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Diet and Medication Therapy in the Treatment of Type 2 Diabetes

Comparison between Finland and the United States of America (USA)

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Thesis abstract

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Diabetes is a chronic disease which arises when the body is unable to use the insulin it produces effectively (type 2), or when enough insulin is not produced by the pancreas (type 1). (WHO 2015a)

This thesis aims to find out how effective a drug and diet therapy is in the treatment of diabetes (type 2), as well as how nurses and health workers can assist patients in the care/management of diabetes using drug and diet therapy. The purpose of this thesis is to identify the differences and / or similarities in the treatment of diabetes (type2) focusing on medication therapy (pills, insulin, follow up blood sugar test) and diet therapy (eating habit & exercise) comparing Finland and the USA.

The research questions of this thesis were: 1.What are the difference and / or similarities between Finland and USA regarding their drug and diet therapy of diabetes (type2)?. 2. What are the differences in the outcome in both countries after the treatment of diabetes (type 2) using drug and diet therapy?

The data collection method was literature review. Inclusive and exclusive principles were set, keywords selected and MEDLINE, CINAHL and SAGE databases used.

The data collected were analysed using the inductive content analysis. The chosen materials were read through several times carefully, findings were gathered and classified to identify results.

The results of this thesis answer the research questions of what are the differences and similarities Finland and the USA have in their treatment of type 2 diabetes as well the possible difference in the outcome of their treatments. The results also show the general guidelines necessary for nurses, patient and their caregiver (e.g.family) in the management of type 2 diabetes.

Keywords: Diabetes, Diabetes type2, diet therapy, drug therapy.

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Abbreviations

ADA	American Diabetes Association
CVD	Cardiovascular disorder
DPP-4	Dipeptidylpeptidase -4
FPG	Fasting Plasma Glucose
GLP-1	Glucagon-like peptide-1
HbA1c	Glycated hemoglobin
IDF	International Diabetes Federation
NICE	National Institute for Health and Care Excellence
USA	The United States of America
WHO	World Health Organization
ACCE	American Association of Clinical Endocrinologists

1 INTRODUCTION

Diabetes generally is one of the most common diseases worldwide, but recently type 2 diabetes is not only seen in adults anymore, but also in children and adolescents (International Diabetes Federation 2014). This thesis focuses on the use of diet and drug therapy as a treatment of diabetes type 2. It will give an overview of how nurses, parents, caregivers and as well as patients contribute in the treatment of diabetes.

The main topic of this thesis is to compare the diet and drug therapy in the treatment of diabetes (type2) in Finland and the United States. Since diabetes, especially type 1, is showing more cases every day, authors will briefly mention few things people can do in order to prevent diabetes.

According to WHO (2015a), type 2 diabetes that was previously known as non-insulin-dependent or adult-onset, diabetes results from the body's ineffective use of insulin. Though type2 diabetes is characterized by multiple metabolic abnormalities, Insulin resistance is the most common feature with patients. Hyperglycaemia which is also connected to type 2 diabetes, develops only when there is an accompanying defect in insulin secretion in relation to the degree of insulin resistance. As the duration of type 2 diabetes lengthens, there is a functional defect in the pancreatic beta-cell resulting from a decrease in beta cell mass. The pancreatic beta cell function defects include decreased production of endogenous insulin, reduced unresponsiveness to glucose and worsening hyperglycaemia. This defect basically leads to a need for exogenous insulin (Pratley 2008, 7).

Type 2 diabetes comprises 90% of people with diabetes around the world and appears largely as a result of excess body weight and physical inactivity. The common symptoms include excessive excretion of urine (polyuria), thirst (polydipsia) and excess body weight. This symptom is usually less marked. As a result, the disease may be diagnosed several years after onset, once complications have already arisen. (WHO 2015a).

This thesis was written using literature review method. After collecting the necessary data and analysing them, the result showed that both Finland and the USA

have very similar diet and drug therapy for diabetes type 2 and diabetes treatment in general.

2 PATIENT EDUCATION

It is stated by Mellor (2012) that patient education has been a key component of diabetes management in Europe for over 30 years. The commonly used model is the therapeutic patient education (TPE) (Mühlhauser et al, 1983 as referred to by Mellor 2012). The International Diabetes Federation (2005 as stated by Mellor 2012.) suggests that education should be offered at diagnosis and then frequently reviewed at changes of treatment. Dietary advice is important in improving management of diabetes at diagnosis. Health care department and diabetes UK states that the principles of well-framed education are evidence based and fulfil the needs of individuals, a structured curriculum, delivered by a competent instructor, are quality assured and regularly edited.

Blood pressure recommendation target for type 2 diabetes is <140/80mmHg. However, for people with other medical complication such as kidney damage or cerebrovascular damage, the target is <130/80mmHg. It is important for health care providers to educate patient about this. Patients can also be taught how to measure their own blood pressure and the measures to take when the result is below or above normal. (Bannister 2008.)

Self-blood glucose monitoring is important for all diabetic patients including the newly diagnosed patients. An average quality randomized control trials has also proven this. Most of the patients do want to and are able to monitor their own glucose level. The reason for the self-blood glucose monitoring must be authorized and patient must be educated on how to interpret the result and the action that needs to be carried out whether the blood sugar has raised more or its getting better. Health provider must make sure that patient doing the self-blood glucose monitoring are reviewed on impact regularly. (Bannister 2008)

Nursing intervention on diet and nutrition helps patient to be aware of importance of healthy eating in relation to diabetes. Individual should take three regular meals and ensure different ranges; snacks may be needed between meals and before bed where medication/insulin controls diabetes. Patient should take high fibre carbohydrates. Always eat more fruit, vegetables as part of meal. Fruit juice must be limited because it increases blood sugar quickly. Beans help in control of blood

sugars / blood fats. Reduce fat from meat and dairy products. Avoid saturated fats; grill, steam and oven-bake foods. Limit the amount of salt in food. Drink about 8 glasses a day especially water, patient must not add sugar or sweeteners to drinks and choose sugar-free drinks. (De Kleijn 2008.)

3 DIABETES

Diabetes is a chronic disease which happens when adequate insulin, a hormone that regulates blood sugar, is not produced by the pancreas, or when the insulin production cannot be used by the body effectively. This situation leads to hyperglycaemia, which is an increase in blood glucose concentrations. The major consequences diabetes has on the body are severe damage to the kidneys, heart (e.g. Stroke), eyes, nerves and blood vessels. Statistics show that it is the major cause of blindness, amputation and kidney failure. Furthermore, about 347 million people in the world have diabetes and in 2012, diabetes was the major cause of 1.5 million people's death. The total death amount that would be caused by diabetes in the next ten years is estimated to rise more than 50%, hence it is predicted to be the 7th leading cause of death in the world by the year 2030 (WHO 2015a).

3.1 Forms of diabetes

Generally, diabetes is categorized into three major forms known as diabetes type 1, diabetes type 2 and gestational diabetes.

Diabetes Type 1 is not preventable with current knowledge and was previously referred to as insulin dependent, juvenile or childhood-onset diabetes. The cause of diabetes type 1 is still not known. However, the risk for developing type 1 diabetes has been linked to exposure to some viral infections or environmental factors. Also the risk for developing the disease slightly increases, if there is a family member with the disease (IDF 2014). Diabetes type 1 is identified by the lack of insulin production by the pancreas and requires daily administration of insulin. Symptoms of type 1 diabetes include polyuria (excessive urine), polydipsia (excessive thirst), weight loss, changes in vision, tiredness and constant hunger. (WHO, 2015a.)

Diabetes Type 2, also known as non-insulin dependent or adult-onset diabetes, occurs as a result of the body's ineffective insulin usage. The common causes of diabetes type 2 are unhealthy diet, lack of physical activity and obesity (over weight). Its symptoms are similar to that of diabetes type 1, except that they are

less obvious, which makes it mostly difficult to be diagnosed in the early stages, hence complications would have already risen. (WHO, 2015a.)

Gestational Diabetes occurs to women during pregnancy. It is indicated by hyperglycemia with above normal blood glucose levels but below the diagnostic of diabetes. When this happens, the risk of complications during pregnancy and at delivery is increased. Also the possibility of having diabetes type 2 in the future is higher. Gestational diabetes is determined through prenatal screening, instead of reported symptoms. (WHO, 2015a.)

The authors of this thesis decided to focus on type 2 diabetes because it is becoming an increasingly common disease among all ages in the world which, if not managed properly, leads to micro and macro vascular complications. These complications can minimize the quality of life and increase morbidity and mortality rate (WHO 2015a). The authors wanted to discuss the causes, symptoms, diagnostic criteria as well as diet and treatment of type 2 diabetes.

3.2 Diabetes type 2

Diabetes type 2, which used to be only seen in adults but can now be diagnosed at any age, even with children, because it may remain undetected for many years. It is not always, but usually it is associated with obese or overweight people with a sedentary life style. Other risk factors that could lead to the development of diabetes type 2 include: family history and history of gestational diabetes. It is often diagnosed when complications (e.g. kidney failure, blindness, lower limb amputation, cardiovascular disease) appear, or when a routine blood or urine glucose test is done. During the early stages, diabetes type 2 can be managed through healthy diet and regular physical activity but as it progresses, there will be a need for oral drug or insulin. (IDF 2014.)

Management and treatment of type 2 diabetes require monitoring the blood glucose level, which can be done by a care giver or the patients themselves, thus self-monitoring of blood glucose. This helps care givers and the patient to access and follow the efficiency of their glycemic control plan. Diabetes screening should

be done for: overweight children starting at the age of 10 and repeated every 2 years, adults with body mass index (BMI) of 25 and above, every adult aged 45 years and above, repeating it every other 3 years, or any young person having the risk factor for developing type 2 diabetes. Every three months, examinations of blood pressure, eyes as well as skin and bones on feet and legs are done in order to prevent diabetes related complications. (Medlineplus 2014.)

