternet nettverk (passord: basicinternet) og får lastet ned appen på sin mobiltelefon sin. Hun kan også laste ned Gravid+appen hjemme. Du gir kvinnen skjema «Hvordan du laster ned Gravid+appen fra Apple Store».
9. Alle kvinner som er med i Gravid+ studien får nå opplæring i hvordan blodsukkerapparatet Diamond Mini skal brukes. Kvinnene med tilgang til appen får også opplæring i hvordan den automatiske overføringen fungerer.

10. Vis kvinnene som får tilgang til appen hvordan de kan printe blodsukkerverdiene neste gang de kommer til deg. For å gjøre dette må de logge seg på «Gravid Pluss» nettverket (passord: gravidpluss) og så trykke på «printe blodsukkerverdier» i appen.
11. Uke 36: Se etter Gravid+klistremerket på helsekortet. Du henter iPaden slik at kvinnen får besvart spørreskjema 2, Q2.

Ved spørsmål ta kontakt med Iren Borgen (mobil: xxx xx xxx)