UNIVERSITY OF COPENHAGEN

Empowering Patients with Non-Insulin Treated Type-2-Diabetes Through Self-Monitoring of Blood Glucose Levels: An Exploratory Study

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diabetes foreningen

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Abstract

Type 2 diabetes mellitus (T2DM) is a chronic disease that affects approximately 463 million people in the world. (IDF, 2019) In Denmark, T2DM affects approximately 241.400 people. (Diabetesforeningen, 2018) T2DM is an irregularity in blood glucose regulation due to either insulin resistance or insulin deficit. The prevalence of people with T2DM is increasing at an alarming rate. If people with T2DM are not treated in time it would lead to comorbidities such as neuropathy, retinopathy, coronary artery disease, etc. There is evidence that there is a reversible component of β-cell dysfunction in a patient with T2DM. There is also evidence that self-monitoring of blood glucose (SMBG) in patients with T2DM can reduce the HbA1c level. However, there is no clear evidence of the insights of what impacts the blood glucose levels leading to a decrease of HbA1c. This study aims to explore the insights into the impact of blood glucose levels using semi-structured SMBG.

17 participants for this study were recruited through The Danish Diabetes Association Magazine, The Danish Diabetes Association's homepage, and through an ad on Facebook. The design of blood glucose monitoring was semi-structured introducing the 'guess' attribute as a provotype to provoke reflections upon the participants' lifestyle. The participants were chosen through a set of inclusion and exclusion criteria. The participants underwent an experiment for 30 days Data were collected using qualitative research methods in terms of surveys and focus group interviews. The participants were offered telecare by a diabetes nurse. Data collected were analyzed using coding and categorization to collect the insights, experiences, and reflections during this exploratory study.

The results of this study are personas to gain information and type of patients with NIT T2DM in this study. The surveys and the focus group interviews reveal insights, experiences, and reflections in diet, exercise, stability of blood glucose, and the frequency of measurements. At the end of this study, the participants reported that they have obtained insights in the course of their blood glucose levels, how to influence their blood glucose levels with their newly obtained knowledge, and what in their lifestyle should be changed to achieve euglycemia. The ratings of the different insights and experiences showed some similarities but differed which support the fact that patients with T2DM are different and need different treatment plans. It was also reported that 40% of the participants who went to their doctor had a reduced HbA1c level.

Resumé

Type 2 diabetes mellitus (T2DM) er en kronisk sygdom, der rammer ca. 463 millioner mennesker i verden. (IDF, 2019) I Danmark påvirker T2DM cirka 241.400 mennesker. (Diabetesforeningen, 2018) T2DM er en uregelmæssighed i blodsukkerreguleringen på grund af enten insulin resistens eller insulin underskud. Udbredelsen af patienter med T2DM stiger med en alarmerende hastighed. Hvis patienter med T2DM ikke behandles i tide, vil det føre til følgesygdomme såsom neuropati, retinopati, koronararteriesygdom osv. Der er tegn på, at der er en reversibel komponent af β-celle dysfunktion hos en patient med T2DM. Der er også tegn på, at selv-monitorering af blodglukose (SMBG) hos patienter med T2DM kan reducere HbA1c-niveauet. Der er dog ingen klare beviser for, hvad der påvirker blodsukkerniveauet, hvilket fører til et fald i HbA1c. Denne undersøgelse sigter mod at undersøge indsigten i virkningen af blodglukoseniveauer ved hjælp af semi-struktureret SMBG.

17 deltagere til denne undersøgelse blev rekrutteret gennem Diabetesforeningens medlemsblad, Diabetesforeningens hjemmeside og gennem en annonce på Facebook. Designet af blodsukkerovervågning var semi-struktureret og introducerede 'gætte'-funktionen som en provotype til at fremkalde refleksioner over deltagernes livsstil. Deltagerne blev valgt gennem et sæt inkluderings- og eksklusionskriterier. Deltagerne gennemgik et eksperiment i 30 dage. Data blev indsamlet ved hjælp af kvalitative forskningsmetoder og fokusgruppeinterviews. Deltagerne blev tilbudt telepleje af en diabetessygeplejerske. Data indsamlet blev analyseret ved hjælp af kodning og kategorisering for at indsamle indsigter, oplevelser og refleksioner under dette eksplorative studie.

Resultaterne af denne undersøgelse er personas for at få informationer og den type patienter med NIT T2DM i dette studie. Undersøgelserne og fokusgruppeinterviewene afslører indsigter, erfaringer og refleksioner i diæt, motion, stabilitet af blodsukker og hyppigheden af målinger. I slutningen af dette studie rapporterede deltagerne, at de har fået indsigter i forløbet af deres blodsukkerniveauer, hvordan de kan påvirke deres blodsukkerniveauer med deres nytilegnede viden, og hvad i deres livsstil der skal ændres for at opnå euglykæmi. Bedømmelserne af de forskellige indsigter og oplevelser viste nogle ligheder, men adskilte sig, hvilket understøtter det faktum, at patienter med T2DM er forskellige og dermed har brug for forskellige behandlingsplaner. Det blev også rapporteret, at 40 % af deltagerne, der gik til deres læge, havde et reduceret HbA1c-niveau.

Preface

This master's thesis was prepared at The Danish Diabetes Association and the Department of Biomedical Sciences, University of Copenhagen in fulfillment of the requirements for acquiring a Master of Science degree in Medicine and Technology (Biomedical Engineering).

The project start date was 12 October 2020 and the end project date was 12 April 2021 including holidays. The assigned workload of this thesis was 35 ECTS credits.

Copenhagen, April 12, 2021

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Finally, I would like to thank my family for always showing support, understanding and encouragement throughout my entire project period.

Nomenclature

Abbreviations

ACG Active Control Group

BBB Blood-Brain-Barrier

DSAM Dansk Selskab for Almen Medicin

EC Enterochromaffin cell

EEC Enteroendocrine Cell

FFA Free Fatty Acid

FGI Focus Group Interview

GCPR G-Protein-Coupled Receptor

GIP Glucose-Dependent Insulinotropic Peptide

GLP-1 Glucagon-Like Peptide 1

GLUT-1 Glucose Transporter Type 1

GLUT-2 Glucose Transporter Type 2

GLUT-3 Glucose Transporter Type 3

GLUT-4 Glucose Transporter Type 4

HbA1c Hemoglobin A1c

LMM Linear Mixed Models

NIT Non-Insulin Treated

RCT Randomized Clinical Trials

SMBG Self-Monitoring of Blood Glucose

STG Structured Testing Group

T2DM Type 2 Diabetes Mellitus

List of symbols

$t_{1/2}$ Half Life

Contents

CHAPTER 1

Introduction

1.1 Research Motivation

Type 2 Diabetes Mellitus (T2DM)[1] is a chronic disease that affects approximately 463 million people worldwide (IDF, 2019) and in Denmark it affects approximately 241.400 people (Diabetesforeningen, 2018). Due to an irregularity in blood glucose regulation and nutrient storage it can either be related to an insulin deficit or a resistance against the function of insulin. Worldwide, there is an alarming increase in the rate of prevalence due to T2DM. T2DM when not treated may lead to comorbidities in macrovascular- and microvascular diseases. Macrovascular diseases covers coronary artery disease, peripheral vascular disease and cerebrovascular disease. Microvascular diseases covers retinopathy, nephropathy and neuropathy (Parsons et al., 2019).

HbA1c is considered to be the golden standard in glucose control (Manucci et al., 2018). Glucose control requires quarterly visitations to the doctor in order to obtain the long-term blood glucose average which is considered in the treatment plan for a patient with T2DM (The Danish Diabetes Association, 2021). The main drawback of this is that valuable information about the day-to-day blood glucose levels are lost. With HbA1c it is not possible to obtain information about the day-to-day blood glucose levels which hypothetically can aid to elucidate how, why and what affects the long-term HbA1c. Self-monitoring of blood glucose (SMBG) is a method used to obtain the day-to-day information of the blood glucose levels. Multiple studies have shown that there are evidence supporting that patients with T2DM using SMBG have reduced their HbA1c significantly. The methods used in the studies are structured SMBG, unstructured SMBG and telecare. However, the aim of these studies was to reduce HbA1c by using the SMBG method. Even though these studies obtained the day-to-day blood glucose levels they did not obtain the patients with T2DM's reflections, experience nor insights in how, why and what affects their blood glucose levels.

The aim of this study is to empower patients with T2DM by using a semi-structured SMBG method and obtain the reflections, experiences and insights in how, why and what affects their blood glucose levels. A paper-tool method is applied stating only the frequencies of the blood glucose measurements and fields to make own

[1] Due to the scope of this thesis Diabetes Mellitus Type 1 will not be described.

inputs. Additionally, the paper-tool will be used as a 'provotype' which represents the ability to guess the blood glucose levels prior to the measurements. Furthermore the telecare method is applied which is voluntary. This study will not obtain information about the HbA1c values and the day-to-day blood glucose levels. Data of reflections, experiences and insights will be gathered using qualitative interviews in terms of surveys and statements from the focus group interviews.

Chapter 1 includes a presentation of the research motivation of this thesis. Chapter 2 includes a presentation of the clinical background including the pathophysiology of T2DM, comorbidities of T2DM and monitoring of diabetes. Chapter 3 includes a presentation of the overview of the studies within non-insulin treated T2DM and SMBG. Chapter 4 presents the research question and hypothesis of this thesis. Chapter 5 includes the methodologies used in this thesis. The methodologies which will be presented are inclåusion and exclusion criteria, the provotype method, qualitative interviews, coding and categories, focus group interview and interview with a diabetes nurse. In chapter 6 the obtained results will be presented and discussed accordingly. Chapter 7 includes the conclusion of the study of this thesis. Chapter 8 includes the future perspective.

CHAPTER 2

Clinical background

In this chapter, the clinical background of this thesis will be presented. First, the physiology of T2DM is described. Hereby, the metabolism and storage regarding glucose, fat, and protein of the body. Hormonal control regarding the pancreas and its hormones insulin, glucagon, and gut-derived hormones. Then the pathophysiology of T2DM will be described regarding insulin resistance, treatments, macrovascular complications, and microvascular complications. Finally, monitoring of diabetes will be described regarding HbA1c and SMBG.

2.1 Metabolism and Storage

The body's need for energy can be obtained from glucose and fatty acids. There is not always a continuous need for energy sources and therefore the body needs to store them. The liver is capable of this by absorbing glucose and slowly and efficiently secrete glucose. (Scheen, 2014)

2.1.1 Glucose

The brain and the nervous system are dependent on glucose. Without glucose in the brain for more than a couple of minutes, there is a high risk of complications. In severe and prolonged hypoglycemia the brain can die and in moderate hypoglycemia, significant cerebral complications may rise. (Mergenthaler et al., 2013)

Normally in a healthy subject, the blood glucose level when fasting should be between 80 and 90 mg/dL which translates to 4.4 to 5.0 mmol/L. Postprandial glucose will be increased and approximately 2/3 of the glucose floating in the blood will be stored in the liver and converted to glycogen. This enables the body to have a continuous energy supply between meals. To maintain the body functions and the blood glucose levels the liver will secrete glucose into the blood. This feature is called glycogenolysis. However, when the body doesn't need the energy that is left in the blood glucose will be converted into fat or glycogen. On the other hand, if the liver becomes saturated with glycogen which makes it difficult to store more glycogen additional glucose will be converted into fatty acids by the liver and stored as triglycerides in the adipose tissues. Gluconeogenesis is a feature where the liver synthesizes glucose

from lactic acid, glycerol, and amino acids which either are secreted into the bloodstream or stores as glycogen. (The Danish Diabetes Association, 2021) (Mergenthaler et al., 2013)

2.1.2 Fat

Fat is mainly composed of triglycerides and stored in adipose tissue where its functions as an important source of energy (except for the brain, the red blood cells, and the nervous system). Triglyceride is composed of three fatty acids connected with one glycerol molecule. The triglycerides to are broken-down into energy, an lipase enzyme has to initiate the breaking down of the triglycerides into glycerol and fatty acids. Along with glucose, glycerol produces energy and the fatty acids are transported to tissues that need energy. (Galicia-Garcia et al., 2020)

2.1.3 Protein

All body structures such as the bone matrix, the formation of genes, the formation of hemoglobin for red blood cells, and the muscles need protein to function. Protein consists of amino acids which are important for gluconeogenesis. Gluconeogenesis is initiated when the body's metabolic needs are not met with the food intake. There is a confined space of storage and there are different routes for the storage of amino acids. The amino acids can be converted into ketones, fatty acids, or glucose. After conversion, they are stored and used when needed. (ibid.)

2.2 Hormonal Control

2.2.1 Pancreas

To regulate glucose there is a need for hormones. The pancreas secretes hormones that have this function. The islet of Langerhans accounts for 1-2% of the volume of the pancreas that secretes hormones into the bloodstream. There are different cell types in the islet of Langerhans that are essential in blood glucose regulation. There are alpha cells that secrete glucagon, β-cells that secrete insulin and amylin, and delta cells that secrete somatostatin. Blood glucose regulation is also affected by hormones such as gut-derived hormones that can increase the postprandial insulin secretion to maintain the blood glucose levels when there is use of glucose. (ibid.)

2.2.2 Insulin

The peptide hormone insulin has a direct effect on reducing the blood glucose level. Insulin enables skeletal muscles and the liver to absorb glucose as glycogen, disables lipases to convert fat into energy, and prevents glycogenolysis, gluconeogenesis, and

protein synthesis increases. It increases the transport of glucose into fat cells and due to triglyceride synthesis, it also inhibits the intracellular breakdown of stored triglyceride. It also inhibits the breakdown of proteins by increasing the transport of amino acids into the cells. (Wilcox, 2005)

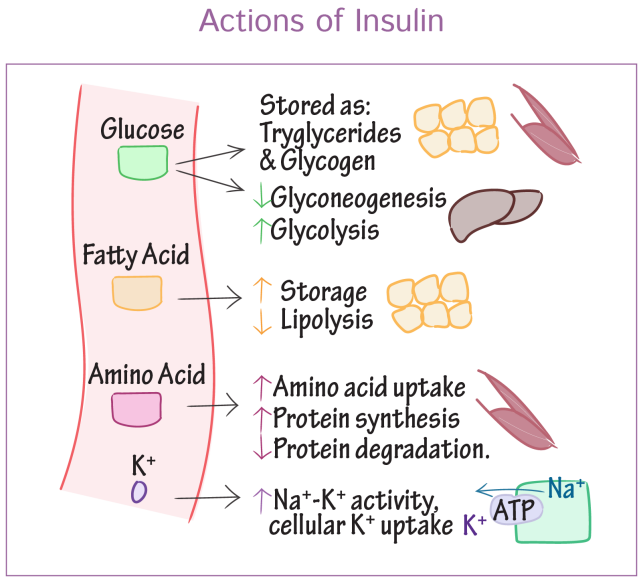


Figure 2.1: Effects of insulin on glucose transportation and storage (Medical and Sciences, 2021).

In the islet of Langerhans, β-cells produce proinsulin which produces active insulin. Proinsulin is a two-polypeptide chain that consists of an A chain and a B chain. To produce insulin in which the body needs an enzyme is located in the β-cell whose function is to convert proinsulin into active insulin and in-active C-peptide. The volume of C-peptide can be measured and show the β-cell function. Especially in people with type 2 diabetes, it can tell whether a need for insulin treatment is necessary. (Galicia-Garcia et al., 2020)

The insulin secretion response is biphasic. When glucose is in the bloodstream the blood glucose level increases in order to maintain the level of blood glucose insulin

is secreted from the pancreas. The level of blood glucose and insulin secretion are proportional. However, as mentioned the insulin response is biphasic which means that the first reaction to elevated blood glucose level is the preformed insulin which has been stored and occurs acutely. The second phase newly synthesized insulin is secreted to decrease the blood glucose level, see Figure 2.2. (Wilcox, 2005)

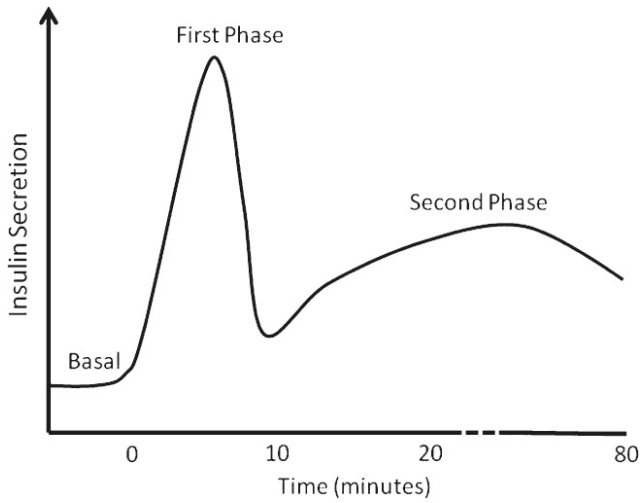


Figure 2.2: Biphasic insulin response to a constant glucose stimulus in healthy subject (Meloni et al., 2012).