Glycemic control / blood glucose monitoring can be grouped into two categories: Patient self-control of blood glucose: For insulin pump therapy and different insulin injection SCBG need to be done not less than three times per day. It allows patient to determine if they have reached the glycemic target by evaluating their response to therapy. The outcome may be useful in the prevention of hypoglycemia and adjusting medications (especially dosage of prandial insulin). It helps to achieve glycaemic goals for clients, using irregular insulin injections, medical nutritional therapy and non-insulin therapy. (American Diabetes Association 2008b.)

A1C (Glycated haemoglobin): This should be done two or more times a year for patients with stable glycemic control. It should be done periodically for patient that are not achieving glycemic goals or changed therapy. The point-of-care testing in A1C grants proper decision when needed on therapy changes. (American Diabetes Association 2008b.)

4 DIET THERAPY

The main goal in treating type 2 diabetics is to gradually improve the glycemic control which includes both pharmacological approach and diet therapy-non-pharmacology approach (American diabetes association 2008a). Diet therapy includes both healthy nutrition and healthy weight. Healthy meal means eating food from all the food groups, low calories and taking the same amount of carbohydrate at each meal (Medlineplus 2015a.)

It is said that the comprehensive way to reducing the glucose level is to eat low carbohydrate food. Patient with diabetes type 2 should eat carbohydrate from fruit, vegetables, low fat milk and whole grains. Also should monitor their carbohydrate level by counting the amount of carbohydrate in their food content. (American diabetes association 2008a.)

4.1 Carbohydrate

For maintaining glucose balance, large amount of carbohydrate is consumed and it will increase the required amount of insulin secretion. Insulin secretion by beta-cells is glucose sensitive and a high intake of carbohydrate in relation to energy intake produces higher post-prandial insulin levels. It is possible that repeated stimulation of a high insulin output by a high carbohydrate diet could speed up an age-related decline in insulin secretion and lead to an earlier onset of type 2 diabetes. However, the quality and quantity of carbohydrate can urge this response (Mann 2006). The most important source of carbohydrate is from vegetables, legumes, whole-grain cereals and fruits and a person total energy intake should contain about 45-60% of this while free sugars such as fruit juice and sugary drink should be no more than 5%. (The Scientific Advisory Committee on nutrition (SACN).

Additionally, carbohydrate needs to be monitored in other to obtain glycemic control like counting carbohydrate in meal, exchanges and experience-based estimation. Meal containing sucrose can be replaced by other carbohydrate food or if taken insulin or lowering glucose medication should be used after the meal. Too

much of energy intake should be avoided. The recommended dietary allowance for carbohydrate is 130g/day (American diabetes association 2008a.)

4.2 Protein

The dietary intake of protein should not be more than 20% of energy this is the same for patient without diabetes type 2, different studies have shown that glucose that are produced from ingested protein does not increase plasma glucose concentration but produces more serum insulin response. (American diabetes association 2008a)

4.3 Fat

(American diabetes association 2008a) recommends that patient should increase their intake of long-chain omega-3 fatty acids-EPA-Eicosapentaenoic acid and DHA-docosahexaenoic acid for example, fatty fish, and omega-3 linolenic acid ALA-alpha-linolenic acid. Fish (particularly fatty fish) should be eaten at least two times (two servings) each week. The amount of dietary saturated fat, cholesterol, and trans-fat recommended for people with diabetes is the same as that recommended for the general population. High level fat meal should be reduced such as, fat pies, pastries, sausages, burgers and other processed meat, full-fat dairy foods, cakes, crisps, chocolate should be reduced. (Clark 2014). In addition, saturated fatty acids and trans-unsaturated fatty acids is said to be below 10% of an individual's total energy (or below 8% if low-density lipoprotein [LDL] cholesterol is raised) these fatty acids has effect on insulin resistance and the increase insulin sensitivity recognized when unsaturated fatty acids are replaced by cis-unsaturated fatty acids. (Mann 2006).

4.4 Fiber

The intake of food that are naturally rich in fiber should be about 40 g/d (or 20 g/1000 kcal/d), this recommendation was derived from a random trail on type 1

and type 2 diabetes but this can vary due to individual beneficial effect. Around half of total dietary fiber should be soluble. This type of diet does not only improve glycemic control but also produce an increase in high density lipoprotein cholesterol level and reduces the low density lipoprotein cholesterol level. Food containing high soluble fiber has a low glycemic index. It is also stated that a meta-analysis within diabetes subject shows the percentage of hemoglobin A1c of average 0.43% lower in those consuming a diet of low-glycemic-index foods than in people eating a diet of high-glycemic index foods. (Mann 2006).

4.5 Alcohol

It has been said that alcohol raises the risk of low blood sugar (hypoglycemia) for patient that take tablet or insulin to control their diabetes. Limited amount of alcohol can be taken, but blood sugar level can be affect if alcohol is taken with an empty stomach. Liqueurs contain high level of sugar and they must be avoided (Nazarko 2011). Daily intake should be about one drink for women and two drinks for men. If alcohol is taken with carbohydrate substance it may raise the blood glucose but may not have affect alone when consumed moderately. (American diabetes association 2008a).

5 MEDICATION / DRUG THERAPY FOR TYPE 2 DIABETES

Pharmacological interventions or medication therapy are required in the treatment of type 2 diabetes when lifestyle modification alone proves insufficient to improve the glycemic control/index and reduce the risk of cardiovascular complications. In type 2 diabetes, important risk factors include central obesity, age and decreased physical activity among adults. (Capriotti 2005, 341.) The National Institute for Health and Care Excellence (NICE 2009) provides guidelines for type 2 diabetes management and states that the first line in drug treatment for type 2 diabetes is a class of oral anti-diabetic agents, namely: metformin, insulin secretagogues and acarbose, which is collectively known as oral glucose control therapies. This is started as a mono-therapy (e.g. metformin only), then continued as a combination therapy (e.g. metformin+ sulphonylurea) if a desired blood glucose level or a glycosylated hemoglobin (HbA1c \geq 6.5%) is not achieved.

The second line drug treatment for type 2 diabetes is other oral agents (e.g. Dipeptidylpeptidase-4 (DPP-4) inhibitor, thiazolidinediones) and Glucagon-Like Peptide-1 (GLP-1) receptor agonist. These drug(s) are introduced when the control of blood glucose level remains and / or becomes insufficient, or if the patient does not tolerate the first line drug therapies. The final stage is the initiation of insulin therapies or/ and combining insulin with an oral agent when the oral therapies fail. (NICE 2009.)

5.1 Oral and anti-diabetics agents

The Treatment of diabetes type 2 with oral anti-diabetic agents concentrates on reducing fasting and post meal hyperglycaemia as well restoring and maintaining a good glycaemic control. The major classes of oral anti-diabetics agents for the treatment of type 2 diabetes have different modes of action, safety profiles and tolerability. These classes include agents that spur insulin secretion, increase insulin action, minimize hepatic glucose production and delay digestion and absorption of intestinal carbohydrates. Oral anti-diabetic agents should be started with a low dose, then after the measurement of glycosylated hemoglobin (HbA1c) which is

done by self-monitoring of capillary blood glucose by some patients, the dose may then be titrated up conforming to the glycaemic response. The major classes of oral anti-diabetic agents have usually had a comparable average glucose-lowering effect, thus about an average of 1–2% reduction in HbA1c. It is an essential doctrine to modify treatments according to individual patients and doses must be titrated up steadily according to response. (Krentz & Bailey 2005, 386-387.)

5.1.1 Insulin Secretagogues

Insulin secretagogues consist of drug groups called sulphonylureas and rapid-acting prandial insulin releasers also known as meglitimide analogues.

Sulphonylurea has been largely used for half a century for type 2 diabetes treatment. These agents stimulate the secretion of insulin from the β -cell of the pancreatic islet, thereby lowering blood glucose levels. They are very effective when used early after type 2 diabetes diagnosis and are also regarded as good first line oral drugs for patients who, despite using non pharmacological measures (e.g. diet, exercise), have not achieved or cannot maintain a desired glycaemic index and are not overweight. They are cheap and when properly used, are safe and tolerable. Excluding other insulin secretagogues, they can also be used as combination therapy with other anti-diabetic agents. However, they can cause hypoglycaemia due to their ability to inhibit glucose production and stimulate insulin release at a low glucose level. They also have a side effect of increased appetite, unwanted weight gain and provoke long term cardiovascular disease risk. (Krentz & Bailey 2005, 390-395.)

Rapid-acting prandial insulin releasers (meglitimide analogues) are taken with meals or 30 minutes before meals, thus three times daily to stimulate fast but momentary insulin secretion. They improve fasting hyperglycaemia as well as lower postprandial glucose levels. They can be used as mono-therapy or as a combination therapy with other class of oral anti diabetic agents. Meglitimides can be helpful drugs for mild to moderate renal impairment patients but a small increase in weight could be expected. They are quite more expensive and have a lower risk of hypoglycaemia than sulphonylureas. (Capriotti 2005, 345.)

5.1.2 Insulin Sensitizers

These agents act directly against insulin resistance which is the main symptom of type 2 diabetes. It is made up of thiazolidinediones and biguanides (metformin). **Thiazolidinediones (glitazones)** enhance the whole body insulin sensitivity by stimulating a nuclear receptor called peroxisome proliferator-activated receptor γ (PPAR γ). The only thiazolidinediones the European Medicine Agency (EMA) approved of are pioglitazone and rosiglitazone, though using them as a combination therapy with insulin is still contraindicated. (Krentz & Bailey 2005, 404-408.) Thiazolidinediones reduce gluconeogenesis in the liver and increase glucose uptake in the skeletal muscle. It also reduces the concentration of plasma insulin. They have no risk of hypoglycaemia when used as mono-therapy, hence it can be used as a replacement drug if a patient has contraindication for, or is intolerant to metformin. They are also used as a combination therapy with other oral agents for obese or non-obese type 2 diabetes patients. The major possible risks to take into consideration when using thiazolidinediones are oedema, weight gain, bone fracture and anaemia. Diabetic patients with dyslipidaemia should not use thiazolidinediones because of their effect of increasing total cholesterol and LDL cholesterol levels. Patients with evidence of congestive heart disease or heart failure are contraindicated to the use of thiazolidinediones. (Capriotti 2005, 344.)