The serum insulin level starts to elevate in the first 3-5 minutes where the peak is reached. It takes approximately 2-3 hours for the insulin level to return to its basal level. Insulin is secreted in β-cells and travels through the portal circulation which goes from the abdominal organs through the portal vein and goes into the sinusoids of the liver. 50% of the insulin is metabolized in the liver and the rest is pumped into the bloodstream. Insulin in the plasma has a half-life, $t_{1/2}$, of 4-6 minutes minutes where it binds to the membrane receptor of the target tissues. (Duckworth et al., 1998)

As mentioned, for glucose to be able to enter a cell, insulin is needed. Insulin binds to a target cell by connecting itself to a membrane receptor, hereby the α subunits of the insulin receptor. The insulin receptor contains two α subunits that reside in the membrane of the cell and extends to the extracellular space. This enables insulin to connect to the mentioned subunits. The insulin receptor also contains β subunits that reside in the intracellular space in the cell.As a result of this, different enzymes become activated the effect of insulin is exerted. Cell membranes are impermeable to glucose and therefore when insulin binding occurs there are glucose transporter carriers, that carry glucose through the membrane. The glucose transporters in class

I range from GLUT-1 to GLUT-4 proteins. GLUT-1 proteins reside in every tissue of the body. Besides the rest of the GLUT protein family, GLUT-1 does not need insulin to be activated. GLUT-2 is mainly the transporter for glucose into β cells and hepatocytes after a meal when the blood glucose level is increased. GLUT-3 has a high affinity in the BBB in the brain. GLUT-4 becomes activated in the adipose tissue and the skeletal muscle, which is insulin-dependent. (Simpson et al., 2008)

2.2.3 Glucagon

Glucagon is a hormone secreted from the α-cells in the pancreas. Its function is to raise the blood glucose level when an emergency occurs. To control the blood glucose it is dependent on a membrane-protein called G-protein-coupled receptors (GPCRs). When activated a sequence of actions occurs inside the cell. For glucagon to function it needs to bind to a glucagon receptor which is located in the liver and muscle cells. The result of this is to release glucose into the bloodstream. (Wein, 2017)

2.2.4 Gut-Derived Hormones

The gut hormones that are going to be described in this section are serotonin, glucose-dependent insulinotropic peptide and glucagon-like peptide 1 by which are secreted by gut enteroendocrine cells (EECs).

2.2.5 Serotonin (5-HT)

Serotonin (5-HT) is secreted by enterochromaffin cells (EC) and can be found in the gut. EC cells can recognize gut fatty acids, glucose, fructose, etc. In preprandial conditions, serotonin (5-HT) and glucagon serve to maintain normal glycemic regulation by increasing hepatic gluconeogenesis and glycogenolysis. Simultaneously inhibiting the uptake of glucose and synthesis of glycogen. The result is the preservation of energy and weight gain. It has been shown that circulating serotonin are increasing in patients with type 2 diabetes and obese persons. (Sun et al., 2019)

2.2.6 Glucose-Dependent Insulinotropic Peptide

K cells in the proximal small intestine secrete glucose-dependent insulinotropic peptide (GIP) when stimulated by nutrients. GIP receptors can be found on pancreatic islet cells, adipocytes, bone cells, and the central nervous system. 70% of the post-prandial insulin represents the effect of GIP and glucagon-like peptide 1 (GLP-1). The functions of GIP are to inhibit β cell apoptosis, increase β cell proliferation and secretion of insulin. In patients with type 2 diabetes, the level of GIP in their body is decreased which is one of the predisposing factors to type 2 diabetes. Furthermore, GIP can also be a factor that a first degree relative to a patient with type 2 diabetes is predisposed to develop type 2 diabetes during the lifetime. Moreover, in patients

with type 2 diabetes when being in the condition of hyperglycemia a glucagonotropic effect can be experienced which worsens the glycemic control. (Sun et al., 2019)

2.2.7 Glucagon-Like Peptide 1

Enteroendocrine L cells secrete glucagon-like peptide 1 which is an incretin hormone that is released 10-15 minutes postprandial. The function of GLP-1 is to maintain insulin regulation. Glucose regulation is done by increasing insulin which decreases the production of glucose in the liver. The effect of GLP-1 is exerted by GLP-1R that signals to the brainstem to reduce food intake and induce satiety and regulate the energy balance. (ibid.)

2.3 Type 2 Diabetes Mellitus

T2DM is characterized as non-insulin-dependent diabetes. This type of diabetes consists of hyperglycemia and an irregularity in pancreatic β-cells function. This means that pancreatic β-cells have dysfunction in the production of insulin. In connection with relative insulin deficiency target membrane receptors becomes insulin resistant which leads to an increase in pancreatic beta-cell activity. In the beginning, due to the high activity of pancreatic β-cells hypertrophy and hyperinsulinemia occurs. The liver starts to increase its glucose production and secrete it into the bloodstream which adds to the hyperglycemic condition.

2.3.1 Insulin Resistance

Insulin-responsive cells sensitivity to circulating insulin is decreased. Insulin resistance may be the result of decreased insulin secretion by β-cells, insulin antagonists in the plasma, or impaired insulin response in target tissues. (Galicia-Garcia et al., 2020) Growth hormone and glucagon-like peptide 1 (GLP-1) interact with insulin postprandial and to prevent hypoglycemia caused by insulin, glucagon will regulate the blood glucose level. Insulin resistance may be caused by counteracting hormones such as catecholamines that promote lipolysis and glycogenolysis and glucocorticoid that promotes muscle breakdown, gluconeogenesis, and lipolysis. Skeletal muscle, adipose tissue, and the liver are insulin-sensitive organs when one of them is defective may lead to systemic insulin resistance and T2DM. (ibid.)

In the skeletal muscle, the process of glucose metabolism is that insulin stimulates glucose synthesis. To allow the uptake of glucose, GLUT-4 needs to shift from the intracellular compartments, endosomal recycling compartments, and trans-Golgi networks to the plasma membrane. Tyrosine kinase activity is essential for glucose metabolism and impairment of any of the phosphorylation sites can impair this activity thus impairing the insulin sensitivity in the skeletal muscle. (ibid.) While physical

activity enhances glucose utilization by counteracting adipokines in the skeletal muscle evidence has suggested an association between obesity and chronic inflammation may contribute to insulin resistance. (Wu and Ballantyne, 2017)

There are two pathways by which insulin can affect adipose tissue. Firstly, insulin stimulates glucose uptake and synthesis of triglyceride. Secondly, insulin suppresses triglyceride hydrolysis and stimulates the uptake of free fatty acid (FFA) and glycerol from the circulatory system. Adipose insulin resistance is when an inhibited stimulation of adipose tissue by insulin occurs. This may suppress lipolysis, glucose uptake and increases the release of FFA into plasma. Hyperglycemia increases further due to the activation of lipolytic enzymes. The reason is due to inhibited AKT activity that inhibits GLUT-4 shift to the membrane. (Galicia-Garcia et al., 2020)

In the liver, the production of glucose is regulated by insulin and glucagon. Glucagon increases hepatic glucose production. Insulin decreases the hepatic production of glucose and promotes glucose storage as glycogen. However, if the liver is insulin resistant glycogen synthesis is inhibited, insufficient suppression of glucose production, increased lipolysis and increased pro-inflammatory protein CRP. (ibid.)

2.4 Reversible and irreversible component of β-cell dysfunction

There are evidence that β-cell apoptosis contributes to atrophy of the capacity of insulin secretion. Factors that contributes to the damage of insulin secretion and apoptosis of β-cells includes inflammation, dysregulation of cytokines and chronic exposure of high levels of islet cell amyloid, hyperglycemia and free fatty acids. It has been found that glucotoxicity and lipotoxicity contributes to the damage of the body's normal regulation of blood glucose levels which are components that can be regulated. The current measures of β-cell function can not accommodate a scale for reversibility or irreversibility of β-cell function. In spite of this it is a concept that is overlooked and may contribute to a better treatment plan for patients with T2DM. (Retnakaran, 2014)

In Figure 2.3 it can be seen that the component of reversibility of β-cell dysfunction decreases with the years of having diabetes. As mentioned in the previous section that in T2DM hypertrophy of pancreatic β-cells occurs. But in time when T2DM is not treated properly atrophy of the pancreatic β-cells can occur.

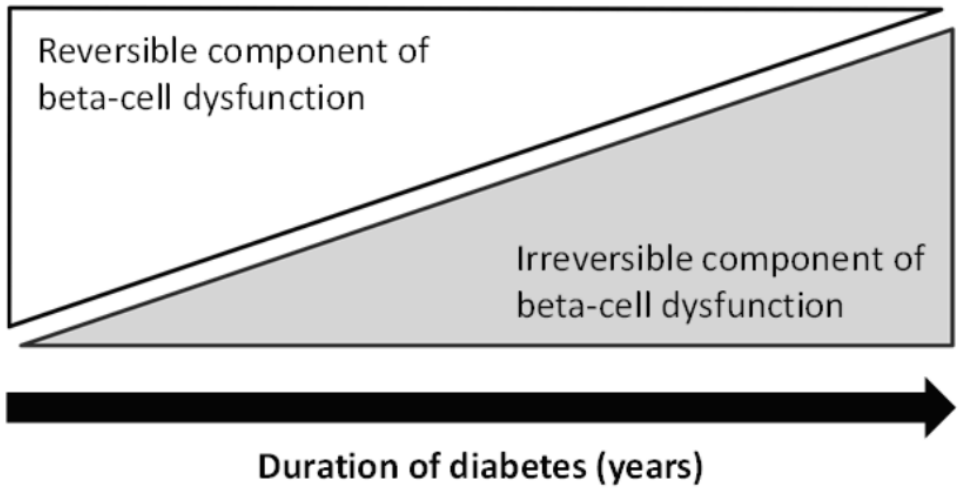


Figure 2.3: The reversible- and irreversible component of β-cell dysfunction as a function of duration of diabetes (years) (Retnakaran, 2014).

2.5 Individual Treatment Goals

According to the guideline formulated by The Danish Diabetes Association, Dansk Endokronologisk Selskab and Dansk Selskab for Almen Medicin (DSAM) it is impossible to create a general guideline for all patients with type 2 diabetes (2021). Instead, the cooperating organizations formulated a guideline stating the recommended optimum values for HbA1c. (The Danish Diabetes Association, 2021)

- 48 mmol/mol should be the goal the first many years with diabetes
- 53 mmol/mol should be an optimal goal when being diagnosed with diabetes for many years
- 58 mmol/mol should be the optimal HbA1c value for patients with cardiovascular disease

2.6 Monitoring of Diabetes

In this section definitions and mechanisms behind the long-term and short-term blood glucose control methods will be described.

2.6.1 Retrospective HbA1c

The unanimous golden standard for glycemic control is glycated hemoglobin (HbA1c). It determines the long-term glycemic average for the past 120 days. HbA1c is a reflection of the glucose in the blood and is formed when exposed to erythrocytes during its lifespan. (Unnikrishnan et al., 2012) (Boutati and A., 2009)

HbA1c is seen as a risk predictor in the terms of diabetes management. It has been shown in the Diabetes Control and Complications Trial (DCCT) that diabetic complications are closely related to HbA1c. (Nathan, 2014) In the study of HbA1c variability clinical evidence has shown that long-term fluctuations in HbA1c may predict the risk of vascular complications and mortality in patients with type 2 diabetes. (Mehring et al., 2016)

However, HbA1c is a retrospective measure of the average blood glucose levels for the past 100-120 days which means that the 'data' in between is not provided. (Boutati and A., 2009) As seen in Figure 2.4 day 0-30 contributes with circa 50% of the average blood glucose concentration, 30-60 days contributes with circa 25% and finally, 60-120 days contributes with circa 25%. (Leow, 2016) (Goldstein et al., 2004)

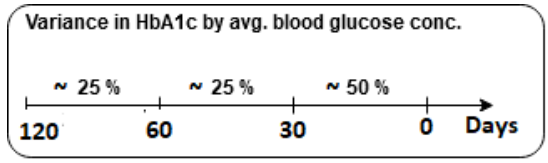


Figure 2.4: Variance in HbA1c by the average of blood glucose concentration and percentages contributing to HbA1c.

2.6.2 Self-Monitoring of Blood Glucose (SMBG)

The SMBG method provides real-time data of the blood glucose levels. The process of blood testing is to prick the finger with a lancet and place the blood on the test strip attached to a blood glucose meter. The blood glucose meter will show the actual level of the blood glucose. This information shows the real-time data by which is the advantage over the retrospective HbA1c. Furthermore, this information can give the possibility to develop an individualized blood glucose profile giving the doctors the capacity to create an individualized guide, regimen, and treatment choices suited for diet and exercise. (Boutati and A., 2009)

In Figure 2.5 a comparison of HbA1c and SMBG for one month is shown. To emphasis the importance of SMBG it can be seen that the day-to-day blood glucose levels of HbA1c are unknown by which can give a disadvantage to the empowerment

of a patient with T2DM. Applying the SMBG method for a consecutive period may empower the patient with T2DM and realize a pattern which may lead to a reduction in HbA1c. (Boutati and A., 2009)

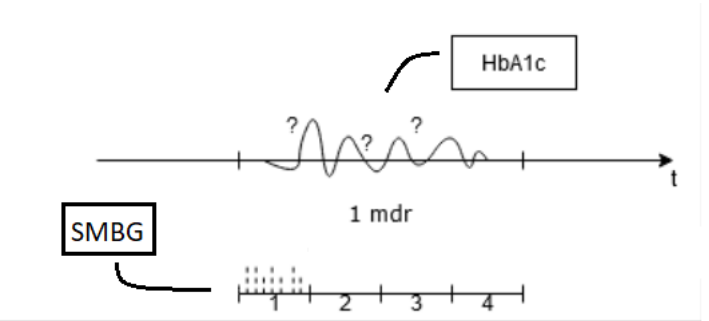


Figure 2.5: Limitation of 'real-time data' in HbA1c in comparison to SMBG.

To aid the understanding and the realization of the pattern which may occur when using SMBG the recommended blood glucose target levels according to NICE (NG17, 2015) shown below:

- Fasting glucose level should be 4-7 mmol/L
- Plasma glucose level before meals should be 4-7 mmol/L
- After at least 90 minutes after meals below 8.5 mmol/L

CHAPTER 3

State-of-the-art

In this chapter the most recent trends in self-monitoring of blood glucose levels will be described. The state-of-the-art review will include the methods used in the articles.

(Parsons et al., 2019) conducted a 12 month RCT study to examine the impact of structured self-monitoring of blood glucose with or without TeleCare support. The RCT was conducted in order to determine if the use of structured SMBG in a large population of people with non-insulin treated (NIT) type 2 diabetes would improve HbA1c and also if the consultation with a trained study nurse provided any benefit. The 323 participants were randomized into three groups hereby a control group, a SMBG group and a SMBG group receiving TeleCare. During the study the participants were under the care of their own doctors and changes of medications were prescribed when it was recommended by the study team. The authors perform statistical analysis from a linear mixed model for repeated measures where the primary outcome was HbA1c. They also included other covariates using iterative Markov chain Monte Carlo methods. The results of this study were that HbA1c levels decreased from 71 mmol/mol to 67 mmol/mol in the control group. A HbA1c reduction from 70 mmol/mol to 57 mmol/mol in combined SMBG group where at 12 months the mean HbA1c reduction was 12.2 mmol/mol compared to 3.3 mmol/mol in the control group. There was no significant reduction difference in comparison to the two SMBG groups. The findings have shown that it was three times more likely that the structured SMBG group would reach the target of $\leq$53 mmol/mol compared to the control group.

(Polonsky et al., 2011) conducted a 12 month prospective cluster-randomized study with the intent to investigate the effect of structured SMBG intervention on glycemic control on poorly controlled patients with NIT T2DM. Frequency, timing and intensity of treatment modification and general well-being of this SMBG intervention was assessed in correlation to the resulting effect. The method behind this study was to develop a Structured Testing Program (STeP) where one group of patients used structured SMBG with enhanced usual care (Structured Testing group [STG]) and the other group of patients was the active control group (ACG) that only received enhanced usual care. Enhanced usual care provides diabetes management, free blood glucose meters (Accu-Chek system) and strips and point-of-care A1c capability. The participants underwent 5 screenings in the 12 month period and data about medical history, physical examinations, A1c samples and all medications

were gathered. All participants completed questionnaires developed by the authors and reported changes made to their diabetes treatment. The participants received instructions and guidance for the blood glucose meters and blood glucose patterins and through the blood glucose meters the participants recorded and plottet a 7-point SMBG profile which were reviewed by the physicians. The physicians called the participants via telephone a week prior their next appointment about potential changes to their diabetes management. Statistical analysis were conducted to determine A1C levels by using two-sample t-test (α=0.05 and SD=1.5%). The change in A1C levels were analyzed by using Linear Mixed Models (LMM) to compare the two groups. The results were that the A1C levels were reduced in both groups where the STG group showed a significant greater mean reduction in A1C that in the ACG group, respectively -1.2% vs. -0.9%. Per protocol analysis showed that a greater reduction mean in the STG group than in the ACG group, respectively -1.3% vs. -0.8%.

(Williams et al., 2020) conducted a 12-month randomized controlled trial to determine whether structured SMBG resulted in a significant improvement in HbA1c and if nurse-led telecare had an impact on HbA1c. The study employed a variety of measures to define glycemic control such as mean BG, fasting BG, and HbA1c. Participants were randomized into three groups; structured SMBG with telecare, structured SMBG without telecare, and a control group without structured SMBG. For the groups with structured SMBG, the BG (fasting BG, BG 2 hours after breakfast, before and 2 hours after main meal two days a week) and HbA1c every 3-month data were obtained and they received technical and standardized SMBG education. For non-SMBG only 3 month HbA1c data were obtained. The results showed a significant reduction in HbA1c -7.0 mmol/mol in the groups with structured SMBG. However, no significant differences were found between the two groups whether telecare was provided or not.

(Manucci et al., 2018) conducted a meta-analysis of randomized controlled trials with the aim to assess the published articles of the effect of SMBG on HbA1c in patients with NIT T2DM. Furthermore look into the predefined schedule for glucose measurements and use of SMBG data by physicians to make changes in diabetes medication. The authors compared RCTs of minimum 24 weeks and compared SMBG vs. no SMBG, structured SMBG and unstructured SMBG. The analysis show when comparing SMBG with no SMBG a significant reduction on HbA1c when using SMBG. However, the reduction on HbA1c was greater when the SMBG data were analyzed by physicians and the participants received changes in their diabetes medication. When comparing structured SMBG versus unstructured SMBG the findings are similar to the latter. A significant reduction on HbA1c was found in the group of structured SMBG who received medical adjustments from physicians.