Biguanides (metformin) is one of the cheapest and most recognizable oral anti-diabetic drug available. Most type 2 diabetes patients widely regard metformin as a foundation of oral therapy or as an add-on to some patients on other treatments, such as sulphonylureas. Minimizing the production of an enormous amount of hepatic glucose is the dominant action of metformin. It increases hepatic sensitivity, coordinates cellular energy as well as glucose and lipid metabolism. It exhibits glucose lowering actions without causing overt hypoglycaemia and weight gain, in some cases it enhances weight loss in obese patients. Glucose uptake by the skeletal muscle is also increased by metformin. The potential adverse effects, however, include anorexia, impaired absorption of vitamin B12, gastrointestinal disturbance and sometimes lactic acidosis. (Capriotti 2005, 343.)

Metformin can be used as a mono-therapy or in combination with other oral anti-diabetic drugs and insulin, but it is contraindicated in patients with renal failure,

cardiac or respiratory problems, liver disease, metabolic acidosis history, alcohol abuse or any other condition that may lead to hypoxia. The initiating dose for children is one tablet of 500mg once / twice daily with meal and this may be increased at weekly intervals by 500mg. Depending on the country, the maximum dose for an adult is 2.55-3.0g daily (Krentz, Bailey & Patel 2008, 2134-2317.)

5.1.3 Alpha-Glucosidase Inhibitors

The alpha- glucosidase inhibitors available include miglitol, voglibose and acarbose being the most common. They have a good safety record of reducing postprandial hyperglycaemia by slowing down the digestion of carbohydrate, without causing weight gain or hypoglycaemia. They can minimize postprandial hyperinsulinaemia and some studies have proven that they have plasma triglyceride lowering effects. The most common side effect of alpha-glucosidase inhibitor agents is the gastrointestinal agent. (Krentz, Patel & Bailey 2008, 2138-2319).

5.2 Incretin-Based Therapy

Incretin therapy is a glucose lowering therapy based on the incretin hormone GLP-1 which is released from the endocrine cell in the gut during and after meal ingestion. GLP-1 contributes to the large secretion of insulin after meal ingestion which is associated with developed glucose-stimulated insulin secretion by intestinal hormones and called incretin effect. Incretin therapy action of stimulating insulin secretion and inhibiting glucagon secretion in the long run lowers fasting plasma glucose and fasting postprandial with a very low hypoglycaemic risk and no weight gain. A major challenge of GLP-1, however, was that it was inactivated quickly by an enzyme DPP-4 produced in the endothelial cell ,thereby making the circulating half- life of GLP-1 one to two minutes only. In order to overcome the effect of DPP-4, GLP-1 receptor agonist (DPP-4 resistant) and DPP-4 inhibitor were developed. (Ahren 2013, 31.)

5.2.1 Glucagon Like Peptides-1 (GLP-1) and GLP-1 Receptor Agonist/Inhibitor

Glucagon-like peptide (GLP-1), though found to be the most powerful insulin stimulator, still had poor response on people with Type 2 Diabetes. Therefore, GLP-1 agonists were developed to lengthen and upgrade GLP-1's activity of reducing blood glucose levels. GLP-1 agonists are now licensed for use in type 2 diabetes. These agents are injectable therapies, given subcutaneously (Ahren, 2013, p 31). GLP-1 agonist only works if there is glucose available to work with. This direct relationship to oral glucose load means that their hypo-glycaemia (hypo) risk is very low, hypo-glycaemia only increases when GLP-1 agonists are used with other drugs known to cause hypos. GLP-1 agonist has a wide range of effects among which there are; reduces both fasting and postprandial glucose levels which stimulates the secretion of glucose dependent insulin and suppresses the inappropriate elevation of glucagon; It also leads to weight and systolic blood pressure reduction. (Pratley 2008, 8.); It also hinders glucose neo-genesis in the liver and slows down the digestion process, hence delays gastric emptying leaving the patient feeling fuller for longer which leads to weight loss in some patients. (Ahren 2013, 31.)

GLP-1 receptor agonists are safe and highly tolerable with the only persistent adverse reaction being nausea and vomiting, which appears mostly only in the early weeks after therapy has begun. There are now four different types of GLP-1 analogues available: the original exenatide (Byetta) 5-10mcg is injected subcutaneously twice daily, the newer longer-acting version of exenatide 2 mg (Bydureon) is injected once weekly, liraglutide (Victoza) 0.6-1.2 mg and lixisenatide (Lyxumia) 10-20 Meg, are both injected once daily. Both exenatide and liraglutide when used as add on to metformin, sulphonylurea and thiazolidinedione, result in reduced HbA1c, fasting and prandial glucose as well as body weight. (Ahren 2013, 31.)

Liraglutide also comes in a dose of 1.8mg but this is not often used and is not endorsed by NICE (2010) in the treatment of diabetes, unless recommended by a specialist. The NICE (2009) guidelines also state that any patients treated with a GLP-1 should ideally achieve a glycaemic improvement of about 10 mmol/mol (1%) and/or a weight loss of 3% in the first 6 months of treatment. Failure to

achieve one of these targets means the treatment should be reviewed as it may not be cost-effective. Failure to reach either target should result in the treatment being stopped.

5.2.2 Dipeptidylpeptidase-4 (DPP-4) Inhibitor

DPP-4 inhibitors are oral tablets taken once or twice daily, developed to prevent the activity of the DPP-4 enzyme and prolong and strengthen the activities of GLP-1. The first study that showed the possibility of using DPP-4 was tested for a period of four weeks and the result was that it showed a reduction in both prandial and fasting blood glucose as well as HbA1c. DPP-4 inhibitors can be used as a monotherapy, as well as in combination with metformin, sulphonylurea, thiazolidinedione and insulin. Regardless of how it is used, there was improvement in glycaemia without weight gain or even with a slight reduction in weight with very low risk for negative effects including hypoglycaemia. DPP-4 inhibitors, such as sitagliptin (Januvia), vildagliptin (Galvus), saxagliptin (Onglyza) and linagliptin (Trajenta) are now clinically used in a lot of countries by patients. (Ahren 2013, 32.) Table 1 summarises the differences and similarities of the effects of DPP-4 inhibitor and GLP-1 receptor agonist.

Table 1. Differences and similarities between GLP-1 receptor agonist and DPP-4 inhibitor (Blonde 2011).

DPP-4 Inhibitors and GLP-1 Receptor Agonists



Properties/Effect	DPP-4 Inhibitors	GLP-1 Receptor Agonists
Glucose-dependent stimulation of insulin secretion	Yes	Yes
Glucose-dependent reduction of increased glucagon	Yes	Yes
Slows gastric emptying	No	Yes
Effect on body weight	Weight neutral	Weight loss
Side effects	Well tolerated, rare hypersensitivity	Nausea, vomiting
Hypoglycemia	Low risk if not used in combination with SU or insulin*	Low risk if not used in combination with SU or insulin [†]
Administration	Oral	SC

DPP-4, dipeptidyl peptidase-4; SC, subcutaneous.

*Staglipin combination with insulin FDA approved

[†]GLP-1 receptor agonists combination with insulin is investigational.

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5.3 Selective Sodium Glucose Co-transporter 2 Inhibitor (SGLT2-i)

Selective sodium glucose co-transporter 2 inhibitor (SGLT2-i), also known as gli-flozin, is a new class of glucose lowering drugs approved for mono-therapy, but mostly used in combination with metformin or other glucose lowering agents. They reduce glucose reabsorption and increase urine excretion by inhibiting the SGLT2 in the proximal nephron. Thus, it reduces blood glucose level by increasing the outflow of blood sugar (glucose) in urine. They reduce HbA1c by 5.5-11 mmol/mol (0.5-1.0%) and can be used at any stage of type 2 diabetes because their action is independent of insulin (Diabetes care, 2015). It safely and moderately reduces weight, FPG as well as systolic and diastolic blood pressure and has very low or no risk of hypoglycaemia. The side effects however are: worsened polyuria, dehydration, osmotic diuresis, urinary tract infections and Vulvo-vaginal infections. Patients already using diuretics and elderly patients should use this agent with caution. (ADA, 2015.)

5.4 Insulin Therapy

Insulin therapy was usually initiated by practitioners in a / the majority of type 2 diabetes patients in order to reach a desired and optimal glycaemic control (HbA1C <6) when the combination of non- insulin therapies and changes in life-style do not produce a satisfactory glycaemic control. Different kinds of individual factors, such as type of diabetes, the patient's degree of interest, patient needs, presence of diabetic complications (e.g. blindness), patient's job and financial situation etc. influence the decision to start insulin therapy, and a final decision should be made only after having a full discussion with the patient about it. A potential insulin therapy's side effect of hypoglycaemia and weight gain, as well as patient's own reluctance to monitor blood glucose and needle phobia, are the common reasons why some patients want to or try to avoid insulin therapy. Some patients also believe insulin therapy is a sign that they have failed in their treatment and would rather prefer to live with poor glycaemic control instead of starting insulin injection. Therefore, it is the duty of the health care professional to educate and help patients accept and start insulin therapy in order to succeed. Oral anti-diabetics such as metformin, sulfonylurea, sitagliptin, pioglitazone may still be continued while using insulin, unless contraindicated. (Morris 2011, 496.) Insulin therapy generally consists of three insulin regimens, namely: basal, prandial and premixed insulins.

Basal Insulin is the most common starting point for insulin therapy initiation consisting of glargine, detemir and neutral protamine hagedorn (NPH) and a dosage of once daily. They reduce preprandial glucose level, minimize the level of fasting glucose and weight gain with a low risk of both nocturnal and prebreakfast hypoglycaemia. This is achieved by basal insulin's function of indicating the amount of insulin required to minimize the liver's production of glucose and maintain good glucose levels between meals. (Spollet 2012, 254.) Basal insulin is usually started when the HbA1c level is less than about 9.5%. (Morris 2011, 497.)

Prandial Insulin (Rapid & short- acting insulin) according to Spollet (2012, 254-256) is short-acting insulin administered as a bolus to regulate postprandial hyperglycaemia. It is given before meal as a replacement therapy for basal insulin, or as an add- on therapy to the basal insulin. This has a quicker onset effect with a shorter acting time, hence producing a great reduction in the glycaemic levels. The

actions of the prandial insulin could be fast and / or short. The fast /rapid acting prandial insulin should be taken during meals, while the short acting prandial insulin should be injected 30 minutes before meal. There is an increased risk of hypoglycaemia if prandial insulin is not injected at the right time. Types of prandial insulin analogues include: insulin aspart (novolog), glulisine (apidra) and lispro (Humalog). (Boyle 2008, 384.) Morris (2011, 497) stated that this is given or intensified when basal insulin does not achieve the required glucose level or when the HbA1c level is greater than 9.5%.

Premixed Insulin Therapy is a premixed combination of a fixed dose of basal and regular or analog rapid-acting insulin used twice or thrice daily with meals, if greater control is required. Patients may, however, switch back to the basal-bolus therapy if an excellent or desired glucose control is not achieved after two or three premix insulin injections. Premixed insulin also has a high risk of hypoglycaemia if not used at the right time. (Spollet 2012, 255). According to NICE (2009), premixed insulin therapy should be considered if a patient's HbA1C \geq 9.

6 THE GOALS AND PURPOSE OF THE THESIS

The goals of the thesis were to find out the treatment of diabetes focusing on the drug and diet therapy in Finland compared to United States of America. In addition, authors of this thesis wants to find out how effective this treatment is in Finland as compared to the United States and how nurses can assist patients in the management/treatment of diabetes.

The purpose of the thesis was to find out the possible differences and similarities in the treatment of type 2 diabetes in Finland and the United States focusing on diet therapy (eating habits, exercise) and medication therapy(insulin, oral dugs, follow up blood sugar tests) based on the evidence based articles, journals, textbooks, and reliable sources like WHO.

This thesis explores the difference in the treatment outcomes of diabetes type 2 in Finland and the USA and the role of nurses, family members, health care practitioners and type 2 diabetes patients themselves in the treatment of diabetes.

The research questions of this thesis were:

What are the differences and or similarities between Finland and the USA in their diet and medication therapy treatment of type 2 diabetes?.

After the treatment of diabetes in both countries what are the differences in the outcome?.

7 THESIS IMPLEMENTATION

7.1 Literature review

The method used for data collection in this thesis was the literature review. Hart (1998 as stated in Cronin, Ryan & Coughlan 2008, 38) defines literature review as an objective, detailed or comprehensive summary and critical analysis of important researches and non-research literature on a topic being studied (Cronin, Ryan & Coughlan 2008, 38). Literature review can also be a simple summary of information published on a particular subject within a period of time. The discussed published information is coordinated in a pattern that combines both summary of the source's important information and the reconstruction or reorganization of the whole information. (The writing centre 2012.)

A good literature review is well written and incorporates if any, only a few personal prejudices. Literature review is a five step process, with the first step being identifying the subject of the literature review or selecting a topic for review. The second step is to search for the literature of the review topic using journals, books and publications and / or computers as well as appropriate electronic databases with keyword searches or alternative keywords with similar meanings (synonyms) that might evoke further information on the topic. The third step is to read and analyse the literature that has been gathered. This is done first by an initial overview of the articles, which mostly is done by reading the abstracts or summaries at the beginning of the papers. This helps to decide which articles are worthy of further reading. It is followed by a more critical and systematic review of the content of the chosen articles. The fourth step is writing the review. In order to write a good review after reading and analysing the literature, findings must be presented in a clear and logical way while considering the research questions at every decision. The last step is to mark all the references that were used in the research. This will create a complete background together with the information written about the current knowledge of the research topic or study reviewed. (Cronin, Ryan & Coughlan 2008, 39-42).

A thorough search for the research articles was done using CINAHL and SAGE data bases as well as other reliable online sources and publications. This search was limited to full text sources only in Finnish and English languages. The search outcomes were reduced to articles published from 2004 to 2015.

7.2 Data collecting process

The data collecting process proceeded according to the literature review process. The keywords used to search for information were diabetes, diabetes type 2, diet therapy and drug therapy.

Diabetes: This is a condition or a disease in which the blood sugar, or blood glucose levels are too high. Diabetes when not properly controlled or managed can lead to major damage of the body systems. (WHO 2015)

Diabetes type 2: This condition occurs when the body does not produce enough insulin or the insulin produced is not effectively used by the body. Diabetes type 2 is also known as adult onset diabetes and it is usually occurs as a result of physical inactivity and excess body weight. (WHO 2015).

Diet therapy: This involves treatment of a disease by regulating the whole diet. The diet regulated includes daily amount as well as the kind of food and drink taken in by a person (The free dictionary 2015 a).

Drug therapy: This is also known as pharmacotherapy. It is the use of drugs in the treatment of disease (The free dictionary 2015 b)

7.2.1 Choosing the topic for review

Choosing a topic for review was the first step in this thesis writing, as it is required in order to begin collecting data for the thesis. The authors of this thesis chose to write about the diet and medication therapy in the treatment of type 2 diabetes. The focus was on the diet recommendations for type 2 diabetes patients, as well

as the different kinds of type 2 diabetes drug/medication therapy, their effect and when to initiate them on patients.

7.2.2 Inclusion and exclusion criteria

Appropriate keywords related to the thesis topic were used as search words, and the result outcome were restricted by choosing inclusion and exclusion criteria. This helped to achieve useful and up-to-date information for the thesis and also reduce the number of result articles to a manageable size. The data search was restricted by choosing only full text articles, published literature and the articles had to be peer reviewed. All the articles and information used were no more than ten years old. Table 2. explains more about the inclusion and exclusion criteria.

Table 2. Inclusion and Exclusion criteria used in the data search of the thesis.

Inclusion Criteria	Exclusion Criteria
Published literature	Non- published literature
Language: English and Finnish	Language: Other languages
Free articles	Non- free articles
Articles with abstract	Articles with no abstract
Published in year 2004 or later	Published before 2004
Peer reviewed articles	Non- peer reviewed articles
Full text articles	Non- full text articles
Scientific articles	

7.2.3 Data search result

CINAHL with full text and SAGE were the electronic databases used for data search to write this thesis. "Type 2 diabetes" AND "Diet therapy", "Diabetes type 2" AND "Drug therapy" were the search words used to search for articles in both databases used and each yielded quite a large number of search results. The basic inclusion and exclusion, such as full text articles published from 2004 were marked beforehand.

CINAHL with full text database was used twice to search for articles, each time using different keywords. The first search word used in CINAHL was "type 2 diabetes" AND "diet therapy", the search results' outcome were 98 articles. After reading the title, 88 articles were included while 10 were excluded. Also, after reading the abstract and the introduction, 29 articles were included from the 88 articles. After reading through, 21 articles were excluded and 7 were included. After reading thoroughly, all the 7 articles were used in the thesis. The second search word was "diabetes type 2" AND "drug therapy". The search results' outcome for this search word was 363 articles. 82 articles were included after reading through all the titles of the search result outcome. Furthermore, 30 articles were included after reading the abstracts of those 82 articles. Finally, after thoroughly reading through and reviewing the 30 chosen articles, 19 were excluded and 10 were found to be relevant to the thesis topic and were included in the final thesis. CINAHL with full text database search process of both search words, including how the inclusion and exclusion criteria were used to get the required articles, are shown in the figures 1 and 2.

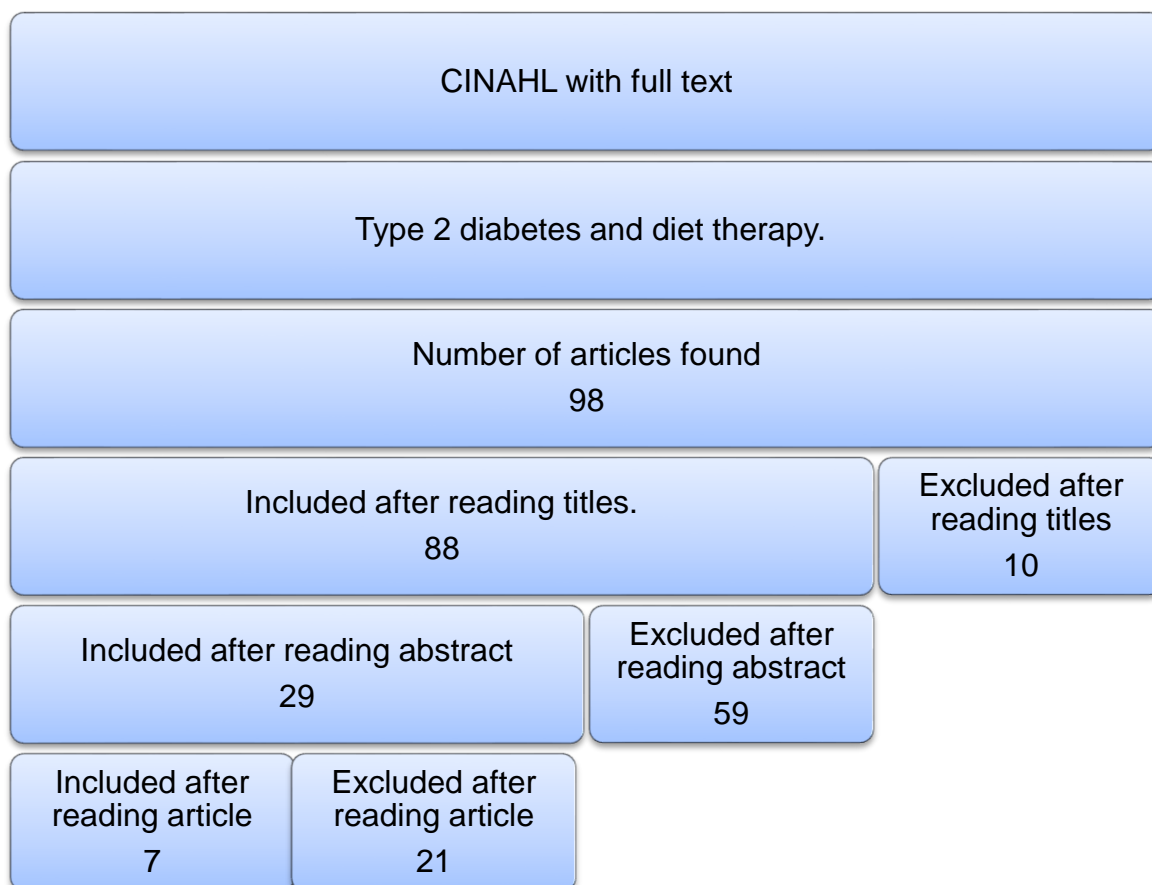


Figure 1. The first search results from CINAHL.