3.1 Summary of the State-of-the-art

The reason behind the choice of these articles in the literature review is to show that there are findings that suggests that SMBG may aid to reduce HbA1c in patients with NIT T2DM. Although most of the authors do not obtain information about the reflections the participants have had prior, during and after the different studies. For instance in the study of (Polonsky et al., 2011), trained physicians/staff analyzed the data the participants provided but it was not disclosed if the participants exactly knew what impacted their blood glucose levels. Interpretation of their data and recommendations came from trained physicians. It was also disclosed that many from the STG group found it too difficult to carry out. In the study of (Williams et al., 2020) data related to potential changes made in diet and or physical activities were not provided. Even though their finding showed a significant reduction of HbA1c, what, how and why exactly this reduction to HbA1c occurred is still unclear.

The problem with the methods used in the presented articles is that how, when and why are not disclosed in order to reveal why SMBG may aid to the reduction of HbA1c. There is a need to empower the patients with NIT T2DM and to explore what exactly affects their blood glucose. To cope with this problem the exploratory study conducted in this thesis will recruit patients with NIT T2DM and methods described in 5.3 to intrigue them into reflection with focus on blood glucose using semi-structured SMBG method.

CHAPTER 4

Hypothesis

In this chapter the research question and the hypothesis will be formulated according to the aim of this thesis.

After the clarification on the pathophysiology behind NIT T2DM and multiple studies conducted with the aim to reduce HbA1c by using SMBG. It has been found using SMBG reduces HbA1c significantly. However, the insights found by using SMBG remains unclear.

The research question in this thesis:

'Do patients with type 2 diabetes know what affects the blood glucose level without self-monitoring of blood glucose?'

The literature review has suggested that by using SMBG the reduction on HbA1c is significant. Furthermore, the authors claims that the SMBG method for patients with NIT T2DM is still unclear and there is a need for further explorations in the field. Therefore this thesis hypothesize the following:

'Patients with type 2 diabetes will obtain knowledge of what influences their blood glucose levels, by performing multiple daily blood glucose measurements'.

CHAPTER 5
Methodology

In this chapter the theory behind data collection and analysis conducted in this thesis will be described.

5.1 Inclusion and Exclusion Criteria

In this section the inclusion and exclusion criteria can be seen in table 5.1 underneath:

Inclusion criteria	**Exclusion criteria**
- NIT T2DM	- T1DM
- Own blood glucose meter	- T2DM on insulin
- Be able to buy the 'Start kit' from TDDA - 150 lancets and teststrips (1500 DKK)	- Unable to buy the 'Start kit' from TDDA
- Be able to respond to the minimum of 2 surveys	- Unable to respond to the minimum of 2 surveys

Table 5.1: The inclusion and exclusion criteria that are required in the project 'Kend dit blodsukker' conducted at The Danish Diabetes Association.

5.2 Study Design and Participants

In this sections the study design and participants can be seen in table 5.2 underneath:

Type	Specifications
Study Design	Exploratory Design
Type of Data	Primary Data: Qualitative and Quantitative Data
Participants and Location	- 16 Participants with NIT T2DM, - Located in Denmark, - Danish Speaking, - Recruited through TDDA Magazine, TDDA Homepage and Facebook
Data Collection Methods	Structured Interviews: Surveys Semi-Structured Interviews: Focus Group Interviews
Aim of Data Collection	Collection of Insights, Experiences and Reflections

Table 5.2: This table shows the study design and participants of this thesis.

5.3 Provotype - Guessing The Blood Glucose

Provotyping is a concept that usually comes from the area of system design. The idea behind this concept is to use the conflicts of perception of an area of interest and embody the tensions within and around the area of interest. Provotype is a new concept the in the field of design. The idea behind this concept is to provoke the users by using the tension from within and around the area of interest. The conflicting perceptions will be embodied in the provotype. One of the outcome is provocation upon reflection. (Boer and Donovan, 2012)

In this thesis provotyping is incorporated in the development of the template of the blood glucose measurements which can be seen in Appendix A.1.

5.4 Qualitative Interviews

To get the full potential of the survey the questions in this exploratory study will be open-ended. While a survey is often conducted with closed-ended questions, open-ended questions suit the purpose of this exploratory study better. The reasoning behind open-ended questions is to unveil the full potential this survey can have. Therefore the surveys given to the respondents are as unbiased and open as possible. It is expected that by setting open-ended questions the respondents can answer with precisely what they feel like answering. This can encourage the respondents to brainstorm and provide spontaneous answers without influence from a earlier question or the question itself.

5.4.1 Survey 1

The questions for survey 1 can be seen in table 5.3 below. Survey 1 was given to the participants the first day of the one month period this exploratory study was carried out.

Survey 1	
No.	**Questions**
1	Are you a male or a female?
2	How many years have you been diagnosed with type 2 diabetes?
3	Have you performed multiple daily blood glucose measurements for a period of time before?
4	How many periods?
5	Was it a good experience?
6	Please elaborate (on question 5)
7	Why are you curios into an insight in your blood glucose?
8	Do you have an overview of your daily blood glucose level?
9	Do you have any general comments before the beginning of the experiment?
10	Can we contact you during this experiment?

Table 5.3: This table contains the questions from survey 1.

5.4.2 Survey 2

The questions for survey 2 can be seen in table 5.4

Survey 2	
No.	**Questions**
1	Have anything surprised you regarding the execution of blood glucose measurements?
2	Did anything surprise you by performing the blood glucose measurements?
3	What were your experiences regarding execution of blood glucose measurements?
4	Can you mention 3 advantages of performing daily blood glucose measurements?
5	Can you mention 3 disadvantages of performing daily blood glucose measurements?
6	Do you imagine that the insights in your blood glucose levels would change your everyday choices from now on?
7	How many weeks did you perform daily blood glucose measurements?
8	How many blood glucose measurements did you typically perform daily?
9	Did you use the beforehand given template for blood glucose measurements?
10	Do you possibly have inputs for improvement of the template for blood glucose measurements or the project 'Kend dit blodsukker'?
11	What are you inputs?
12	Did you use other materials/actions other than the given template in the regard in measuring your blood glucose measurements? Have you done something or bought something that have made it easier for you to control the execution of your daily blood glucose measurements?
13	Which materials/actions?
14	From your experiences with daily blood glucose measurements would you recommend this to others with type 2 diabetes?
15	Do you think that performing SMBG have given you a better understanding on what affects your blood glucose?
16	Do you have any comments to the project 'Kend dit blodsukker' in general?

Table 5.4: This table contains the questions from survey 2.

5.4.3 Survey 3

The questions for survey 3 are based on the analysis of survey 1, survey 2 and the FGIs. The questions for survey 3 can be seen in table XX underneath:

Survey 3	
No.	**Questions**
1	Do you still perform blood glucose measurements after the end of the project?
2	Do you measure: Daily, Weekly or Monthly?
3	How often do you measure your blood glucose level?
	How much do you agree with the following insights and experiences?:
	- Stress, depression results in high blood glucose?
	- Vegetables does not increase the blood glucose?
	- Cabbage decreases the blood glucose?
	- The template was useful to conduct the project?
	- There is a need for a fixed template for blood glucose measurements?
	- There is a need for an unfixed template for blood glucose measurements?
4	- Family/acquaintances/colleagues makes it easier to conduct this project?
	- Point in time for meals have a significance for the blood glucose?
	- Too many finger pricks can lead to pain and demotivation?
	- Walks can decrease the blood glucose level?
	- Fixed diet does not help in the long run?
	- Too high blood glucose can cause nausea?
	- Too high blood glucose can cause headache?
	- Circadian rhythm affects the blood glucose level?
5	State 3 specific insights/experiences you take into account in your daily routine since the end of the project "Kend dit blodsukker"
6	Have acquired new insights/experiences?
7	Can you state up to 3 specific insights/experiences that you do not take into account in your daily routine?
8	How have your acquired insights affected your behaviour?
9	Have been at your doctor since the end of the project?
10	Have your HbA1c level been measured after November 2020?
11	What is the level of your HbA1c compared to the level before your participated in this project?

Table 5.5: This table contains the questions from survey 3.

5.5 Coding and Categorization

In order to interpret the feedback from the surveys the method of coding and categorization is used. To help capture what responses is about assigning codes to the words and phrases aid to analyze and summarize the results from the surveys. The type of qualitative data analysis is content analysis by which includes categorization, tagging and thematic analysis. The result of this type of data analysis is insights of behavioural data. (Linneberg and Korsgaard, 2019)

The analysis of the qualitative data is conducted manually and coding of the data is inductive which means that the codes and categories are not generated prior to the analysis. All the data from the surveys are read through to get an overview of data and to create the first set of codes. The data are read through again in more detail altering the codes. The codes will be categorized and the categories with the highest frequencies are identified. (ibid.)

5.6 Focus Group Interview

In this thesis the qualitative research method, Focus Group Interview (FGI), has been applied in order to achieve a closer objective at the insights and experiences given from the respondents which is harder to interpret from the surveys.

This research method is a pre-designed interview developed in this thesis. The participants are divided into two groups of five and three participants. The participants in each group discussed the questions and themes among each other given in table 5.6. The FGI is semi-structured which enables the course of the discussion to go in favor of the participants. However, the role of the researcher in this thesis is to insure that the course of the discussion stays within the main theme of the research. This allows the researcher to achieve a better understanding of the in-depth insights given from the respondents. However, the issue with FGI is that there is a lack of any statistical representation possibilities when conducting this method but rather giving the in-depth insights from a broad and freedom inducing interviews. (Ciesielska and D., 2018)

The researcher is a vital and active part of the interviews. The role of the researcher is to create questions, regulate the depth of the discussion, the order of the interview, and the language to accommodate for the responses given in the interview. The impact of the respondents is crucial to the course of the interview as they can affect the outcome. In order not to force a specific answer from the respondents the researcher has to ask open-ended questions. (ibid.)

Unstructured transcription have been applied to the analysis of the FGIs. The main goal of the FGIs was to gather the insights, experiences and reflections upon the blood glucose measurements the participants conducted. The results were used to form question 4 in survey 3 to be rated which can be seen in table 5.5.

5.6.1 Interview Guide for Focus Group Interview

After the analysis of survey 1 and survey 2 the interview guide used to conduct the focus group interviews can be seen in table 5.6 underneath:

Themes	**Interview Questions**
Briefing and Presentation (5 min.)	- Presentation of my self, my thesis and the agenda of the FGI - Ask for a presentation of each participant, how they discovered this project and their motivation - Inform the participants of survey 3
Guess of the Blood Glucose Levels (15 min.)	- How did the guessing go? - Did it give motivation to change the daily routine? - Which emotions were bound with guessing? (Good/bad?)
Daily blood glucose measurements + Solutions (15 min.)	- Which tools did you use? - How was the glucose meter used in social contexts? Workplace? - Which obstacles occurred with SMBG?
Reflection of BG level and new insights (15 min.)	- Which experiences were begotten with SMBG? - Which surprises occurred with SMBG? - How were the BG levels and new insights reflected upon?
Social Conditions (10 min.)	- Have anybody been involved in the process and if so, how?

Table 5.6: Interview guide used in the focus group interviews.

5.7 Interview with the Diabetes Nurse at The Danish Diabetes Association

As a part of the project, the participants had the opportunity to talk with a diabetes nurse during the duration of the project. The diabetes nurse is a part of the Danish Diabetes Association and has multiple years of experience in T2DM.

The motivation the participants stated in survey 1 were used to launch the conversation between the diabetes nurse and the participants in their first telephone session. The setting of the sessions were informal one-to-one sessions with a duration of 7-15 minutes each. The diabetes nurse would make sure that there was enough time and let them speak freely about their well-being in the project.

The vast majority of the participants mentioned that they have a lot of faith in authority and do not dare to speak against their doctor. However, they feel that the sessions with their doctor are too fast. The sessions with the diabetes nurse were not only to speak about their blood glucose levels but rather about their well-being in general. Mostly the subjects were about diet and exercise. Often there were doubts about the diet and how the blood glucose levels would react to something that is seen as healthy. For instance, fruit is seen as a healthy food but fruit contains fructose it would increase the blood glucose level which they should have in mind. As mentioned, a lot of the participants would have a guilty conscience if they have had too much sugar on the weekends. They would speak freely about it with the diabetes nurse and the nurse would advise them to be cautious and that it is okay to have a taste of e.g. cake once in a while which would be better than trying to keep away from sugar at all.

In the study of (Williams et al., 2020), it was stated that telecare did not provide additional benefit in reduction of HbA1c. The study of (Parsons et al., 2019) also supports the findings but both of the studies used structured SMBG and stated that the control group that received telecare did benefit in reduction of HbA1c. A suggestion given from (ibid.) however is that even though the study provided no significant contribution to a reduction in HbA1c when using structured SMBG, telecare can help those with a higher HbA1c and in general help the participants to maintain engagement in the exploratory study which is why telecare is provided in this study.

5.8 Personas

The use of personas is widely used to create products or services. It is a fictional representation of the characters that might be a user for a certain product or service, yet developed with real data. It is an abstract form of representation that was first seen in the field of marketing but rapidly saw its way into many other areas as well. The method behind personas includes ethnography and interviews to create different

representations of the characters that might be potential users. It is important that the data used to create the personas are real data and not fictional. (Pruitt and Grudin, 2003) As mentioned before the data can come from interviews and in this thesis the data are retrieved from the surveys and the focus group interviews. It is also important to create multiple personas in order to represent different groups. (ibid.) Due to the number of participants in the 'Kend dit blodsukker' project four different personas have been created (see section 6.3). There must also be a biography about the fictional characters. The personas can include different attributes that is found important in this thesis.

The attributes chosen to be included in the personas are as the following:

Attributes:

- Age
- Occupation
- Gender
- Motivations
- Goals
- Routines
- Biography
- Motto

CHAPTER 6

Results and Discussion

In this chapter the results from the project 'Kend dit blodsukker' will be presented and discussed. The results obtained in this thesis are from the results of survey 1, survey 2, personas and survey 3. It should be noted that the results from this exploratory study differ from the results of the work shown in the state of the art. Furthermore, parallels between the results in this thesis and the work of the authors in the state of the art can not fully be met.

6.1 Survey 1

The result for survey 1 can be seen in appendix A.2. In total 15 responded to survey 1 and the gender distribution of the survey were 67% females and 33% males.

In Figure 6.1 corresponds to question 2 (see section5.3) and it was asked for the duration of the diagnosis of type 2 diabetes. It can be seen that 27% have been diagnosed with T2DM between 0-2 years, 20% have been diagnosed with T2DM for 2-4 years, 7% have been diagnosed with T2DM for 5-7 years, 13% have been diagnosed with T2DM for 8-10 years and 33% have been diagnosed with T2DM for over 10 years. This result is due to the limited size of participants and not setting the criteria of having evenly distributed duration of diagnosis.

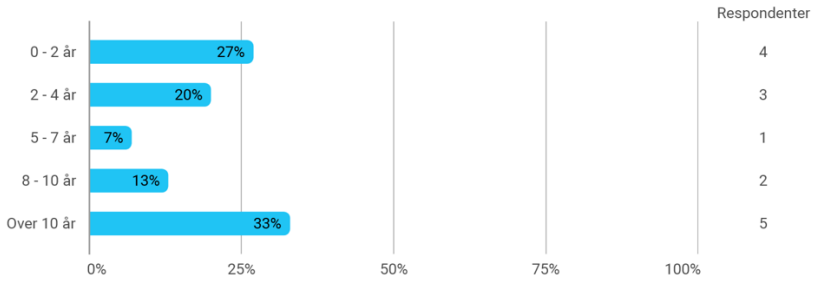


Figure 6.1: How many years have you been diagnosed with type 2 diabetes?.

100% of the respondents also reported that they have had a good experience with

daily blood glucose measurements which they elaborated on. The elaboration of the latter was coded and categorized which corresponds to question 6 seen in Table 6.1.

Categories	Occurrence	Statements
Diet and exercise	7/15	1. "Reassuring to measure the result which can depend on exercise and diet." 2. "Better understanding on foods impact on the blood glucose." 3. "[...] how my blood glucose is impacted - when I am at work - at home - have been exercising - been at a party etc." 4. "I had like to follow and see if what I eat affects my blood glucose the least possible."
Stability of blood glucose	6/15	1. "The measurements can provide an update but also provide the changes due to diet and exercise." 2. "I have often done it multiple times a day when I have not felt so good to see if it was because of my blood glucose."
Medication	1/15	1. "It was in the beginning of my diagnose where it could give me an indication of what happened after the tablet treatment was initiated."

Table 6.1: This table shows the categories, occurrences and statements given to question 6 in survey 1 by the respondents.

Question 7 which was about why they were curios after an insight in their blood glucose resulted in the categories seen in Table 6.2

Categories	Occurrence	Statements
Diet and exercise	4/15	1. "Interested in reducing the blood glucose a bit more - via help from change in diet - exercise can only be increased minimally do this much as I pretty much are in the gym everyday and bikes between 25-40 km daily, so there is only the diet." 2. "To better be able to act according to food and exercise and what impact it has."
Stability of blood glucose	4/15	1. "Experience that it from times to times can vary a lot during the day." 2. "Try to live healthy and bring it down." 3. "Because I have a little trouble controlling my blood glucose so my HbA1c is too high."
Overview/Active Action	9/15	1. "So I can act on it." 2. "To better understand how I can affect my blood glucose and hold it stable." 3. "I wish to know if there is a progress or just to be observant on my numbers."

Table 6.2: This table shows the categories, occurrences and statements corresponding to question 6 in survey 1.

From the analysis seen in Table 6.1 and 6.2 it can be seen that it is mainly diet, exercise, stability of blood glucose and active action that have made them realize what can be the benefited from using SMBG. Even though, the participants have had good experience with SMBG prior to the experiment it is indicated that they need

more insights to be able to reduce their HbA1c. There is also an indication that they do know that T2DM is a serious disease and that they want to take action in order to become more healthy. Knowing the possible benefits from using SMBG seems to be the main motivation for participating in this study.

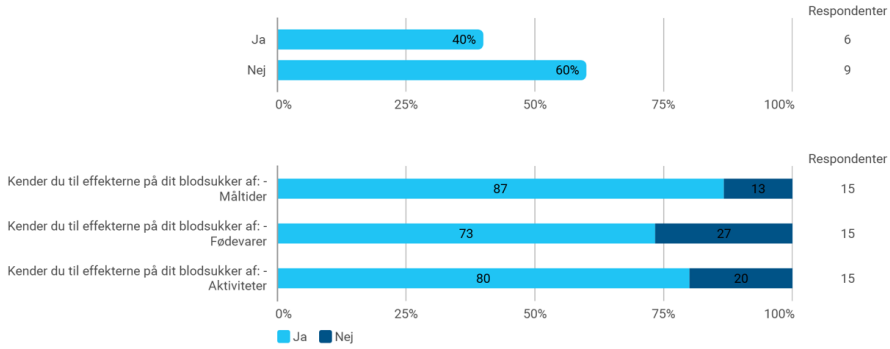


Figure 6.2: Do you have an overview of your daily blood glucose level?.

In Figure 6.2 40% of the respondents reported that they have an overview over their daily blood glucose levels and 60% responded that they do not have an overview of their daily blood glucose levels. It was also reported in Figure 6.2 that 87% of the respondents know the impact of meals on blood glucose, 73% know the impact of food on blood glucose and 80% know the impact of activities on blood glucose. These results were not expected as it was expected that there would be a higher rate of not knowing the impact of blood glucose according to meals, food and activities. However, there is a higher portion reporting not having an overview of daily blood glucose levels which may indicate that they have not implemented their knowledge of the impact of blood glucose levels in their daily routine. Counterwise, the results from question 6 and 7 indicates that there is a need of insights in their blood glucose which is conflicting with the high rate of the respondents knowing the effects of meals, food and activities on their blood glucose.

6.2 Survey 2

The results from survey 2 can be seen in Appendix A.5. The participants responded to this survey after completing the experiment of measuring the blood glucose levels in 30 days. This survey had 16 respondents where 69% (11 respondents) reported that they were surprised by performing the blood glucose measurements. 31% (5 respondents) reported that they were not surprised by performing the blood glucose measurements which can be seen in Figure 6.3. The percentage is similar to what was presented in Section 6.1 that 40% (6 respondents) of the respondents reported

that they had an overview of their daily blood glucose levels. It can indicate that the respondents reporting the aforementioned may have followed a similar course that either was too intensive which lead to a poor result or the duration of the course was too short which also leads to a poor result.

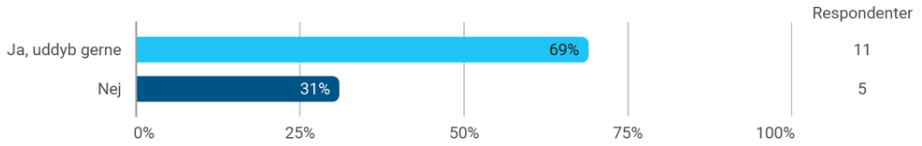


Figure 6.3: Question 2 from survey 2 about experiences regarding execution of SMBG.

The elaboration on question 2 (see section 5.4) were coded and categorized and resulted into three categories:

Categories	Occurrence	Statements
Diet and exercise	2/16	1. "That the measurement reached to the maximum of 13 postprandial." 2. "How alcohol affects the blood glucose."
Stability of blood glucose	7/16	1. "Some of the measurements were a lot higher than expected and vice versa." 2. "Having trouble to sense the changes (high/low blood glucose)"
Measurements	2/16	1. "At the end of week 3 and the beginning of week 4 I discovered how much it actually demanded of me and to remember to be observant on it and make sure to measure five times and relate to the values the measurements showed." 2. "I haven't measured blood glucose before - positive."

Table 6.3: This table corresponds to question 2 in survey 2 and shows the categories, occurrences and statements.

The result seen in Figure 6.3 and Table 6.3 shows that what surprised the participants the most by using SMBG was the stability of blood glucose. The expected blood glucose levels differed from the actual blood glucose levels and the findings showed that the expected blood glucose levels differed from how they felt.

The results to question 3 (see section 5.4) about what their experiences regarding the execution of the blood glucose measurements resulted into three categories:

Categories	Occurrence	Statements
Diet and exercise	8/16	1. "The fact that I saw how great of an impact it has on what I eat and what impact it has dependent on how much I exercise." 2. "It is motivating to see what positive effect exercise has on the blood glucose and it is good to get elucidated that sweet drinks increase the blood glucose." 3. "It is necessary to measure the blood glucose as it is not possible to know the consequences of the blood glucose by ingestion of different foods."
Stability of blood glucose	3/16	1. "I can ascertain that I lie a lot lower in blood glucose than expected [...]." 2. "At the beginning it was difficult to hit my numbers, last in the period I hit more accurate."
Insight in the impact of blood glucose	8/16	1. "The way I could follow the course of how much the blood glucose dropped before I went to bed." 2. "Even though it can be difficult to guess accurately what the measurement would show it has been a good exercise to obtain insights in the circadian rhythm concerning blood glucose it can help to get it more regular and lower blood glucose levels." 3. "It was after 5 weeks in a row that I saw a pattern on my measurements." 4. "I got an insight on what affects my blood glucose and hereby a better knowledge."

Table 6.4: This table shows the categories, occurrences and statements given to question 3 by the respondents.

In Table 6.4 the categories with the highest occurrence are diet and exercise and insight in the impact of blood glucose. The findings support the fact that by performing SMBG for a period shows the patients with T2DM that using SMBG impacts what they eat and how much the blood glucose levels are impacted by exercise. Using SMBG motivates the participants and elucidates the impact of different foods and drinks. The findings also suggest that using SMBG shows the consequences of their lifestyle. Furthermore the participants obtained insights in the impact on the circadian rhythm.

The response to question 4 (see section 5.4) which were about three advantages of performing daily blood glucose measurements resulted into five categories;

Categories	Occurrence	Statements
Diet and exercise	14/16	1. "I can see the importance of the amount of exercise I do daily/weekly." 2. "I can easily change the diet when the blood glucose is already too high." 3. "You learn what the different food do to the blood glucose."
Stability of blood glucose	5/16	1. "To control that the blood glucose stays within the intervals." 2. "You get a bad conscience when the blood glucose level is too high." 3. "Learn more about blood glucose balance."
Insight in impact of blood glucose	16/16	1. "It can help to a far better regulation of blood glucose." 2. "You can experiment and find own condition which can improve blood glucose." 3. "Look to see if there is a pattern on the day, where for instance the blood glucose is too high." 4. "Greater insight in fluctuations of the blood glucose value for instance my is lowest around 15-16 o'clock, I didn't know that." 5. "Gives insight on what the blood glucose levels are through the whole day." 6. "I know now that it is now good for my blood glucose to sleep too little."
Frequency of measurements	6/16	1. "Regular lifestyle with fixed measuring times." 2. "You are retained by measurements." 3. "A disadvantage is that you easily can get measuring stress due to small fluctuations - here you should remember that there is an uncertainty on the measurements and measuring equipment."
Comorbidities	6/16	1. "You get fewer comorbidities when your blood glucose is stabile during the day and not only on an acceptable level over 3-months."

Table 6.5: This table corresponds to question 4 in survey 2 and shows the categories, occurrences and statements.

The result which can be seen in Table 6.5 the category with the highest occurrence is insight in impact of blood glucose. Every participant obtained insights in impact of blood glucose as an advantage of using semi-structured SMBG. They obtained knowledge in how to regulate the blood glucose, when the blood glucose is highest and when it is lowest and that sleep is important. The category with the second highest occurrence is diet and exercise and the participants reported that exercise is very important and learned what different food does to the blood glucose levels.

The response to question 5 (see section 5.4) which is about the 3 disadvantages of performing daily blood glucose measurements resulted into five categories.

Categories	Occurrence	Statements
Economy	4/16	1. "The price for test equipment is expensive." 2. "It is costly in equipment." 3. "Expensive test equipment - e.g. I used my yearly materials in this period, therefore I can not 'afford' to measure for long periods."
Measuring equipment	2/16	1. "To remember the blood glucose meter when I am not home." 2. "The equipment for the measurements needs to be brought along - maybe not a problem if it is necessary in consideration of dosage."
Pain with finger prick	5/16	1. "The finger prick can be painful." 2. "Too many finger prick." 3. "I get sore and is a disadvantage at work."
Consequences with frequent measurements	7/16	1. "My wife thinks I need a blood transfusion with all those measurements." 2. "Try to avoid to be too worried when focusing too much on the blood glucose. Be too worried." 3. "The risk of getting scar tissue that removes the sense of touch in fingers."
Measurement times	14/16	1. "To conduct the measurements around the same times to be able to make a comparison." 2. "Remember the time for measurements when the circadian rhythm fluctuates." 3. "Can forget measurements or hard to measure at the exact times. Sometimes I am driving and you just can't stop." 4. "Forget to measure when I am at work."

Table 6.6: This table corresponds to question 5 in survey 2 and shows the categories, occurrences and statements.

In Table 6.6 the result of the disadvantages of using semi-structured SMBG can be seen. The category with the highest occurrence is measurements times. It is reported that it was hard to remember to measure five times a day. Measuring on the same exact time was also a problem. The fluctuations the circadian rhythm was also a problem for measuring the blood glucose levels. The category the second highest occurrence is consequences with frequent measurements. It is reported that the focus on the blood glucose worried the participants and that participants worried about scar tissues from measuring that frequent.

The responses to question 6 (see section 5.4) about if you can imagine that the insight in your blood glucose levels would change your everyday choices from now on were entirely about diet and exercise.

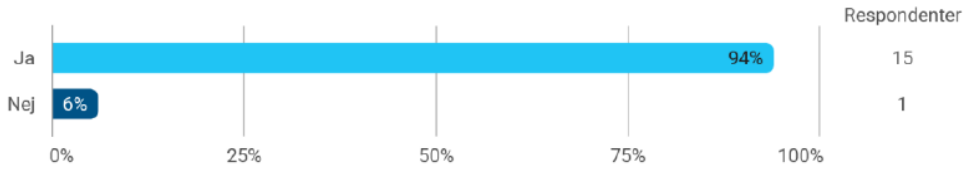


Figure 6.4: Number of percentages that recommends semi-structured SMBG.

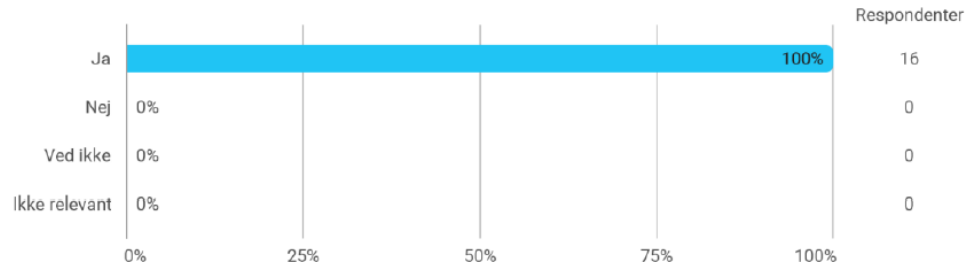


Figure 6.5: Number of percentages that states that semi-structured SMBG gives a better understand of what have an impact on blood glucose.

Figure 6.4 shows that 94% of the participants recommends using semi-structured SMBG for other patients with NIT T2DM. Figure 6.5 shows that 100% of the participants states that semi-structured SMBG helps to obtain knowledge of what have an impact on blood glucose.

6.2.1 Summarizing the results of survey 2 and discussion

From the findings of survey 2 it is clear that SMBG contributed to the knowledge of the participants of what the impact of food, exercise, circadian rhythm have on their blood glucose levels. After 30 days of SMBG the majority of the participants saw a pattern in their blood glucose levels and could regulate their blood glucose levels from the knowledge obtained from participating in this project. The findings also showed the advantages and the disadvantages of performing SMBG. Clearly the disadvantages were stated that finger pricking for one month is tedious and painful, remembering to perform all five measurements per day and it is hard to accommodate with work and other social contexts. Even though the findings that suggest that SMBG may lead to a reduction of health quality of life ignoring the fact that using SMBG may be the key to obtain insight in how to regulate the blood glucose level may result in fewer comorbidities that patients with T2DM are at high risk for as described in section **??** and **??**. Finally, all participants except one recommends SMBG in T2DM management and all participants found that SMBG gives a better understanding of what have an impact on the blood glucose.

However, the participants were not specific enough about the insights obtained by performing SMBG. The goal in this exploratory study is to obtain specific reflections of what, how and why impact on the blood glucose levels using SMBG. Therefore the focus groups interviews were conducted in order to obtain the specific reflections of what impact the blood glucose levels using SMBG.

6.3 Personas

In this exploratory study, the personas were created using the data retrieved from survey 1, survey 2, and the focus group interviews.

Figure 6.6: Persona of a fictive character named George to represent a user type (Shutterstock, 2021a).

The first persona can be seen in Figure 6.6. The fictional representation of a potential user in the project 'Kend dit blodsukker' is called George. The information that can be seen in this figure is gathered from one particular participant. The data

that can be seen in George's persona can not be traced back to the real person. George is a 71-year-old male and are retired. The stars given in the motivation section are given on the background of the focus group interview. George's goals by participating in this project are to achieve insights into his blood glucose levels and follow the course of his blood glucose levels during the day and ultimately during the whole duration of the experiment. He also wants to get knowledge about what in his life affects the blood glucose levels. Another goal of his is to reduce the HbA1c level. Lastly, he wants to exercise more by incorporating exercise into his daily routine. His routine regarding his disease is that he measures his fasting blood glucose level every Sunday and he is used to it. George has had T2DM for over 10 years.

Figure 6.7: Persona of a fictive character named Veronica to represent a user type (Shutterstock, 2021b).

The second persona can be seen in Figure 6.7. The fictional representation of a potential user here is called Veronica. The information that can be seen in the beforementioned figure is gathered from two different participants. Both of the participants are women however their response and goals were almost the same but with slight

differences. Therefore it would make sense to combine the two. Veronica is a female at the age of 59 years old and works as a social and healthcare assistant. The stars given in the 'Motivations' section are given in the background of the surveys and the focus group interviews. Veronica's goals are that she wants to achieve insights into her blood glucose levels. She also wants to know what in her life affects the blood glucose levels during the period of the experiment. Veronica is overweight and struggles to lose weight and maintain weight loss. Due to Veronica's occupation which includes hectic work hours she struggles to have a healthy diet. This is what can be seen in the 'Routines' section. She knows that sometimes what she has for lunch can be too unhealthy but it is always in her mind to eat healthily. Veronica has had T2DM for 0-2 years.

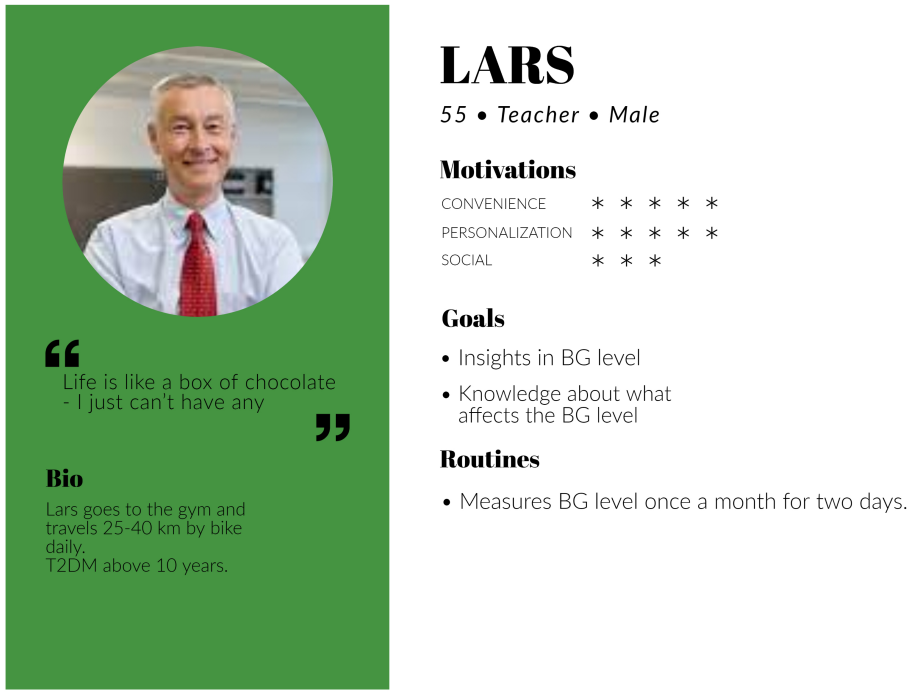


Figure 6.8: Persona of a fictive character named Lars to represent a user type (Shutterstock, 2021c).

The third persona is called Lars. He is a 55 years old male and works as a teacher. The data used to create this persona comes from one participant. The stars given in the section 'Motivations' are given in the background of the surveys and the focus

group interviews. Lars's goals for participating in this project are to get insights into his blood glucose levels and achieve knowledge about what affects his blood glucose levels in his life. His routine regarding T2DM is that he measures his blood glucose levels once a month for two days with a blood glucose meter and lancets and test strips. Lars has had T2DM for over 10 years.

Figure 6.9: Persona of a fictive character named Nathalie to represent a user type (Shutterstock, 2021d).