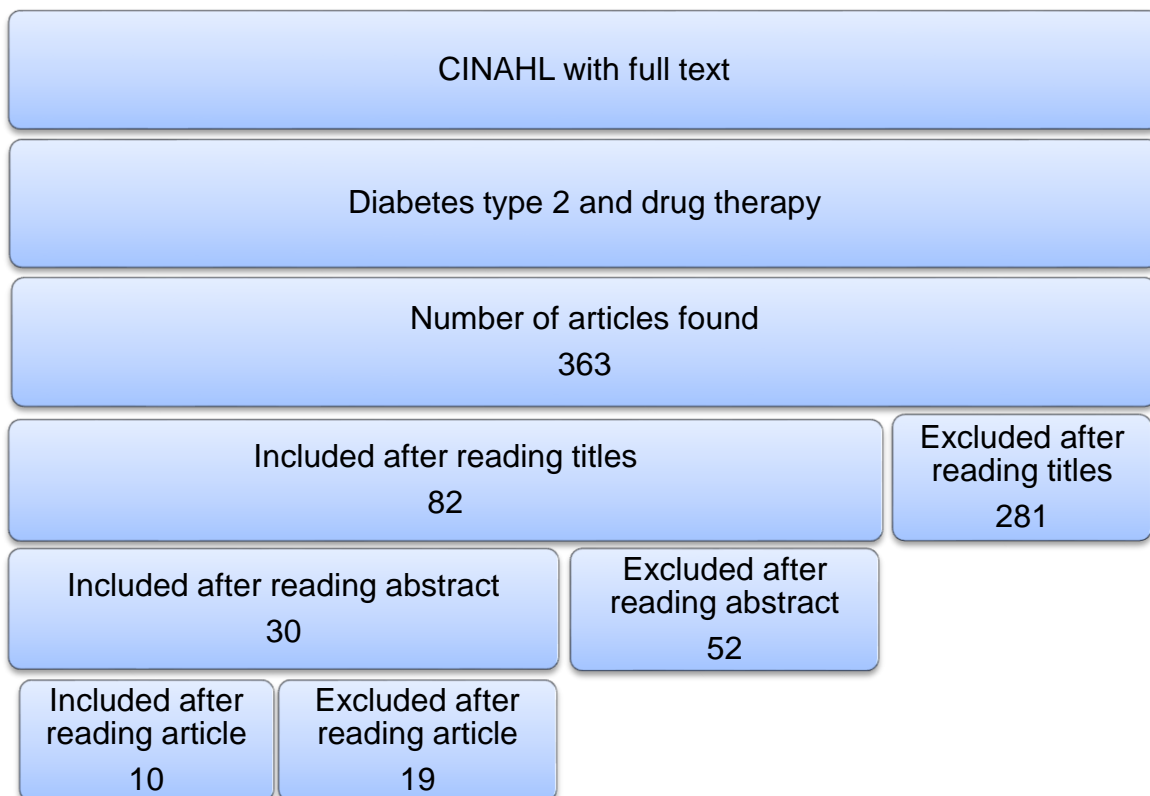


Figure 2. The second search results from CINAHL.

SAGE database was also used twice to search for articles, each time using different keywords. The first search words used in SAGE were “Type 2 diabetes” AND “Diet therapy, and the second search words were “diabetes type 2” AND “drug therapy”. However, no article from SAGE was included in the writing of the thesis after using the inclusion and exclusion criteria as well as reading the titles, abstracts and articles. The search results for both search words when SAGE database was used is provided in figure 3 and figure 4.

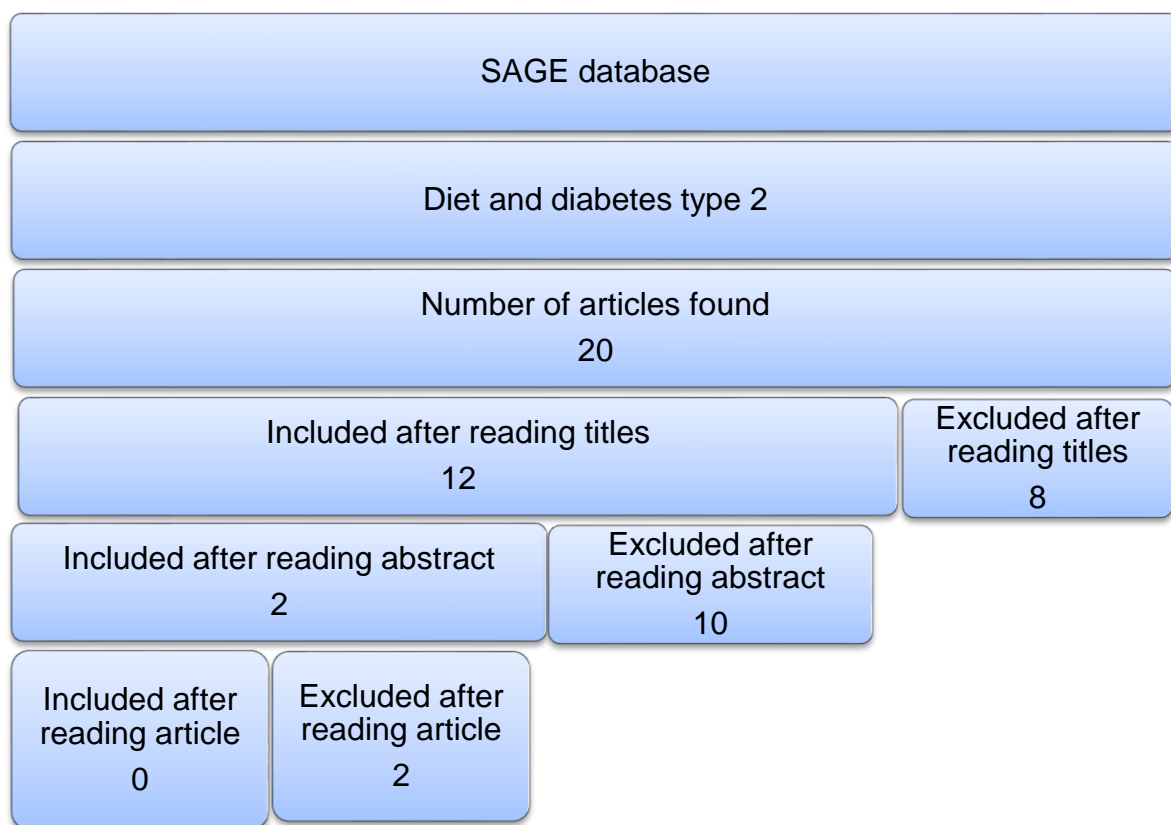


Figure 3. The first search results from SAGE

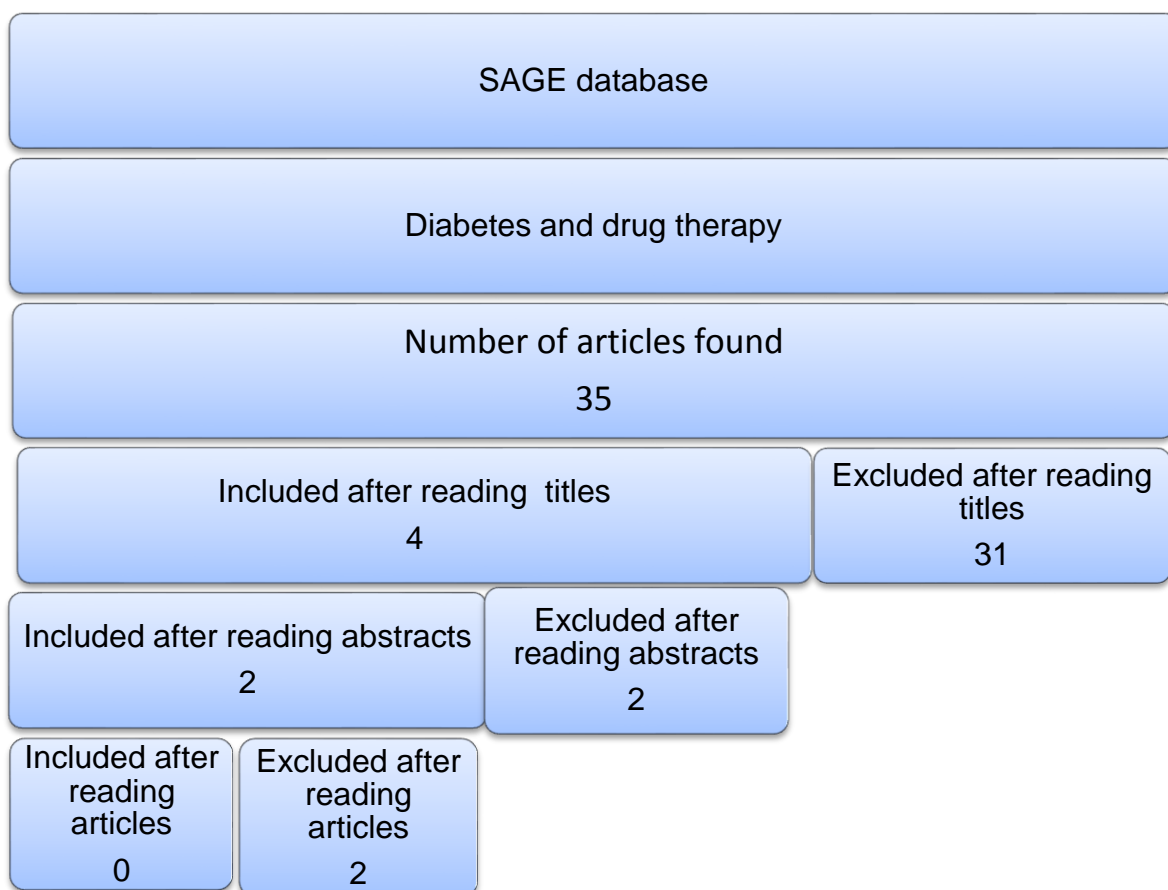


Figure 4. The second search results from SAGE.