The fourth and last persona created in this project is called Nathalie and data used to create this persona comes from one participant. Nathalie is a 62 years old female and a retiree. Nathalie's goal is to achieve insights into her blood glucose levels and knowledge of what affects her blood glucose level. She has been struggling with her weight and tries to reduce her weight and maintain her weight loss. Nathalie dislikes the fact that she needs to take a lot of medicine and wants to find out if she can avoid as much medication as possible in the future. Her routine is to try to stay healthy however she does not perform blood glucose measurements besides the quarterly HbA1c at the doctor. Nathalie has had 2TDM for 8-10 years.

6.3.1 Summarizing personas

In order to understand the participants in this study personas are important to gain a perspective similar to the patients with NIT T2DM. Personas also help to recognize that different patients with NIT T2DM have different goals and needs.

6.4 Survey 3

Survey 3 was responded by 12 participants. All the question were voluntary which is clear in the number of response on the different questions in this survey. This was to enhance the response rate of survey 3.

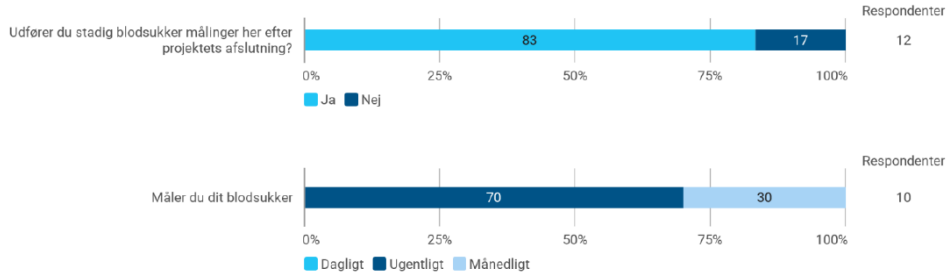


Figure 6.10: The figure in the upper row shows the percentages of respondents still performing SMBG after the end of the project 'Kend dit blodsukker' and the figure in the row underneath shows the percentages performing SMBG daily, weekly and monthly.

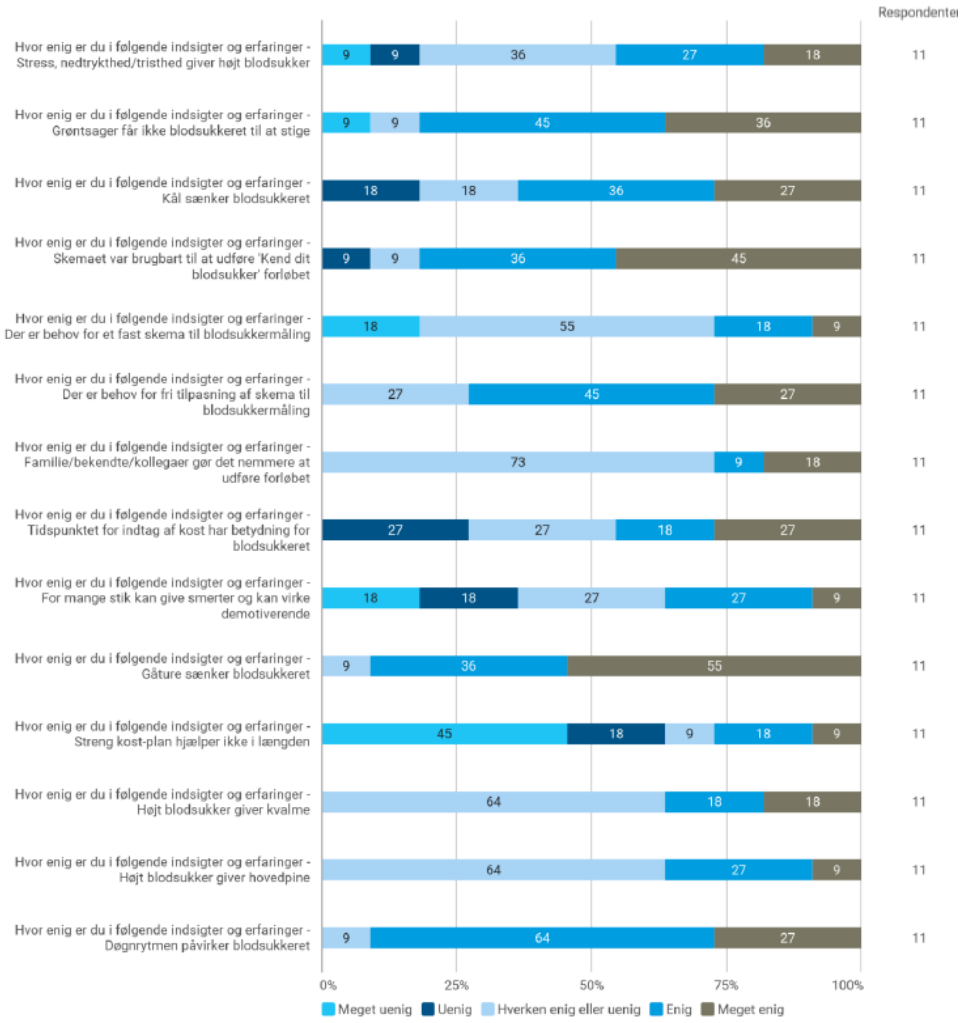


Figure 6.11: This figure shows the percentages of the given ratings to question 4 regarding how much the respondents agree with the different insights and experiences with categories Very 'Strongly disagree', 'Disagree', 'Neither agree or disagree', 'Agree' and 'Strongly agree'.

Figure 6.11 shows the percentages of the ratings on different insights and experiences extracted from survey 1 and 2 and the FGIs. The aim with this is to show the differences and the similarities in each participants views of how insights and

experiences and how the ratings differs and that having T2DM is not the same across everyone having this disease. This corresponds to what is stated in the guidance for patients with T2DM (The Danish Diabetes Association, 2021). Furthermore, 81% of the participants agree on the fact that vegetables do not increase the blood glucose level which further supports the diet suggestions given to patients with T2DM that they need to incorporate more vegetables in their diet. 63% agree that cabbage decreases the blood glucose levels. 18% are neutral and 18% disagree. The majority supports the fact that cabbage decreases the blood glucose level which may suggest that the other participants may not know the benefits of cabbage in the diet. 81% agree that the template given in the project was useful in order to conduct SMBG while 9% are neutral and 9% disagree. It was found in the surveys that some of the participants created their own template which also was one of the aims of the study. The blood glucose template (seen in Appendix A.1) given to the participants is simple on purpose to inspire the participants to find their own ways. However, 73% did not agree that there should be a fixed template for blood glucose measurements which supports the simple template given to the participants and the empowerment of the participants which also supported by 62%. 27% states that family/acquaintances/colleagues makes it easier for them to participate in this project while 73% are neutral which may indicate that either family/acquaintances/colleagues may not be a factor in order for the participants to conduct SMBG. 45% stated that they either agree or strongly agree that the time for meals has an impact on the blood glucose levels. 27% neither disagree or agree while 27% disagree. 27% that neither disagree or agree may indicate that the reason is that the time for their meals did not differ during the time period of this experiment. 91% either agree or strongly agree that walks decrease the blood glucose levels which strongly supports the fact that exercise is an important factor in regulation of blood glucose. 63% states that a strict diet plan does not help in the long run which may indicate that to follow a strict diet plan is too difficult while 9% neither disagree or agree while 27% either agree or strongly agree. This shows that people are different and that a strict diet plan may be too intensive and does not fit into their lifestyle. In the FGIs many stated that it was found through using SMBG that a high blood glucose level can cause nausea which 27% either agree or strongly agree on. However, 64% of the participants neither disagree or agree on that fact that further supports the fact that patients with T2DM are different and nausea as a result may be due to the duration of the diagnosis of T2DM. The rating for the insight that a high blood glucose levels can cause headache is exactly the same as the insight for nausea. Finally, 91% of the participants either agree or strongly agree that the circadian rhythm has an impact of the blood glucose levels while only 9% neither disagree or agree on this insight.

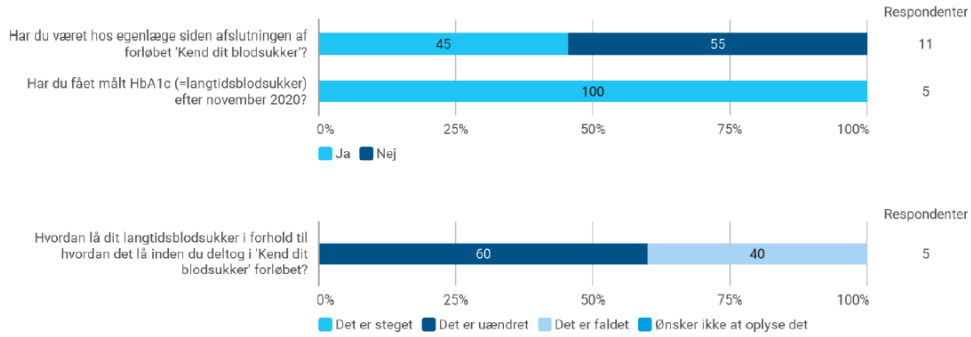


Figure 6.12: This figure shows the results of question 9, 10 and 11 in survey 3.

Figure 6.12 shows the responses to question 9, 10 and 11 which were responded by respectively 11, 5 and 5 respondents. As it can be seen in this figure 11 responded whether they have been at their own doctor and only 5 respondents have been at their own doctor. This can be due to the COVID-19 pandemic that prevented a greater number of respondents going to their doctor. 100% of the 5 respondents that went to their doctor have had their HbA1c measured. At last question 11 which asked how their HbA1c level was now compared to the HbA1c level prior to participating to the project of this thesis shows that the HbA1c level of 60% of the 5 respondents was unchanged and the HbA1c level of 40% of the 5 respondents was decreased.

6.5 Summarizing the results of survey 3 and discussion

Obtaining specific insights and reflections from survey 2 and the focus group interviews were rated by the participants in survey 3. The ratings differed greatly between the different insights and experiences. This emphasizes how different each patient with T2DM experiences this disease which is supported by the guide for patients with T2DM (The Danish Diabetes Association, 2021). The majority of the participants still use SMBG to control the blood glucose which may indicate that they still think that it is important to measure the blood glucose levels and it possibly should be a part in management of T2DM. However, the participants do not measure their blood glucose daily but wither weekly or monthly which might indicate that an intensive period SMBG may be enough for them to only measure their blood glucose levels more loosely. In terms of rating the obtained insights and experiences many differs greatly but the majority agrees on vegetable do not increase the blood glucose, the template for the blood glucose measurements is useful, there should not be a fixed template for blood glucose measurements, walks decrease the blood glucose levels and the circadian rhythm has an impact on the blood glucose levels. Finally, the participants that went to their own doctors the HbA1c decreases in only 40% while

60% had no change in the HbA1c level. Ultimately non of the participants reported an increase in HbA1c level.

CHAPTER 7

Conclusion

This study aimed to explore the use of SMBG in patients with NIT T2DM. Other studies have been conducted with the aim to find out if patients with NIT T2DM could reduce their HbA1c by using SMBG. The studies reviews in this thesis found that the conducted studies did find evidence that SMBG reduced the HbA1c significantly. In this thesis it was also learned that not many exploratory studies of this subject were conducted and that the area of using SMBG in patients with NIT 2TDM remained unclear.

The findings from survey 1 indicate that the participants have experience with SMBG and knows that SMBG is an important factor in order to obtain insights in their blood glucose levels. The participants wants insight in diet, exercise and stability of blood glucose.

The findings in survey 2 indicate that the beginning of using SMBG as T2DM management is hard and the sense of touch in terms of blood glucose differs from the actual blood glucose levels. It was shown that incorporating guesses as a provotype provoked the participants to reflect on their blood glucose levels. However, the participants were surprised over the importance of SMBG and found a lot about themselves in the process. The participants reported the insights on what, how and why impacted their blood glucose levels. The categories that occurred the most were diet, exercise, stability of blood glucose and measurements times. The participants began to see a pattern and were able to influence their blood glucose levels with their newly found knowledge which empowers the participants greatly in the management of blood glucose. The findings also elucidated the downside of using SMBG in terms of physical pain which many overcame by switching fingers from day-to-day. It was also reported that too frequent measurements would affect them mentally in terms of stress. It was also shown that SMBG is recommended by the participants and that using SMBG gave them a better understanding in what have an impact on their blood glucose levels.

The findings in survey 3 suggest that SMBG possibly should be a factor in T2DM management. The collected insights were rated and similarities and differences were found which suggest that T2DM is individual and the findings may be impacted on the duration of the diagnosis of T2DM. The findings also suggest the importance of a simple blood glucose measurement template but it was not found if guessing the

blood glucose levels prior to the actual measurements actually contributed to the insights or the pattern in the blood glucose levels. The participants for the most part agreed on that walks and vegetables decrease their blood glucose levels and that circadian rhythm has an impact on their blood glucose levels. In all there are a great difference between opinions according to the insights and experiences presented to them. To answer the question if patients with NIT T2DM could obtain insights in what influences the blood glucose level by using SMBG from the findings of this study using SMBG greatly elucidated why, how and what influence their blood glucose levels. The findings also showed that some of participants' HbA1c level was reduced.

CHAPTER 8

Future Perspective

The findings of this thesis shows that the method semi-structured SMBG resulted into insights, experiences and reflections on the impact of the blood glucose levels and that reduction in HbA1c was found. It will support the idea behind semi-structured SMBG and the recommendation of using semi-structured SMBG according to the participants of this study that there is a need to conduct a randomized controlled trial study to further explore the insights, experiences and reflections upon the blood glucose levels. Also the findings suggest to explore the used of telecare and the importance of telecare.

Incorporating a provotype in terms of a 'guess' prior to the actual blood glucose measurement should be further studied. Even though the participants suggest that it did create a deeper reflection but the actual contribution was not accounted for in the findings of this exploratory study presented in this thesis.

APPENDIX A

An Appendix

A.1 Template For Blood Glucose Measurements

Skema til blodsukkermåling

"Kend dit blodsukker"

diabetes foreningen

Dato		**Gæt**	**Måling**
Før morgenmad			
Formiddag			
Efter frokost			
Efter aftensmad			
Før sengetid			

Dato		**Gæt**	**Måling**
Før morgenmad			
Formiddag			
Efter frokost			
Efter aftensmad			
Før sengetid			

Dato		**Gæt**	**Måling**
Før morgenmad			
Formiddag			
Efter frokost			
Efter aftensmad			
Før sengetid			

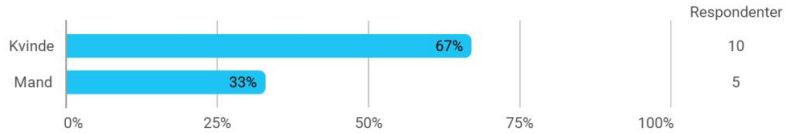
Dato		**Gæt**	**Måling**
Før morgenmad			
Formiddag			
Efter frokost			
Efter aftensmad			
Før sengetid			

Dato		**Gæt**	**Måling**
Før morgenmad			
Formiddag			
Efter frokost			
Efter aftensmad			
Før sengetid			

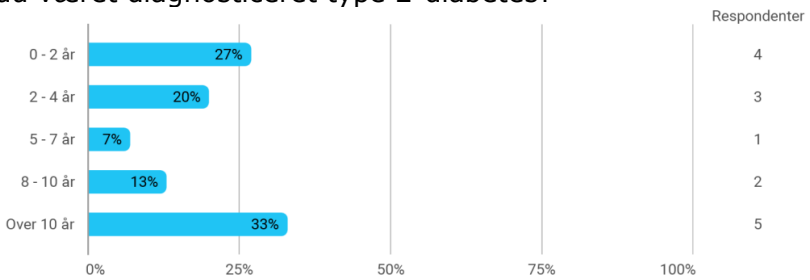
Dato		**Gæt**	**Måling**
Før morgenmad			
Formiddag			
Efter frokost			
Efter aftensmad			
Før sengetid			

A.2 Results of Survey 1

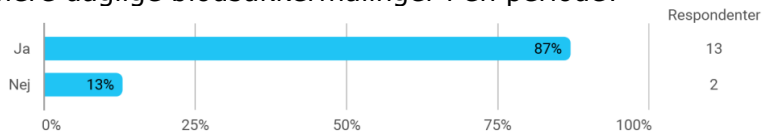
Er du:



Hvor mange år har du været diagnosticeret type 2-diabetes?



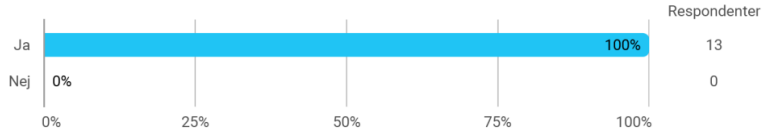
Har du tidligere udført flere daglige blodsukkermålinger i en periode?



Hvor mange perioder?

- dagligt
- 2
- 3
- Svært at sige men ca. 1 gang om mdr. i 2 døgn
- 20
- 1
- Ca 4 gange årligt
- 4 gange til min egen orientering når jeg ikke har haft det godt
- En eller to
- 1
- Fulgt et 10 ugers projekt udbudt af kommunens sundhedshus.
- Ca 2gange om året
- Altid

Var det en god oplevelse?



Beskrivelse af tekstanalyse:
Ved åbne svarmuligheder, hvor deltagere kan frit uddybe deres svar, laver jeg indholdsanalyse, hvor jeg kode de tekster som jeg har genlæst på de kommentarer. Derefter kom jeg frem til forskellige indhold af bestemte ord som jeg synes det er relevant i forhold hvad deltagerne har svaret.
Heraf kom jeg frem til tre kategorier, som jeg har sat om i en tabel.