In conclusion, a total of 17 articles from CINAHL and SAGE databases, in addition to other reliable online publications and webpages from free internet such as WHO, ADA, IDF, ACCE, NICE, medlineplus, terveyskirjasto etc. were used in the writing of this thesis.

7.3 Content analysis

Content analysis is a method used to analyse qualitative and / or quantitative data in a deductive or inductive way. Inductive content, which is recommended if there is not enough former knowledge about a subject or if the knowledge is fragmented (Elo & Kyngäs 2008), is the content analysis process used in this thesis.

Generally, there are three main phases in either the deductive or inductive content analysis process, namely: preparation phase, organisation phase and reporting of

results phase. The preparation phase involves collection of data to be analysed. The next phase is the organisation phase, where the data collected are read, understood, interpreted and coded in a valid and reliable way. According to Polit & Beck (2004 as referred to by Elo & Kyngas 2008), in this stage, in order to become totally submerged into the data, it is important to read through the material several times and note the key question when reading the data and material. The questions are: What is happening? When did it happen? Where is this happening? Who is telling? and Why?. The reporting of results or found information is the last phase of content analysis (Elo & Kyngas 2008).

7.3.1 Data analysing process

This thesis was conducted using the inductive content analysis method. Data related to diabetes, diabetes type 2, drug therapy and diet therapy were searched and the articles or materials related to the topic were selected and read. The data was then organised by making notes and headings in the text while reading was going on. The chosen articles were read through several times focusing on points needed to provide information for the thesis writing. Questions stated by Polit & Beck (2004 as referred to by Elo & Kyngas 2008)) were noted and some answered. As many headings as necessary were written down in the margin to describe all aspects of the content and sub-categories and generic categories were freely generated from these headings. The data analysis process used in the thesis is shown in table 3.

Table 3. Result categories of the thesis.

Sub-Categories	Generic Categories	Main Category
<p>Food and eating principles</p> <p>Obesity in diabetes</p> <p>Lifestyle modification</p>	<p>Similarities and differences in the diet therapy between Finland and the USA.</p>	<p>General guidelines on the treatment and management of type 2 diabetes.</p>
<p>Oral antidiabetic agents</p> <p>Glycaemic control algorithm in the treatment of type 2 diabetes.</p> <p>Insulin therapy.</p> <p>Other antidiabetic agents.</p>	<p>Similarities and differences in the drug therapy between Finland and the USA</p>	

8 RESULTS

The results of this thesis answer the research questions concerning the differences and similarities between Finland and the USA in their treatment of type 2 diabetes, as well as the possible differences in the outcome of their treatments. The results also show the general guidelines necessary for nurses, patients and their caregivers (e.g.family) in the management of type 2 diabetes.

Individuals suffering from diabetes have their own metabolic profile, treatment goals, possible outcomes/recovery, eating habit and choices of food, which is why the nutritional therapy must be categorized. Monitoring the metabolic parameters, including glucose, HbA1c, lipids, blood pressure, body weight, and renal function when applicable. The quality of life is also essential to assess the need for changes in therapy and to ensure successful outcomes. Continuous nutrition self-management education and care needs to be available for individuals with diabetes. (American Diabetes Association 2004.)

8.1 General guidelines on the management of type 2 diabetes.

Following the WHO and ADA criteria, the results of one or all of these following three tests can be used to diagnose diabetes type 2: the fasting plasma glucose (FPG) ≥ 7.0 mmol/l (126 mg/dl), or oral glucose tolerance test (OGTT) 75g with 2 hour plasma glucose ≥ 11.1 mmol/l (200 mg/dl), or glycated haemoglobin (HbA1c) $\geq 6.5\%$ / 48 mmol/mol, or random plasma glucose (RPG) ≥ 11.1 mmol/l (200 mg/dl) in the presence of diabetes symptoms (WHO 2006). Asymptomatic individuals with a single abnormal test should have the test repeated to confirm the diagnosis unless the result is unequivocally elevated. When a random plasma glucose (RPG) level is ≥ 5.6 mmol/l (≥ 100 mg/dl) and < 11.1 mmol/l (< 200 mg/dl) is detected, a FPG should be measured, or an OGTT performed, or an HbA1c measured and evaluated after three months in order to accurately diagnose the presence of diabetes. Lifestyle modifications and control of hyperglycaemia, blood pressure and cholesterol are important in the management of diabetes. (IDF 2012.)

The management of type 2 diabetes should be patient centred. Patients should receive formal education on how to take care of themselves and how they will be taken care of, such as the need for a change in lifestyle (diet + exercise + smoking), self –glucose monitoring, carbohydrate counting, possible future care (oral medication and insulin therapies) as well as possible diabetes associated complications and how they can be managed or prevented. Such education should start almost immediately after the diagnosis and throughout the care that will be given. People with diabetes should be advised that it is important to achieve and maintain an HbA1c below 7.0% / 53 mmol/mol, so the risk of developing complications is minimised. For patients with co-morbidities and or history of hypoglycaemia due to an attempt to optimise control, a higher HbA1c target may be considered. For diabetic patients HbA1c level should be regularly checked taking into account benefits, safety and tolerability. The on-going care or treatment should be reviewed and modified if HbA1c level is above or below the agreed target on two consecutive occasions. Advice should be given to patients in whom the target HbA1c levels cannot be reached that any improvement is beneficial (IDF 2012). Table 4 shows the equivalent values for HbA1c and capillary plasma glucose.

Table 4. Values for HbA1c and plasma glucose level. WHO and ADA criteria. (WHO 2006; ADA 2014).

	Normal level	Diabetes level
HbA1c	<6.0% / 42 mmol/mol	≥ 6.5% / 48 mmol/mol
Fasting plasma glucose (FPG)	5.5 mmol/l (100 mg/dl)	≥ 7.0 mmol/l (126 mg/dl)
2 hours Post meal plasma glucose or RPG in the presence of symptoms	<200 mg/dl (11.1 mmol/l)	≥ 200 mg/dl (11.1 mmol/l)

8.1.1 Diabetes and treatment of type 2 diabetes in Finland

In Finland, over about 250,000 people (Finns) have type 2 diabetes (Diabetestieto 2015a). The treatment for type 2 diabetes starts with diet and exercise. Medication therapy is initiated when a desired hb1Ac value is not achieved with diet and exercise only. The treatment of type 2 diabetes is carried out mainly by the patient, thus the patient's willingness to modify his or her life style, since life style modifications such as healthy eating habits and regular exercise are very important in the treatment and management of type2 diabetes. Nurses and health care professionals provide the diet and exercise guidelines. The doctor decides the kind of medication to be administered alongside the life style modification treatment. If the patient is very obese, then bariatric surgery is advised or suggested to patient. Upon patient agreement, it is done to make the patient lose about 30 to 40 kilograms of their weight, which sometimes helps completely with their diabetes cure or restore their blood sugar level back to normal without any medication (Terveyskirjasto 2015). Finland uses the criteria for diabetes diagnosis provided by the World Health Organisation (WHO) and American diabetes association (ADA) in the diagnosing of diabetes (Kaypahoito 2015.)

8.1.2 Diabetes and treatment of type 2 diabetes in the USA

The seventh leading cause of death in the USA now is diabetes mellitus. Type 2 diabetes affects about 90-95% of their population suffering from diabetes (Qaseem, Humphrey, Sweet, Starkey & Shekelle 2012). The treatment of diabetes is started with patient education and lifestyle modification. When the result is not enough, pharmacotherapy is then introduced. Pharmacotherapy is initiated as an add-on therapy to the lifestyle modification and can be adjusted based on patient response. The targeted HbA1c level for patients with low risk of hypoglycaemia and no coexisting serious illness is $\leq 6.5\%$. However, based on factors such as age, co-morbid conditions, duration of diabetes, risk of hypoglycemia, patient motivation, adherence, and life expectancy, care given and HbA1c target level is individualized for each patient, mostly HbA1c target is $> 6.5\%$. In overweigh diabetic patients, obesity is first treated using lifestyle modifications (diet +exercise), medi-

cations and/or surgery. Generally, lifestyle modification is the first step in the treatment of type 2 diabetes. When the desired result (HbA1c $\leq 6.5\%$) is not achieved with lifestyle modifications only, then oral anti-diabetic medications and/or insulin are added to the treatment. (ACCE 2013, 8-10.)

8.2 Similarities and Differences in the diet therapy between Finland and the USA for diabetes type 2.

8.2.1 Food and eating principles for type 2 diabetes patients in Finland

A healthy diet is very important in the treatment of type 2 diabetes, since the major cause of type 2 diabetes is an excess amount of fat tissue inside the abdominal cavity and the liver, therefore a lot of emphases is placed on diet that helps reduce fat from the abdominal cavity relatively more than the skin below. The most important change in the diet of type 2 diabetes patients is to reduce their amount of energy (carbohydrate) intake, their level of salt intake should be monitored (should not be too high) to help treat diabetes related hypertension and cardiovascular diseases, their amount of saturated fat used is also monitored in order to control their blood cholesterol level. Patients are advised to use healthy vegetable oils when cooking. 400-500 grams of vegetables, berries and fruits are or should be eaten daily (Terveyskirjasto 2015).

8.2.2 Food and eating principles for type 2 diabetes in USA

United state department of agriculture food model explains that plate food should contain- vegetable (about half of the plate), protein and starch should be one quarter each. Grain, Beans and Starchy Vegetable- A person should eat six or more serving per day. Foods like bread, grains, beans, rice, pasta, and starchy vegetables are at the bottom of the pyramid because they should serve as the foundation of your diet. All together they contain vitamins, minerals, fiber, and healthy carbohydrates. (Medlineplus 2013)

It is necessary to eat foods containing a lot of fiber, whole-grain meal like whole-grain bread or crackers, tortillas, bran cereal, brown rice, or beans. Whole-wheat or any form of whole-grain flours in cooking and baking and low-fat breads, for example bagels, tortillas. (Medlineplus 2013)

Vegetables should be served about 3-5 servings per day. A patient should eat either fresh or frozen vegetables without added sauces, fats, or salt. Choose more dark green and deep yellow vegetables, such as spinach, broccoli, romaine lettuce, carrots, and peppers. (Medlineplus 2013)

Fruits must be taken about 2-3 serving in a day, more whole fruit rather than juices; whole fruits have extra fiber. Citrus fruits, such as oranges, grapefruits, and tangerines, are the best. Do not take juices that contain added syrups or sweeteners. (Medlineplus 2013)

Milk choice should be low-fat or nonfat milk or yogurt. Yogurt has natural sugar in it, but it can also contain added sugar or artificial sweeteners. Yogurt with artificial sweeteners has fewer calories than yogurt with added sugar. (Medlineplus 2013)

Meat and Fish eaten should regularly be fish and poultry. Make sure to remove the turkey and chicken skins because of the fat it produces. Select lean cuts of beef, veal, pork, or wild game remove also any visible fats. Patient should avoid frying food by baking, roasting, grilling or boil. (Medlineplus 2013.)

8.2.3 Similarities of drug therapy of diabetes type 2 diabetes in Finland and U.S.A.

Carbohydrate counting is very important when planning the diet of type 2 diabetes patients. Carbohydrates are one of the main nutrients found in food and drinks which includes starch, sugar and fibre. However, it increases it cases a rise in blood sugar level than the other nutrient, Carbohydrate counting helps to control the blood sugar level. It has been suggested that carbohydrate intake should be from 45-60% total calories. One gram of carbohydrate provides about 4 calories, so patient must divide the number of calories you want to get from carbohydrates by 4 to get the number of grams. For example, if you want to eat 1,800 total calo-

ries per day and get 45% of your calories from carbohydrates, you would aim for about 200 grams of carbohydrate daily. You would calculate that amount as follows: $45 \times 1,800 \text{ calories} = 810 \text{ calories}$. $810 \div 4 = 202.5 \text{ grams of carbohydrate}$ (NIH 2014). Table 5 shows the percentage of total intake of nutrients required of a diabetic type 2 patient whiles Figure 7 show an example of a daily meal calories.

Table 5. Percentage of total energy intake. (Diabeetikon Ruokavaliosuositus 2008).

Nutrient	Form	Amount (%)
Carbohydrate		45-60
Fat	Saturated and trans fatty acid.	Less than 10
	Monosaturated fatty acids	10-20
	Polyunsaturated fatty	5-10
Protein		10-20



Figure 5. Example of a daily meal 300-400kcal ((Diabetestietoa 2015b)

Obesity is defined as an abnormal or excessive fat accumulation by the body that presents a risk to health. Obesity is measured using the body mass index (BMI) scale. This involves measuring a person's weight (in kilograms) divided by the square of his or her height (in metres). Generally an individual is considered obese if BMI reads 30 or above while those with BMI equal to or more than 25 are considered overweight (WHO 2015b). Obesity management is essential in the prevention and treatment of type 2 diabetes and its complications. Overweight or obese people are at high risk of developing type 2 diabetes. Also being overweight following a diagnosis of type 2 diabetes will raise the risk of future complications. Estimation shows that 60–90% of cases of type 2 diabetes are directly related to obesity. There has been a suggestion that people who are overweight and have been diagnosed with type 2 diabetes need significant weight loss through a very low calorie diet (600kcalorie/day) or through bariatric surgery, and this may even lead to remission of the condition. There has been improvement in the glycaemic control and reduction in the risk of developing diabetes in people who have impaired fasting glycaemia or impaired glucose tolerance upon moderate weight losses (5-10% of starting weight). Over the years, numerous drug options have been tried to help people lose weight, but many, as a result of the undesirable negative effect (drug reaction), have been withdrawn from the market. Presently orlistat is the only medicine which has a license for prescription in the UK to help support weight loss. (Thomas & Storey 2013). Recent research into the role of liraglutide as a weight loss treatment has now proved promising and may offer another tool in the fight against obesity (NICE 2010).

Lifestyle modifications, such as weight loss, increased physical activity and improved eating habits are essential in the management of type 2 diabetes. Nurses educate patients on the importance of lifestyle modifications in relation to diabetes. Guidance on the kinds of healthy foods and eating habits which include no over-eating, eating only when hungry not when bored or sad, not watching television while eating, etc. are taught to patients. Nurses advise and educate patients on the effects of smoking and alcohol intake on their health and present condition if patients use them. Patients are guided on the kinds of exercise and physical activities they can engage in that will lead to weight loss. Nurses can also plan with patients on how they can go about the exercise, either alone, with a friend(s) or

group e.g. gym and if it is going to be daily or some days a week. Nurses advise patients on how long they can exercise when they do, then how many minutes or hour is enough at a time or for a day. Nurses discuss the goal weight with patients and the time frame for achieving it, but let patients understand that it is still a progress if there is a decrease in weight, even if they are not able to achieve the set goal. Despite the fact that lifestyle modification alone is unlikely to help achieve an adequate glycaemic control, there has been evidence that lifestyle modifications can result in prolonged changes in blood glucose levels with the right support from healthcare professionals. (Robertson 2012, 278-279).

8.2.4 Differences

After reading through many scientific and this thesis topic related articles, authors found out that there is no difference in the diet therapy in both countries. Their most important focus in the diet of type 2 diabetes patients is to reduce their amount of energy (carbohydrate) intake.

8.3 Similarities and differences in the drug therapy between Finland and the USA

Below 8.2.1 and 8.2.2 will explain how drug therapy for diabetes type 2 is used and managed in both Finland and U.S.A. It will also show or emphasize on any similarities and or differences these two countries have in their treatment ways

8.3.1 Drug Therapy (antidiabetics) in Finland

Oral anti-diabetic agents are the medication initiated in the drug therapy of type 2 diabetes. In Finland, medication therapy for the treatment of type 2 diabetes is usually initiated when HbA1c level is repeatedly about 6.5-7.0% (50 mmol/mol) despite patient's lifestyle modification (exercise and diet) measures. Medication therapy is started using oral anti-diabetic agents. Metformin is usually the oral anti-diabetic agent started as a first line drug treatment for type 2 diabetes patients un-

less contraindicated (Diabetestietoa 2015a). It is also a starting treatment for overweight diabetic patients. It reduces sugar production in the liver. Other oral medication may be added to metformin or any first line drug used, if a single agent is not effective within 3-6 month. This is known as the dual or combination therapy. Insulin therapy is the final treatment when the oral medication, together with the lifestyle modifications, still do not help achieve a normal or desired HbA1c level, thus HbA1c < 7.0% (53 mmol/mol). The commonly used insulin is the long-acting insulin, which is mostly injected in the evenings and the short-acting insulin which is injected before meals. Usually metformin and other oral medication could still be continued even when insulin therapy is introduced or initiated (Terveyskirjasto 2015). It is important to constantly monitor weight, blood pressure and cholesterol levels after pharmacotherapy initiation, and also each time a drug is intensified (Diabetestietoa 2015a).

Other oral antidiabetic agents and medication used in Finland besides metformin are sulphonylureas (glibenclamide, glipizide, glimepiride) to increase pancreatic insulin secretion. DPP-4 inhibitors (sitagliptin, linagliptin, vildagliptin, saxagliptin) are administered once or twice a day depending on the product to increase insulin secretion and reduce glucagon secretion. GLP-1 inhibitors (exenatide and liraglutide) are injected 1 to 2 times a day to increase insulin secretion and reduce hepatic production of sugar. Insulin sensitizers or glitazones (pioglitazones) are used to sensitize tissues to the effects of insulin. Rapid acting prandial insulin releaser "glinidit" (nateglinide, repaglinide) are consumed immediately before meal to rapidly increase the pancreas in secretion of insulin, SGLT2-I and acarbose. (Sydänsairudet 2014.)

8.3.2 Drug therapy for type 2 diabetes in the USA

Pharmacotherapy is initiated as an add-on therapy to lifestyle modification. Oral anti-diabetic agents / medications are initiated when starting pharmacotherapy. Metformin, sulphonylurea, thiazolidinedones, GLP-1 inhibitor, DPP-4 inhibitor, glinides, sodium glucose co-transporter 2 inhibitor (SGLT-2i), and meglitimide are the oral anti-diabetics used in the treatment of type 2 diabetes. Most of these

drugs have little or no side effects. However, thiazolidinediones, sulphonylurea, SGLT-2i, and glinides should be used with caution. Any of these drugs could be used as a mono, dual and/or triple therapy, though metformin is usually the preferred first line drug to use unless contraindicated. Each therapy initiated is monitored and evaluated every three months before moving on to or adding on another therapy or stopping some therapy. Insulin therapy is the last therapy initiated and/or intensified when the desired HbA1c level is not attained. The cost and benefit: risk ratio is taken into consideration when choosing a medication and ineffective therapies are stopped. (ACCE 2013, 8.)

8.3.3 Similarities

Both the USA and Finland use the same or similar diagnostic criteria in diagnosing type 2 diabetes. Upon the diagnosis of type 2 diabetes in both countries, patients are educated about the disease: how to deal with it or manage it with their activities of daily living and how their care plan is going to progress. The care given is patient centred and the goals are to: safely lower blood glucose level using pharmacological and non-pharmacological therapies, improve patient wellbeing, educate patients, evaluate micro and macro-vascular complications and reduce cardiovascular and other possible long term risk associated with type 2 diabetes. They both also have similar care pathways in the treatment of type 2 diabetes, it begins with lifestyle modifications, with possible bariatric surgery if the patient is very overweight. Then initiation of pharmacotherapy, if lifestyle modification measures alone are not providing the desired result. The pharmacotherapy starts with oral anti-diabetic agent, preferably metformin and progress to insulin therapy if needed (Qaseem, Humphrey, Sweet, Starkey & Shekelle 2012, 221-222 ; terveykirjasto 2015). These steps in the treatment of type 2 diabetes are known as glycaemic control algorithm. (IDF 2012.)