Uddyb gerne

- Beroende på at måle resultatet, som kan være afhængig af motion samt kost.
- Bedre forståelse af madens påvirkning af blodsukkeret
- Udmærket oplevelse, men følte ikke, det var nødvendigt altid at måle daglige/jævnlige målinger
- Målingerne kan give en status, men også være med til at se forandringer pga. ændret på kost og motion.
- så for man syn for hvor BS ligger
- Det var i starten af mit forløb. hvor det kunne give et indtryk af hvad der skete efter tabletbehandlingen, var startet
- Jeg prøver at få overblik over hvad og hvordan mit blodsukker påvirkes - når jeg er på arbejde - hjemme - har dyrket motion - været til fest osv.
- jeg har tit taget det flere gange om dagen når jeg ikke har haft det så godt for at se om det er pga mit blodsukker.
- Jeg kan godt lide at følge med og se, om jeg spiser, så det påvirker mit blodsukker mindst muligt
- Jeg målte blodsukker før min diagnose, da jeg vidste at jeg nærmede grænsen for diabetes. Jeg målte døgnprofiler nogle dage, og andre dage målte jeg blodsukker hvis jeg var meget tørstig.
- Mødte andre i samme båd og kunne mærke at de påvirkede min energi til at udføre skemaet.
- Det giver mig overblik over hvordan min kost påvirker mit blodsukker, så jeg kan justere min kost herefter. Samtidig om motion på får mit blodsukker til at falde.
  Jeg har brug for at justere min kost og motion løbende for at holde vægten.
- Det er supergodt at vide hvad ens BS er og det giver straks motivation til at holde BS stabilt.
  Hvorimod hvis man ikke måler er det helt sikkert at det vil skride /stige.
  Man vil heller aldrig lære hvad forskellige madvarer gør ved BS hvis man ikke måler et par timer efter indtagelsen.

Kodning og kategori		
Motion og kost	**stabilitet af blodsukker**	**medicin**
7	**5-6**	**1**

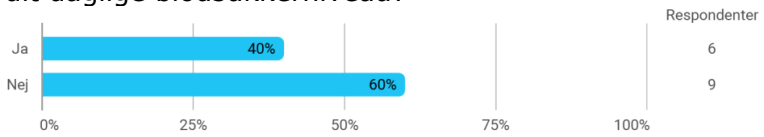
Hvorfor er du nysgerrig efter en indsigt i dit blodsukker?

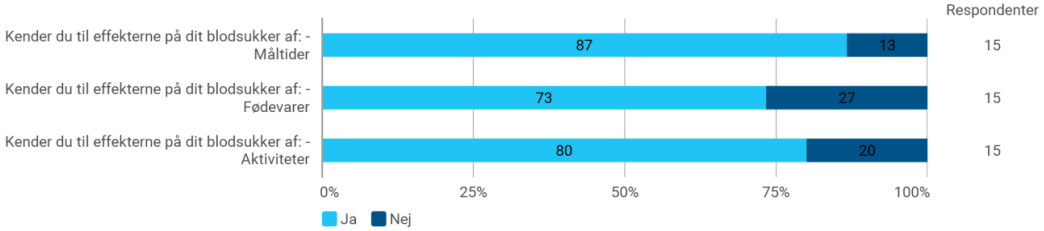
- Oplever at det ind imellem kan svige for meget over dagen
- Forsøger at leve sundt og holde det nede
- Fordi jeg pt. Har lidt svært ved at styre mit blodsukker, så min HbA1c er for højt
- Er interesseret i at sænke blodsukkeret lidt mere - ved hjælp af ændring i kost- motion kan kun øges minimalt idet jeg stort set er i fitness hver dag og cykler mellem 25 - 40 km om dagen, så der er kun kosten.
- så jeg kan agere efter det
- For bedre at kunne agere i forhold til mad og motion og hvad indvirkning det har
- For bedre at kunne forstå hvordan jeg selv kan påvirke mit blodsukker og holde det stabilt.
- For at passe på mig selv
- Jeg vil spise efter det for at minimere risikoen for følgesygdomme
- Fordi jeg gerne vil vide mere detaljeret om hvordan min kost påvirker mit blodsukker, end at jeg bare hver 3. måned får målt mit langtidsblodsukker.
- Jeg ønsker at vide om der er fremgang eller bare være obs på mine tal,
  Håber jeg evt. kan få det væk
- Jeg ved godt det er vigtigt med balance i blodsukkeret for at kunne holde en sund hverdag
- Jeg vil gerne undgå at tage medicin, så det kræver at jeg har styr på mit blodsukker og ikke tager på.
  Jeg er også nysgerrig efter at vide hvordan blodsukkeret svinger over en længere periode og hvad der påvirker det. Jeg håber, det kan give mig viden og erfaring som jeg kan bruge i det daglige.
- Jeg tager mit blodsukker fastende hver søndag, men jeg har læst at blodsukkeret kan ændre sig meget i løbet af dag/nat afhængig af hvad der indtages og det kunne være interessant at få belyst.

- For mit velvære og sundhed

Kodning og kategori		
Motion og kost	**stabilitet af blodsukker**	**Oversigt/aktiv handling**
4	**4**	**9**

Har du et overblik over dit daglige blodsukkerniveau?

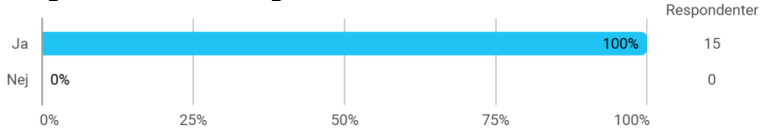




Har du generelt nogle kommentarer inden forløbet?

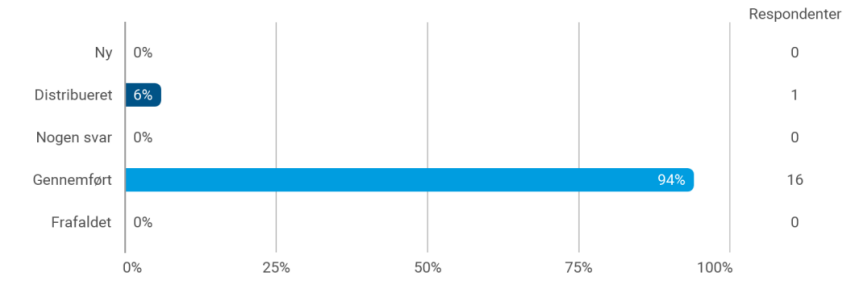
- Er interesseret i information, om jeg skal omlægge min kost og motion vaner
- Håber på at kunne nedsætte medicinen ved målrettet blodsukkerpåvirkning.
- Nej
- Ser frem til at få mere indblik i hvad jeg yderligere kan gøre.
- ser frem til at deltage
- Skal jeg downloade skemaerne eller får vi dem sendt pr mail/brev?
  Får man prøvestiks betalt?
- Jeg har det lidt svært med fødevare, og mit blodsukker om morgenen kan tit ikke forstå det er høj 8-9
- Jeg er bare spændt på at være med og se, om jeg bliver klogere på mig selv
- nej
- Nej, spændende
- Har lige nu lidt svært ved at sige nej til mig selv, når jeg får lyst til noget usundt til min diabetes
- Nej
- Håber som nævnt at få et overblik over hvordan blodsukkeret opfører sig dagen igennem.

Må vi kontakte dig i forlængelse af undersøgelsen?

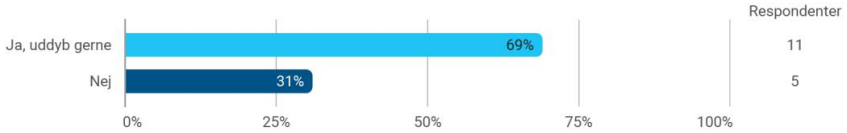


A.3 Results of Survey 2

Samlet status



1. Har noget overrasket dig ifm. at udføre blodsukkermålingerne?



2. Har noget overrasket dig ifm. at udføre blodsukkermålingerne? - Ja, uddyb gerne

- At målingen steg op til max 13, efter at have spist
- Har ikke tidligere målt blodsukkeret - positivt
- Nogle målinger var en del højere end forventet og omvendt
- Hen af slut 3. Start 4. Uge opdagede jeg hvor meget det engentlug krævede af en og huske være obs på og få målt 5 x om dagen samt og forholde sig til de tal målingen viste
- har svært ved at mærke forandringerne (højt/ lavt BS)
- at morgenblodsukkeret er højere end aftenen før
- at mit blodsukker svinger så meget
- Hvordan alkohol påvirker blodsukkeret
- At det udvikler sig i løbet af dagen, hvor følsomt det er
- mit sukkerniveauet stiger meget efter frokosten.
- Hvor dårlig jeg er til at gætte enten højt eller lavt blodsukker.

Kost og motion	Stabilitet af BS	Måling
2	7	2

3. Hvad var godt ved at udføre blodsukkermålingerne?

- Det at jeg så, hvor stor en indflydelse det har på det jeg spiser, samt hvilken indflydelse det har, afhængig hvor meget motion jeg dyrker.
  Det at jeg kunne følge med i hvor meget blodsukkeret faldt inden jeg gik i seng
- Overblik over blodsukkerniveauet i forbindelse med måltiderne
- At man kunne blive overrasket over målingerne og dermed blive mere opmærksom på, hvad og hvor meget, man kan indtage af kulhydrater
- Selvom det kan være vanskeligt at gætte præcis hvad målingen vil vise har det været en god øvelse at få indblik i døgnrytmen vedr. blodsukker det kan medvirke til at få mere jævn og lavere blodsukkerværdier.
- OK overblik så længde det varede for mig.
- Det var at når det var over 5 uger i træk at jeg så et mønster i mine målinger..

- Jeg kan konstatere at jeg ligger noget lavere i BS end forventet. Og at selv lav aktivitet påvirker (vinterbadning) giver øget BS-værdi. Og så kan jeg få en over næsen :-) når jeg kan se hvordan sene/ forkerte indtag giver et for højt tal inden søvnperiode, men hvor usundt er det?
- at jeg fik indblik i hvordan forskellige fødevarer og motion påvirker blodsukkeret
- I starten var det svært at ramme mit tal, sidt i perioden ramte jeg lidt mere plet
- Det er altid interessant at følge med, så man har mulighed for at tilpasse sin kost, hvis noget ikke fungerer i forhold til blodsukkeret
- motiverende at se hvilken positiv virkning motion har på blodsukkeret, og godt at få belyst at søde drikke får blodsukkeret til at stige. det er god anskuelsesundervisning.
- Indblik, man kan se sine gode og sin dårlige adfærd
- Mit eget fokus på at have diabetes blev mere bedere i forhold til mad.
- At kunne se, hvordan niveauet var af løbet af dagen
- Jeg fik et indblik i hvad der påvirker mit blodsukker og dermed en bedre viden.
- Det er nødvendigt at måle sit blodsukker, da man ellers ikke kender konsekvensen på sit BS ved indtagelse af forskellige fødevarer.
  Man kan heller ikke udlede andet end trends i sit langtidsblodsukker, man kan ligge faretruende lavt om morgenen og højt om aftenen, hvilket gør at ens langtids BS ser pænt ud

Kost og motion	Stabilitet af BS	Indblik i påvirkning af BS
8	3	8

4. Kan du nævne 3 fordele ved udførsel af daglige blodsukkermålinger?

- 1. At jeg får et overblik over hvorledes målingerne er over dagen
  2. At jeg får en indikation hvor påpasselig jeg skal være med hvad og hvornår man spiser
  3. Jeg kan se betydningen af den mængde motion jeg dyrker dagligt / ugentlig
- Overblik over en længere periode

  Focus på Diabetes

  Regelmæssig livsstil ved faste måletider
- 1. Man kan blive bedre til at holde blodsukker nede
  2. Man kan nemmere ændre kosten, hvis BS allerede er lidt for højt.
- Det er en fordel løbende at have "kontrol" på BS-værdierne således at evt. forandringer bliver opdaget.
  Ved at måle dagligt er det muligt løbende at korrigere i forhold til kost og fysisk aktivitet.
  Man kan eksperimenter og finde egne forhold som kan forbedre BS.
  En ulempe er at man nemt kan få måle stress over selv mindre afvigelser - her skal man huske at der er usikkerhed på målingerne og måleudstyr.
- Overblik
  Vurdering af livsstil
- 1) man bliver fastholdt i målinger
  2) ser om der viser sig et mønster på dagen , hvor man feks ligger for højt
  3)det kan medvirke til en langt bedre regulering af blodsukker .
- 1. Sikker overvågning af BS-niveauet
  2. Klarhed over uønskede madvare/ sammensætning
  3. Kortere reaktionstid for at modgå høje BS-tal
- 1 større indblik i udsving i blodsukkerværdien f.eks er mit lavest omkring kl 15-16, det var jeg ikke klar over.
  2 indblik i kostens betydning - har foretaget flere målinger lige efter måltider.
  3 indblik i motions betydning for blodsukkeret , om morgenen hvis jeg motionerer før morgenmad, så er BS højere end fasteblodsukkeret
- jeg blev klar over hvad det påvirke når jeg spiste noget til "aften Kaffen"

  at jeg skal spise mindre og tit midt på dagen

  skal passe på hvad jeg drikker

- Kontrol med, at blodsukkeret holder sig indenfor rammen, påvirkning af bestemte fødevarer, at kunne undgå følgesygdomme
- Jeg mener ikke at man nødvendigvis ved en stabil diabetes bør måle daglige blodsukker. Men ved sygdomsdebut er det en god læring. Og senere også godt i særlige situationer.
  Hvis et blodsukker afviger fra det forventede, bør man kunne notere sig, hvad årsagen kan være.
- Alvor, og indblik samt undgå at det løber løbsk
- Ansvarlighed og for min diabetes.
  Lære mere om blodsukker balance.
  Fokus på ubehagelige ubalancer omkring hovedpine.
- 1. Jeg kender mig selv 100%
  2. Jeg ved præcis, hvad jeg kan tåle at spise.
  3. Jeg ved nu, at det er ikke godt for mit sukker at sove for lidt.
  4. Jeg kan se at efter træning, falder mit sukker niveau.
- - Giver indblik i hvad der påvirker blodsukkeret.
  - Giver oveblik over blodsukkeret forløbet i gennem døgnet.
  - Giver "overraskelser" hvis blodsukkeret ikke var som gættet inden måling.
- 1. Man lærer hvad de forskellige madvarer gør ved ens BS.
  2. Man får dårlig samvittighed når man ser et højt BS
  3. Man får færre følgesygdomme når en BS ligger stabilt over hele døgnet og ikke kun på et acceptabelt niveau over 3 md.

Kost og motion
Måle hyppighed
Indblik i påvirkning af BS
Følgesygdomme

Kost og motion	Stabilitet af BS	Indblik i påvirkning af BS	Måle hyppighed	Følgesygdomme
14	5	17	6	6

5. Kan du nævne 3 ulemper ved udførsel af daglige blodsukkermålinger?

- 1. Prisen for test udstyr er dyr
  2. Det at foretage målingen nogenlunde på samme tidspunkt for at få den rette sammenligning
  3. At skulle fortage op til 5 målinger / dag
- Huske måleudstyr når der ikke måles hjemme

  Huske klokkeslet for måling
- 1. At huske at måle, når man har en meget varierende dagsrytme.
  2. At stikket kan gøre lidt ondt
  3. Risikoen for arvæv, så følesans i fingre forsvinder
- BS stress (se fordele)
  Det kræver planlægning i forhold til andre aktiviteter
  Udstyret til måling skal medbringes - måske ingen problem, hvis det er nødvendigt at måle af hensyn til dossering.
- For meget stikkeri
- 1) huske og måle på de samme tidspunkter
  2)5 uger m 5 målinger daglig mærkes på fingrene
  3)svært og huske når man er på job og på besøg
- 1. Jeg bliver S**** øm i fingerne, ulempe ifm. arbejdet
  2. Det er også en bekostelig affære i udstyr
  3. Kan godt glemme målinger eller havde svært ved at ramme samme tidspunkt (cirka). Nogle gange er man jo på køreture og kan ikke lige stoppe.
- 1 man skal planlægge mere
  2 det kan være svært at måle på tid, når man er på kursus og kun har korte pauser, til måling,spisning og måling udenfor pauser
  3 dyrt testmateriale - f.eks brugte jeg mit årsmateriale i denne periode, så der er ikke "råd" til måling i lange perioder
- til sidst ondt i fingrene

svært at huske den om formiddagen

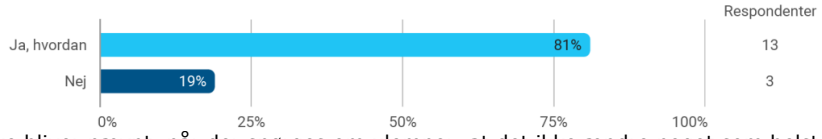
at huske at tage det

- Med kun 150 teststrimler om året er daglige målinger ikke mulige, og det kan godt blive lidt "for meget" at skulle måle hele tiden. Kan ikke nævne flere ulemper
- Det er svært at huske, især at huske det rette tidspunkt.
  Man kan føle sig mere syg end man er.
- Prøve at undgå for meget fokus på blodsukkeret.
  Blive for bekymret
  Huske tiden til udførsel af blodtagningen
- Glemmer at tage blodsukkermålinger.
- 1. I en travl dag på arbejde, er det svære at huske at måle.
  2. Det gør ondt i mine fingre.
  3. Det er dyrt
- - Mange stik i fingrene.
  - Det kan til tider være svært at "huske" at tage målingerne.
  - Min kone mente jeg skulle have en blodtransfusion med alle de stik & målinger.
- Ingen

Økonomi
Måleudstyr
Smerter ved stik
Konsekvenser ved hyppig måling
Måle hyppighed
Måle tider
Sygdom

Økonomi	Måleudstyr	Smerter ved stik	Konsekvenser ved hyppig måling	Måle hyppighed	Måle tider	Sygdom
4	2	5	4	3	14	1

6. Forestiller du dig, at indsigten i dit blodsukker vil ændre dine hverdagsvalg fremover?



Det er underligt at der ikke bliver nævnt, når der spørges om ulemper, at det ikke ændre noget som helst netop fordi man laver daglige blodsukkermålinger.