Glycaemic control algorithm is the general treatment plan and guide used for type 2 diabetes and both Finland and the USA use it in the treatment guide for their type 2 diabetic patients. It shows the necessary steps to take when treating type 2 diabetes. For example, it explains what treatment to begin with and when to

initiate it as well as the appropriate time for next step in the treatment. Glycaemic control algorithm care pathway always begins with lifestyle modification interventions (diet + exercise) for every type 2 diabetic patient. Oral anti-diabetic agents are then added to lifestyle modifications when the target level of blood glucose level is not achieved or maintained. The algorithm explains the kinds of possible medication that can be used as the first line therapy or initiating drugs, the second line medication therapy, the third line medication therapy, fourth line therapy as well as those that can be used alone (mono-therapy), in combination with other agents (dual therapy) and as a triple therapy. It also explains when it is the appropriate time to start each therapy. Figure 5 shows an example of a typical glycaemic control algorithm. (ACCE 2013, 8.)

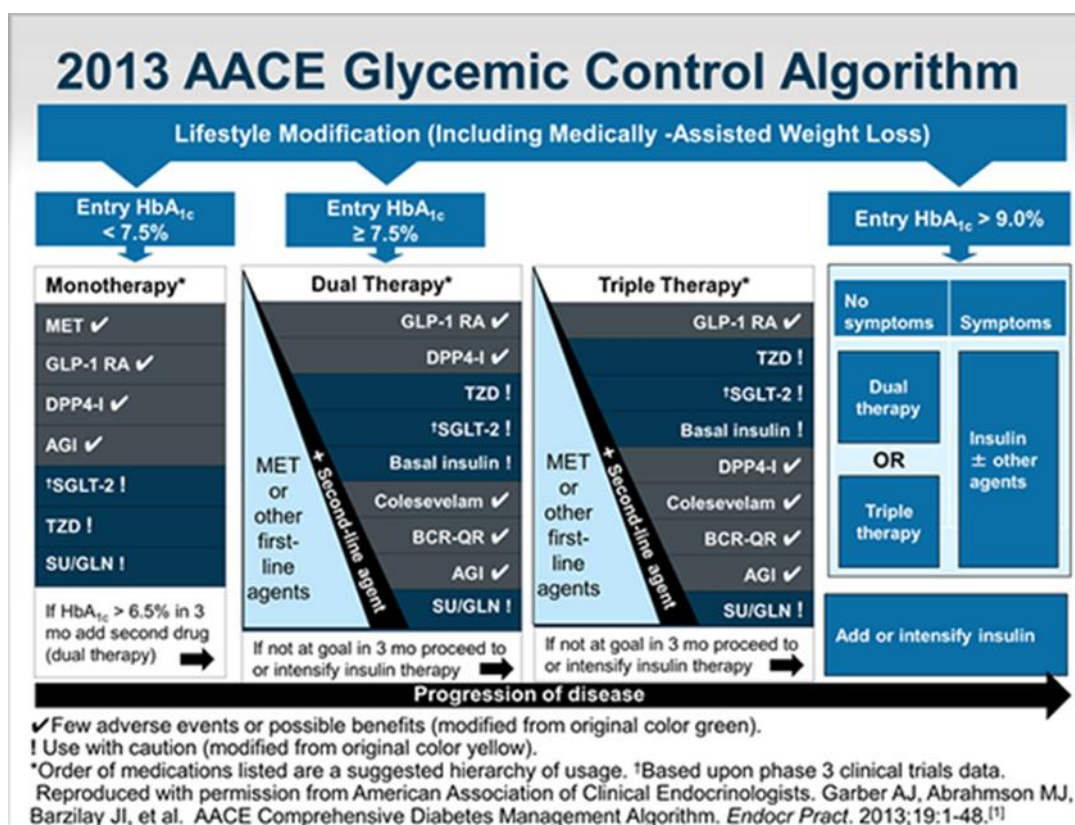


Figure 6. Glycaemic control algorithm for type 2 diabetes treatment. (Medscape 2015).

8.3.4 Differences

It was found that there are no differences in the medication therapy in both Finland and the USA. Both countries have the same medication, such as metformin, and the time frame in the medication usage is also the same.

8.4 Results outcome

The result outcome for the treatment of type 2 diabetes showed that HbA1c level is reduced by 1% by all anti diabetic agents. However, metformin decreases HbA1c level more than DPP-4 inhibitor does. All dual or combination therapies were more efficient than mono-therapies and reduced HbA1c levels by an additional 1%. There was also greater decrease in HbA1c level when metformin was combined with other agents, for example metformin + sulphonyurea. The risk of hypoglycaemia is increased when incretin-based therapies are added to sulphonylureas, though they are generally well tolerated and have a low risk of hypoglycaemia. Monotherapy with metformin resulted in more weight loss as compared to thiazolidinedione, sulphonylureas and DPP-4 inhibitor. A combination therapy of metformin and sulphonylurea resulted in lesser weight loss as compared to the combination of metformin and GLP-1 inhibitor (Qaseem, Humphrey, Sweet, Starkey & Shekelle 2012, 221-222.)

To conclude, the majority of people suffering from type 2 diabetes are insulin resistant or overweight. Nutritional therapy should focus on the lifestyle modifications to result in increased energy figure through physical activity and lowered energy intake. The nutritional therapy of diabetes type 2 emphasis on lifestyle planning to reduce glycaemia, dyslipidaemia and blood pressure; because many people with diabetes have hypertension and dyslipidaemia. This leads to reduction in the intake of cholesterol, saturated fat and sodium desirable. This planning should start as soon as the patient has been diagnosed with diabetes. An increase in physical activity can result in improved glycaemia, lowered insulin resistance, and reduced cardiovascular risk factors. The distribution of the food intake, three meals or smaller meals and snacks, should be based on individual preferences. Treatment with insulin therapy requires firmness in timing of meals and carbohydrate content.

Multiple insulin dosing regimens allow for a more flexible food intake and lifestyle in persons with type 2 diabetes. (American Diabetes Association 2004.)

9 DISCUSSION AND CONCLUSION

9.1 Reflecting on the review and result

Type 2 diabetes people is widely increasing worldwide especially in united states, where there is lot of obesity people both adult and child. Untreated diabetes type 2 can lead to different kind of health problem such as heart disease and stroke, nerve damage, kidney disease and foot problem. (NHS choices 2014). This literature review describes the treatment both pharmacology and nutritional treatment. The quantity of food patient eat depend on weight, diet, exercise regularity and other health risk. (Medline 2013).

In the authors experience in dealing with diabetes 2 patient in Finland hospitals, nurse, doctors, diabetes nurse, and dietician all work together in the process of the treatment. Dietician focus on diabetic patient's food and energy intake. Patients are given instructions on how to count carbohydrate in their meal. Doctors and diabetes nurses deal with medication therapy and the usage (dosage)- Metformin, sulphonylurea, thiazolidinediones, GLP-1 inhibitor, DPP-4 inhibitor, glinides, sodium glucose co-transporter 2 inhibitor (SGLT-2i), and meglitinide. Nurses also have the responsibility to make sure that the carbohydrate is been counted and the doctor's orders on the medication is been used. Physical activity monitoring is also done and encouraged by nurses and care giver need to make sure that both patient and the family member are well counselled. counselling must be on medication usage, complication if the medication is not been taken, amount of exercise per day, and eating habit according to the food and eating principles for type 2 diabetes patient. Dietician role is important when a patient is diagnosed with type 2 diabetes, they provided tailor-made dietary plan, considering the lifestyle modification and any medical conditions. (Theobald 2006). It was however fascinating to realise after the research that both Finland and USA had no difference in their care pathway for type 2 diabetes.

Education needs a multidisciplinary approach, with dieticians and practice nurses providing evidence-based local advice to both patients and carers about nutrition and food, along with supporting other health-care staff to maintain an accurate and

consistent message. (Mellor 2012). Health professionals can help patient in planning their exercise schedule and diet intake and record their behaviour including challenges and positive outcome. Enough time should be taken in other for care givers to notice the change in social, physical, psychological factors that add to patient exercise and diet behaviour. Both health-care professionals and patients must aware that changing diet and exercise behaviour require a gradual process. Thus patients need to be provided with the necessary information's, motivation and alternative strategies during the period of weight-loss therapy so that they are empowered to make their own decisions (Lang and FroeUcher, 2006 as stated by Holt 2006). Patient who are constantly supported either by family or care givers to take charge in their weight loss and make lifestyle changes are likely to have an adequate long-term result. (Pekkarinen and Mustajoki (1997) as mentioned by Holt 2006).

9.1.1 Conclusion

To conclude, it can be said that the best way to treat diabetes type 2 in both USA and Finland is to start with lifestyle modification, then progress to diet and medication therapy if needed. Nurses, Doctors, Dietician, Family member as well as patient must work together to ensure good result after treatment. Patient need to be well counseled so they know that the treatment is a process not something they do and in a day and expect to be better instantly. The finding of this literature review shows the proper drug and diet intake for type 2 diabetes and the result include the treatment in USA and Finland.

9.2 Ethical and authenticity issues

The authors of all the articles used are mention in text (in text reference) and bibliography. The thesis is literature review so it doesn't require patient opinion or approval from health committee. No financial support or interviews needed. The research is done by two student and the only background knowledge we have is from practical training in hospitals. Most of the articles used for this thesis were

from CINAHL, SAGE and some lead us to free internet sites like America diabetes organization. Other articles from free internet were from trustworthy site because the authors had to find things specifically about USA and Finland. Website like Medline plus, CDC and terveyskirjasto were used. Articles were been critically read through before deciding which once are important in relation to the research question.

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