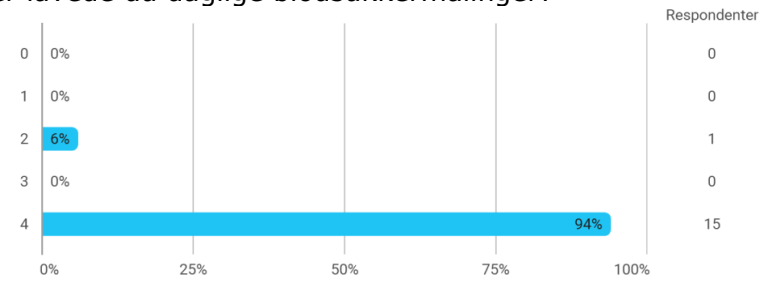
7. Forestiller du dig, at indsigten i dit blodsukker vil ændre dine hverdagsvalg fremover? - Ja, hvordan

- Ved indtagelse at søde sager, samt motion
- Kostsammensætning med lavere påvirkning af blodsukkeret
- Mere opmærksom på, hvad der øger VS, så man kan holde sig fra det
- Vil få mere indflydelse på kost og fysisk aktivitet
- Ja bestemt.. er blevet opmærksom på at når det bliver sidst på eftermiddag så stiger mine blodsukker plus om aftenen..der er mad som påvirker mit blodsukker langt mere end jeg troede , så anden tilgang til nogle fødevare og ændring i medicin.
- er nok lidt mere obs på sene indtag og hvad det er
- når jeg skal vælge madvarer-"nydelse" - motion, så har jeg noget at gå efter.
- Tænker mere over hvad jeg spiser og hvornår
- mindre indtage af søde varme drikke
- Gåture vigtige, om jeg gider eller ej, jeg skal prioritere det, samt madvarer som jeg ved bringer blodsukkeret op i vældig fart, men svært, prøver
- Huske på at den sunde kost ikke overspisning giver bedst balance fysisk og psykisk.

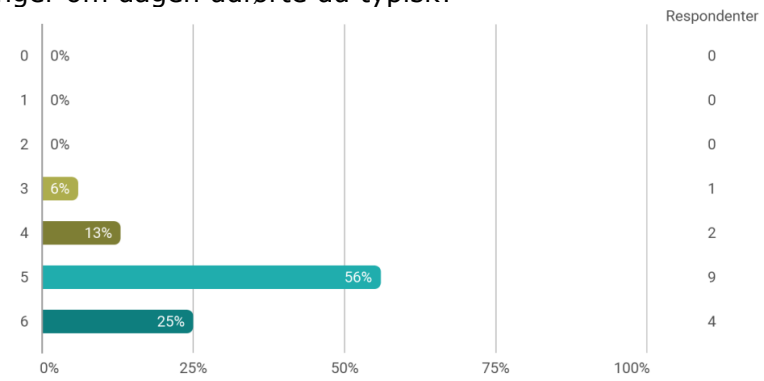
- Vil være let, at sige nej tak til fristelser.
- At udskyde eventuelle følgesygdomme, at få en MEGET bedre hverdag

Kost og motion	Stabilitet af BS	Indblik i påvirkning af BS	Medicin	Sygdom
10	1	1	1	1

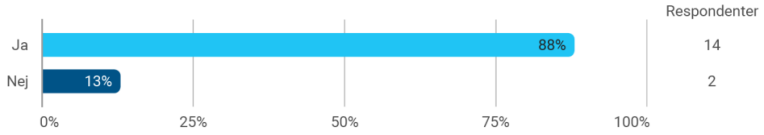
8. I hvor mange uger lavede du daglige blodsukkermålinger?



9. Hvor mange målinger om dagen udførte du typisk?



10. Har du brugt skemaet til blodsukkermålinger som det er sat op på forhånd?

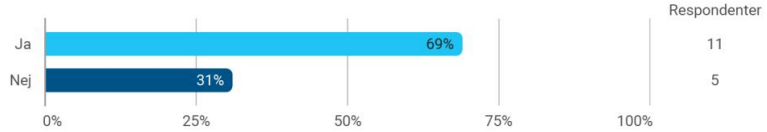


11. Hvilke tiltag/ændringer har du foretaget?

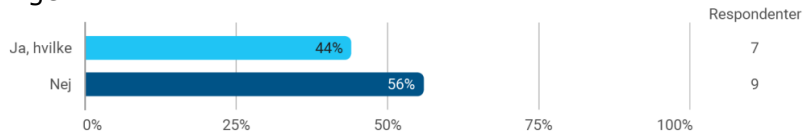
- Jeg nedskrev mine iagttagelser i bog, nysgerrig på før og efter et måltid og hvor lang tid der gik før blodsukkeret var nede igen, det samme med motionens indvirkning.
  Så det vil jeg have i min erindring, og prøve at tænke ind, hvad der gør mig godt og ikke gør noget godt for mig.
- Jeg bruger freeStyle libre (privat betalt)

  Og det vil jeg fortsætte med

12. Har du input til eventuelt at forbedre skemaet til blodsukkermåling eller andet i forløbet "Kend dit blodsukker"?



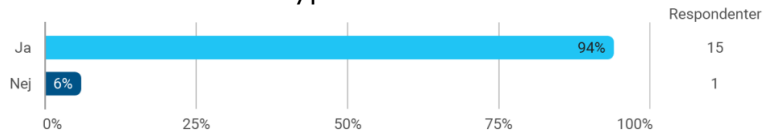
13. Har du gjort brug af andre materialer/tiltag ifm. at udføre dine blodsukkermålinger?



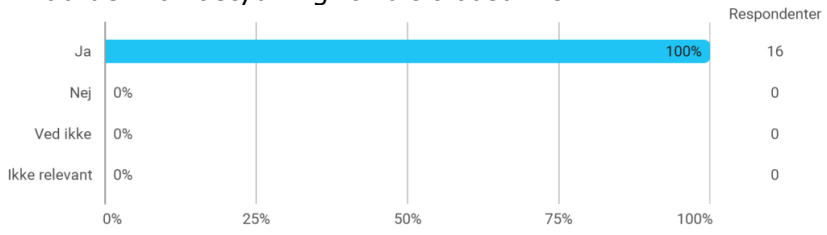
14. Har du gjort brug af andre materialer/tiltag ifm. at udføre dine blodsukkermålinger? - Ja, hvilke

- Tilføj en rubrik med tidspunkt, samt en rubrik med udført aktivitet
- Gerne med mere udførligt om det er 1/2 time el 1 time efter et måltid blodsukker måles.. plads til og skrive medicin på hvad der er taget dagligt.
- jeg har ind i mellem målt hver 1/2 time fra måltidsslut - for at se hvor høje værdier og hvornår det var højest og hvor hurtigt det kom ned igen
- Haft min egen bog, og til tider taget prøve før og efter et måltid samt før og efter motiong d
- Kikket i gammelt info
- Udarbejdet et regneark baseret på Diabetes skemaet og tilføjet "Hvad fik jeg at spise"
- FreeStyle libre

15. Ud fra dine egne erfaringer med daglige blodsukkermålinger vil du anbefale dette til andre med diabetes type 2?



16. Synes du at det at måle dit blodsukker har givet dig en bedre forståelse af, hvad der har betydning for dit blodsukker?



17. Har du generelt nogle kommentarer?

- Som ny diabetikker 2, vil det være godt at udføre målinger daglig på faste tider. For at lære sit blodsukker at kende over tid.
- Har haft Diabetes i ca. 1 år, og har nu en meget bedre forståelse af, hvordan blodsukkeret ligger i løbet af dagen.
- Super fint "eksperiment". Måske rart at have vidst, om måling efter måltid er lige efter eller 1-2 timer efter.
  Målingerne har dog givet stof til eftertanke mht. kulhydrat indtag.
- Har selv haft glæde af at måle BS 30-60-90-120 min. efter måltid - det har faktisk givet mest i forhold til at ændre kosten. Man kan gøre noget tilsvarende efter fysisk aktivitet lidt overraskende at hård træning giver øget BS.

- Synes det har været lærerigt for selvom jeg har haft diabetes i mange år , kan man stadig lære og holdes lidt til ilden m målinger..
- jeg ville gerne ha' haft lidt info i skemaet om hvornår jeg skulle måle- og plads til at skrive hvad jeg havde spist og hvilke aktiviteter jeg havde lavet.
- Det er en god måde at lære sit tal at kende, og hvordan man reager på det man spiser og drikker
- Et Excelark ville være betydeligt lettere at arbejde med end et Word-dokument.
  Og hvis målingerne skal give et helt retvisende billede i forhold til, hvordan måltider påvirker blodsukkeret, skal de tages på andre tidspunkter.
- Et nyt skema til "Kend dit blodsukker" bør indeholde rubrikker til bemærkninger der kan forklare hvorfor et givet blodsukker er som det er.
- Dejligt, at jeg måtte deltage, jo mere opmærksom des bedre, da det eneste lægen kan tilbyde er piller.
  Der er jo så meget andet, f.eks opmærksomhed, støtte, har selv bekostet ophold på livsstilshøjskole, det virker og hjælper i den rigtige retning, med støtte og sund mad, samt motion, Men jo selvfølgelig dyrt, når man skal betale det hele selv, det hjælper ikke på samme niveau , hvis man deltager et gange til oplysning om hvor vigtig kosten samt motionen er, det at være på ophold i flere uger, det virker, men kræver måske endda at jeg gør det igen, fokus og støtte er sagen
  Lægen er kun til piller og løftede pegefinger
- Telefon kontakten understøtter min lyst til at leve sundt.
- Da jeg fik at vide at jeg havde D2, var Anette Sams´ bogen "Ud af Diabetes 2" lige udkommet. Jeg læste den og jeg har brugt hendes råd til vejen ud af D2.: tre solide hovedmåltider med kål. fysisk træning, mindst 1/2 time. 7-9 timers god sovn. Masser af vand. MEN man skal inkludere: MÅLING af blodsukker hver dag. Lige nu mit blodsukker er 6.7, kl. er 23:32, jeg har ikke træne i dag og jeg har ikke spist nok grønsager, ellers har jeg 5.7 hvis jeg passer på. Jeg tager en pille Metformin om dagen. Tak for denne gang. Bh
- Jeg har været glad for at deltage i projektet og fået det ønskede indblik i hvad der kan påvirke blodsukkeret samt fået bekræftet at mit blodsukker ligger nogenlunde konstant i gennem døgnet.
- FreeStyle libre til alle diabetikere, uagtet typ.

Kost og motion	Indblik i påvirkning af BS	Ændring af skema	Lægen	Måling af BS
2	5	3	2	1

A.4 Interview Guide For Focus Group Interview

Briefing

Jeg er en specialestuderende i ingeniørretningen Medicin og teknologi fra DTU og KU og først og fremmest vil Diabetesforeningen og jeg gerne sige tusind tak fordi I har taget jer tid til at deltage i fokusgruppeinterviewet!

Indledningsvis kan vi fortælle, at interviewet indgår i mit speciale, hvor vi undersøger om det er muligt at med den tilegnede indsigt ved at måle sit blodsukker 5 gange dagligt kan sænke sit blodsukker. Vi er interesserede i at få mere at vide om, hvad jeres oplevelser var ved at udføre de forskellige ting forbundet med "Kend dit blodsukker" forløbet herunder at skulle gætte sit tal, daglige målinger plus alt det praktiske forbundet til dette og svare på spørgeskemaer.

I må meget gerne bemærke at interviewet bliver optaget, så vi er sikre på at få det hele med. Som nævnt i jeres invitations mail, vil optagelsen blive slettet lige så snart vi er færdige med den.

Temaer	**Interviewspørgsmål**
Briefing og præsentation (5 min.)	• Vi præsenterer os selv, mit speciale samt hovedemner, vi vil komme ind på i løbet af interviewet • Vi beder interviewpersonerne om at præsentere sig selv, hvordan de fandt frem til projektet "Kend dit blodsukker" og hvad der fik dem til at deltage • Vi informerer dem omkring spørgeskema 3 som vil udgives til januar
Gæt af blodsukker tal (15 min.)	• Hvordan var det at gætte? • Gav det motivation til at ændre nogle ting i hverdagen på baggrund af tallet? • Hvilke følelser var der forbundet med at skulle gætte blodsukkertallet? Gode/dårlige? (Analogi: tjek af saldo i konto)
Daglig måling af blodsukker + løsninger (15 min.)	• Hvilke værktøjer er der blevet brugt? Skema og udover skema • Hvordan blev blodsukkerapparatet brugt i sociale sammenhænge? Arbejdspladsen? • Hvilke udfordringer opstod der i forbindelse med BS-målingerne?
Refleksion over blodsukker tal og nye indsigter (15 min.)	• Hvilke oplevelser var der med at skulle måle blodsukkertallet? • Hvilke overraskelser opstod i forbindelse med BS-måling? • Hvordan blev der reflekteret over tallet og de nye fund?
Sociale forhold (10 min.)	• Hvis der har været andre, der har været inddraget i denne proces, hvordan har de så været involveret?

A.5 Results of Survey 3

Hvor hyppigt måler du dit blodsukker {%expression:iif({*1/2/1982563748:1982563750*},"dagligt",iif({*1/2/1982563748:1982563753*},"ugentligt",iif({*1/2/1982563748:1982563754*},"månedligt","")))%}? (valgfrit)

- 1-3 gange om ugen med gennemsnit 3 målinger pr. dag
- En gang om ugen
- Det variere rigtigt meget - afhænger at mistanke om variation pga. kost og træning så som kontrol.
- over 2-3 dage - morgen, formiddag, middag (før/efter), aften (før/efter) og nat
- Næsten en gang om dagen
- I perioder hver morgen og ellers når jeg vil vide, hvor meget en bestemt fødevare påvirker mit bs. Der måler jeg, når jeg begynder at spise, og derefter hver halve time, til det falder igen.
- Jeg måler ikke blodsukker så tit, da det oftest ligger meget pænt. Men jeg har da taget et par dage hvor jeg har målt det ca 3 gange om dagen. Ellers har jeg målt det hvis jeg synes at jeg har fået for meget eller for sødt at spise, for at se hvor højt det så er blevet.
- Over 5 dage 3 gange om dagen
- To dage
  4 gange om dagen: om morgenen, efter morgenmad, før aftensmad og før sovetid.
  Nogle gange
- Fastende søndag morgen.

Nævn 3 konkrete indsigter/erfaringer du tager højde for i din hverdag siden afslutning af forløbet 'Kend dit blodsukker'? (valgfrit)

- Efter +20 år med diabetes, måles som hoved regel før spise tid.
  Hvis højt blodsukker før aftensmad, foretages der måling før senge tid for at se niveau.
- Måling jævnligt, gør det nemmere at navigere i kosten.
- Kost mindst mulig kulhydrater (gjorde det i forvejen)
  Fysisk aktivitet/træning stabilisere/sænker blodsukker
  Hvis der er nogenlunde styr på blodsukkeret skal man ikke teste for meget det giver stress og koster mange penge til sticks.
- tidsfaktoren efter indtag og før BS-måling
  sammen er gældende efter fysisk træning
  tidspunkt for "sene" indtag
- Holder mere øje med mit blodsukker om aftenen
  Er mere ops på at gå ture/røre mig
  er blevet lidt kloger på mine egene tal
- Forløbet har ikke ændret min måde at gøre tingene på
- 1) At deltagelse i julefrokost hvor jeg spiste normal mad men langsomt over lang tid, ikke gave høje blodsukre.
  2) At frugtgrød er en sukkerbombe der giver mig højt blodsukker.
  3) At jeg nogengange blev overrasket over resultatet af en blodsukkermåling.
- 1. Jeg skal måle, til at sikre en stabil BS.
  2. Jeg bliver glad, når jeg konstaterer ved måling, at niveauet er OK.
  3. Hvis niveauet stiger, reflekterer jeg over min dag: har jeg spist for meget eller forkert?, har jeg sovet for lidt? mangler jeg motion?, Er jeg stresset?
  4. Jeg har tilpasset mit skema med en ekstra kolon til refleksion og en til Blodtryk.
- 1. Jeg har fået bedre kendskab til hvad der får mit blodsukker til at stige/falde.
  2. Jeg tænker derfor mere over hvad jeg putter i munden.
  3. Men jeg har ikke i nævneværdig grad ændret mit liv.

Har du tilegnet dig nye indsigter/erfaringer? - Ja, hvilke (valgfrit)

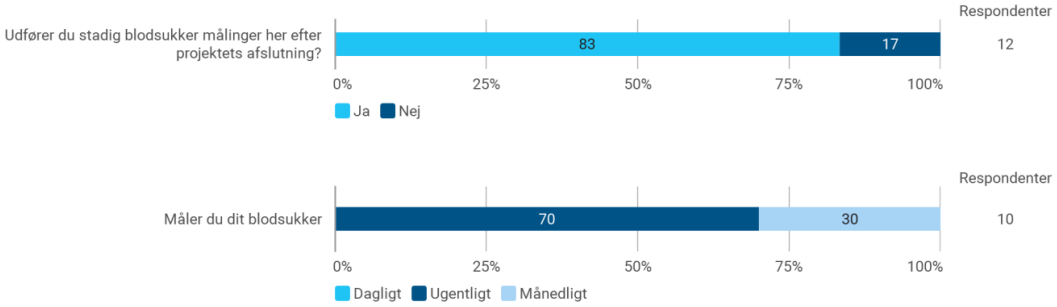
- Til tider målinger før sengetid
- Grøntsagernes altdominerende rolle
- ja med hvid brød
- Hvis jeg har for høj niveauet, dyrker jeg 30 min motion og drikker vand= efter to timer niveauet er på plads igen.
- Bedre indsigt i hvad der får mit blodsukker til at stige/falde.

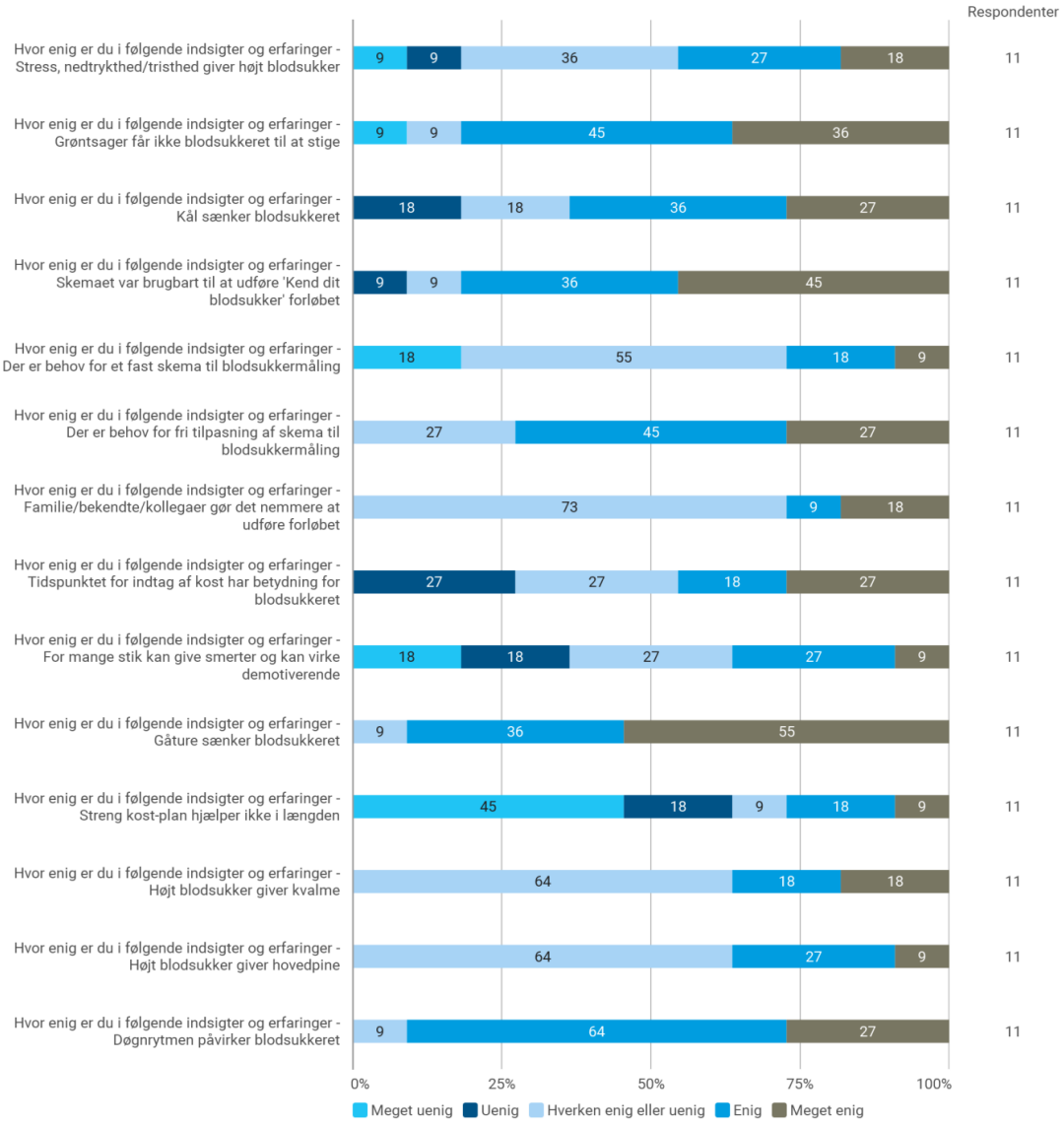
Kan du nævne op til 3 konkrete indsigter/erfaringer, som du lige nu har valgt ikke at handle aktivt på i din hverdag? - Ja, hvilke (valgfrit)

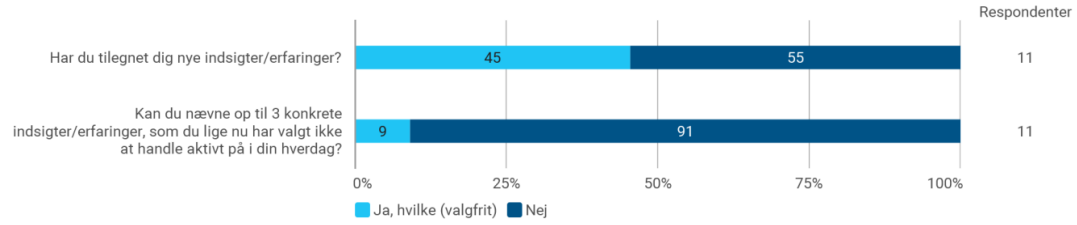
- Manglende jævnlig måling. Burde aktivt ændre lidt på kosten

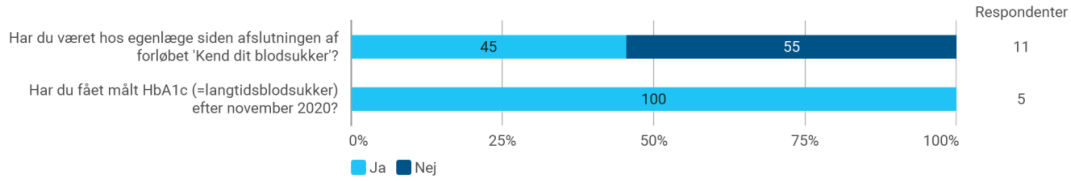
Hvordan har dine tilegnede indsigter påvirket dit adfærd? (valgfrit)

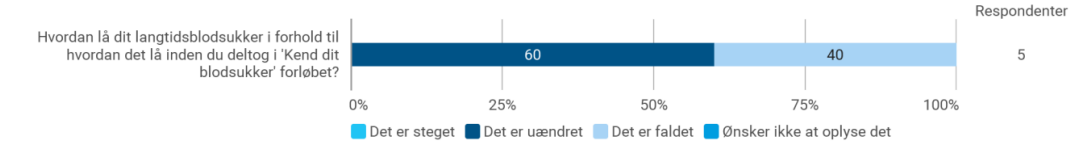
- Mener ikke at jeg har ændret min adfærd, da jeg før denne test, motionerede 3-4 gange om ugen
- En mere struktureret kostplan
- Desværre på ingen måde pt. Men har givet stof til eftertanke
- Fik ikke væsentlig ny viden så ingen ændret adfærd.
- Ingen påvirkning
- Jeg er blevet bedre til at gå turer og få rørt mig
- POSITIVT! Jeg har en bedre livskvalitet.
- Som nævnt har jeg ikke ændret nævneværdigt på mit liv, men tænker dog mere over hvad jeg putter i munden.

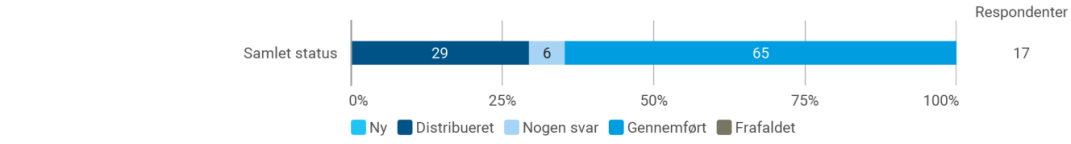



Respondenter
Hvor enig er du i følgende indsigter og erfaringer - Stress, nedtrykthed/tristhed giver højt blodsukker
9 9 36 27 18
11
Hvor enig er du i følgende indsigter og erfaringer - Grøntsager får ikke blodsukkeret til at stige
9 9 45 36
11
Hvor enig er du i følgende indsigter og erfaringer - Kål sænker blodsukkeret
18 18 36 27
11
Hvor enig er du i følgende indsigter og erfaringer - Skemaet var brugbart til at udføre 'Kend dit blodsukker' forløbet
9 9 36 45
11
Hvor enig er du i følgende indsigter og erfaringer - Der er behov for et fast skema til blodsukkermåling
18 55 18 9
11
Hvor enig er du i følgende indsigter og erfaringer - Der er behov for fri tilpasning af skema til blodsukkermåling
27 45 27
11
Hvor enig er du i følgende indsigter og erfaringer - Familie/bekendte/kollegaer gør det nemmere at udføre forløbet
73 9 18
11
Hvor enig er du i følgende indsigter og erfaringer - Tidspunktet for indtag af kost har betydning for blodsukkeret
27 27 18 27
11
Hvor enig er du i følgende indsigter og erfaringer - For mange stik kan give smerter og kan virke demotiverende
18 18 27 27 9
11
Hvor enig er du i følgende indsigter og erfaringer - Gåture sænker blodsukkeret
9 36 55
11
Hvor enig er du i følgende indsigter og erfaringer - Streng kost-plan hjælper ikke i længden
45 18 9 18 9
11
Hvor enig er du i følgende indsigter og erfaringer - Højt blodsukker giver kvalme
64 18 18
11
Hvor enig er du i følgende indsigter og erfaringer - Højt blodsukker giver hovedpine
64 27 9
11
Hvor enig er du i følgende indsigter og erfaringer - Døgnrytmen påvirker blodsukkeret
9 64 27
11
0% 25% 50% 75% 100%
Meget uenig Uenig Hverken enig eller uenig Enig Meget enig


Respondenter
Har du tilegnet dig nye indsigter/erfaringer?
45 55
11
Kan du nævne op til 3 konkrete indsigter/erfaringer, som du lige nu har valgt ikke at handle aktivt på i din hverdag?
9 91
11
0% 25% 50% 75% 100%
Ja, hvilke (valgfrit) Nej


Respondenter
Har du været hos egenlæge siden afslutningen af forløbet 'Kend dit blodsukker'?
45
55
11
Har du fået målt HbA1c (=langtidsblodsukker) efter november 2020?
100
5
0%
25%
50%
75%
100%
Ja
Nej


Respondenter
Hvordan lå dit langtidsblodsukker i forhold til hvordan det lå inden du deltog i 'Kend dit blodsukker' forløbet?
60
40
5
0%
25%
50%
75%
100%
Det er steget
Det er uændret
Det er faldet
Ønsker ikke at oplyse det


Respondenter
Samlet status
29
6
65
17
0%
25%
50%
75%
100%
Ny
Distribueret
Nogen svar
Gennemført
Frafaldet

Bibliography

Boer, Lars and Jared Donovan (2012). "Provotypes for participatory innovation." In: URL: DOI:%2010.1145/2317956.2318014.

Boutati, Eleni I and Raptis Sotiros A. (2009). "Self-Monitoring of Blood Glucose as Part of the Integral Care of Type 2 Diabetes." In: URL: https://doi.org/10.2337/dc09-S312.

Ciesielska, M. and Jemielniak D. (2018). "Qualitative Methodologies in Organization Studies." In: URL: https://doi.org/10.1007/978-3-319-65442-3_5.

Diabetesforeningen (2018). "Nye tal: Flere har diabetes i Danmark :" in: URL: https://diabetes.dk/aktuelt/nyheder/nyhedsarkiv/2020/nye-tal-flere-har-diabetes-i-danmark.aspx.

Duckworth, William C., Robert G. Bennett, and Frederick G. Hamel (1998). "Insulin Degradation: Progress and Potential." In: URL: https://doi.org/10.1210/edrv.19.5.0349.

Galicia-Garcia, Unai, Asier Benito-Vicente, Shifa Jebari, Asier Larrea-Sebal, Haziq Siddiqi, Kepa B Uribe, Helena Ostolaza, and César Martín (2020). "Pathophysiology of Type 2 Diabetes Mellitus." In: URL: 10.3390/ijms21176275.

Goldstein, David E., Randie R. Little, Rodney A. Lorenz, John I. Malone, David Nathan, Charles M. Peterson, and David B. Sacks (2004). "Tests of Glycemia in Diabetes." In: URL: doi:10.2337/diacare.27.7.1761.

IDF (2019). "Diabetes facts and figures." In: URL: https://idf.org/aboutdiabetes/what-is-diabetes/facts-figures.html.

Leow, Melvin K. S. (2016). "Glycated Hemoglobin (HbA1c): Clinical Applications of a Mathematical Concept." In: URL: doi:%2010.5455/aim.2016.24.233-238.

Linneberg, M. S. and S Korsgaard (2019). "Coding qualitative data: a synthesis guiding the novice." In: URL: https://doi.org/10.1108/QRJ-12-2018-0012.

Manucci, Edoardo, Alessandro Antenore, Francesco Giorgino, and Marina Scavini (2018). "Effects of Structured Versus Unstructured Self-Monitoring of Blood Glucose on Glucose Control in Patients With Non-insulin-treated Type 2 Diabetes: A Meta-Analysis of Randomized Controlled Trials." In: URL: 10.1177/1932296817719290.

Medical and Biological Sciences (2021). "Actions of Insulin - Physiology." In: URL: https://www.drawittoknowit.com/course/physiology/glossary/physiological-process/insulin-glucagon.

Mehring, Micheal, Ewan Donnachie, and Antonius Schneider (2016). "HbA1c Variability and Cardiovascular Events." In: URL: https://doi.org/10.1007/s12170-016-0501-x.

Meloni, A. R., M. B. DeYoung, C. Lowe, and D. G. Parkes (2012). "GLP-1 receptor activated insulin secretion from pancreatic -cells: mechanism and glucose dependence." In: URL: https://doi.org/10.1111/j.1463-1326.2012.01663.x.

Mergenthaler, Philipp, ute Lindauer, Gerald A. Dienel, and Andreas Meisel (2013). "Sugar for the brain: the role of glucose in physiological and pathological brain function." In: URL: https://doi.org/10.1016/j.tins.2013.07.001.

Nathan, David M.and the DCCT/EDIC Research Group* (2014). "The Diabetes Control and Complications Trial/Epidemiology of Diabetes Interventions and Complications Study at 30 Years: Overview." In: URL: 10.2337/dc13-2112.

NG17, NICE (2015). "Type 1 Diabetes in Adults: Diagnosis and Management. NICE Guideline 17." In: URL: https://www.nice.org.uk/guidance/ng17/chapter/Recommendations#blood-glucose-management-2.

Parsons, S. N., S. D. Luzio, J. N. Harvey, S. C. Bain, W. Y. Cheung, and A. Watkins (2019). "Effect of structured self-monitoring of blood glucose, with and without additional TeleCare support, on overall glycaemic control in non-insulin treated Type 2 diabetes: the SMBG Study, a 12-month randomized controlled trial." In: URL: 10.1111/dme.13899.

Polonsky, W. H., L. Fisher, C. H. Schikman, D. A. Hinnen, C. G. Parkin, Z. Jelovsky, B. Petersen, M. Schweitzer, and R. S. Wagner (2011). "Structured Self-Monitoring of Blood Glucose Significantly Reduces A1c Levels in Poorly Controlled, Noninsulin-Treated Type 2 Diabetes." In: URL: 10.2337/dc10-1732.

Pruitt, John and Jonathan Grudin (2003). "Personas: Practice and Theory." In: URL: https://www.microsoft.com/en-us/research/wp-content/uploads/2017/01/personas-practice-and-theory.pdf.

Retnakaran, Ravi (2014). "Joe Doupe lecture: emerging strategies for the preservation of pancreatic beta-cell function in early type 2 diabetes." In: URL: https://doi.org/10.25011/cim.v37i6.22247.

Scheen, A. J. (2014). "PATHOPHYSIOLOGY OF TYPE 2 DIABETES." In: URL: https://doi.org/10.1179/acb.2003.58.6.001.

Shutterstock (2021a). "Senior Citizen Picture." In: URL: https://www.shutterstock.com/it/search/fat+phone?image_type=photo.

— (2021b). "Senior Citizen Picture." In: URL: https://www.shutterstock.com/it/search/fat+phone?image_type=photo.

— (2021c). "Senior Citizen Picture." In: URL: https://www.shutterstock.com/it/search/fat+phone?image_type=photo.

— (2021d). "Senior Citizen Picture." In: URL: https://www.shutterstock.com/it/search/fat+phone?image_type=photo.

Simpson, I., D. Dwyer, D. Malide, K. Molley, A. Travis, and J. Vanucci (2008). "The facilitative glucose transporter GLUT3: 20 years of distinction." In: URL: 10.1152/ajpendo.90388.2008.

Sun, E., A. M. Martin, R. L. Young, and D. J. Keating (2019). "The Regulation of Peripheral Metabolism by Gut-Derived Hormones." In: URL: https://doi.org/10.3389/fendo.2018.00754.

The Danish Diabetes Association Dansk Endokronologisk Selskab, Dansk Selskab for Almen Medicin (2021). "Vejledning Type 2 Diabetes." In: URL: https://netbutik.diabetes.dk/collections/populaere-vejledninger/products/vejledning-type-2-diabetes.

Unnikrishnan, Ranjit, Ranjit Mohan Anjana, and Viswanathan Mohan (2012). "Drugs affecting HbA1c levels." In: URL: https://www.ijem.in/text.asp?2012/16/4/528/98004.

Wein, Harrison (2017). "The structures of receptors involved in blood sugar control." In: URL: https://www.nih.gov/news-events/nih-research-matters/structures-receptors-involved-blood-sugar-control.

Wilcox, Gisela (2005). "Insulin and insulin resistance." In: URL: PMC1204764.

Williams, David M., Sharon N. Parsons, Gareth J. Dunseath, Jeffrey W. Stephens, Stephen D. Luzio, and David R. Owens (2020). "The impact of structured self-monitoring of blood glucose on glycaemic variability in non-insulin treated type 2 diabetes: The SMBG study, a 12-month randomised controlled trial." In: URL: 10.1016/j.dsx.2020.01.006.

Wu, Huaizhu and Christie M. Ballantyne (2017). "Skeletal muscle inflammation and insulin resistance in obesity." In: URL: 10.1172/JCI88880.