

EFFECT OF DIABETIC RETINOPATHY EDUCATION ON KNOWLEDGE AND
PLANNED LIFESTYLE ACTIVITIES

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Effect of Diabetic Retinopathy Education on Knowledge and Planned Lifestyle Activities

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ABSTRACT

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Prevalence of diabetes is increasing in the United States as well as in North Dakota. Diabetic retinopathy, a complication of diabetes, is seen in 40-45% of Americans diagnosed with diabetes. It is the leading cause of new cases of blindness in adults. Complications of diabetes can be decreased by controlling blood glucose levels, blood pressure, and blood lipids as well as receiving preventive care in a timely manner. Since diabetic retinopathy may have no symptoms, it is important for healthcare providers as well as those with diabetes to be aware of the disease and how to prevent and treat it. Currently a diet for diabetic retinopathy does not exist, although there are diet recommendations for controlling blood glucose, blood pressure, and blood lipids. In this study, an educational program about diabetic retinopathy and diet was developed based on current research. The educational program was provided to two groups of participants. Group 1 (n=20) and Group 2 (n=40). Group 1 participants were divided into experimental and control (n=7) subgroups. Participants in the experimental group completed a survey prior to and after an educational program. Participants in the control group completed a survey prior to and after reading a brochure on diabetic retinopathy and diet. Group 2 participants were recruited from a required wellness class at North Dakota State University and completed a survey prior to and after an educational program. Mean scores on the pre-and post-surveys were compared to evaluate effectiveness of the educational program. Mean pre- and post- survey scores for Group 1 experimental and control combined were 12.55 and 14.00 and for Group 2, 11.58 and 12.78. A significant change in scores was seen in both Group 1 ($p=.016$) and

Group 2 (Sig=.000, df 39, t=4.183). No significant difference in mean pre- (p=.978) and post-survey (p=.381) scores was seen between Group 1 experimental and control group. In Group 1 both the educational program and the brochure were effective, and no significant interaction between and within subjects (p=.486) was seen. Participants did not change their stage of change as a result of participating in the diabetic retinopathy program, although all of the participants indicated an intention to make at least one behavioral change.

The program including interactive activities, PowerPoint slides, and questionnaires will be used as part of a state-wide educational curriculum targeted towards older adults.

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CHAPTER 1. INTRODUCTION

Statement of the Problem

According to the Centers for Disease Control and Prevention (CDC), diabetes is the seventh leading cause of death in the United States (CDC, 2008b). Prevalence of diagnosed and undiagnosed diabetes is estimated at 23.6 million people (7.8% of the population) (CDC, 2008b). A disproportionate number of those ages 60 and older, 12.2 million people (23.1% of the population) have diabetes (CDC, 2008b). Of the various ethnic groups, American Indians and Alaska Natives have the highest rates of diabetes (16.5%), followed by non-Hispanic blacks (11.8%), Hispanics (10.4%), Asian Americans (7.5%), and non-Hispanic whites (6.6%) (CDC, 2008b). Approximately 57 million people have pre-diabetes (CDC, 2008a). Prevalence of diabetes has increased by more than 3 million from 2005 to 2007 (CDC, 2008a). In North Dakota, 6.1% of adults were diagnosed with diabetes in 2007 (CDC, n.d.). Direct and indirect medical costs of diabetes in the United States are estimated at \$174 billion (CDC, 2008b).

Complications of diabetes include heart disease, stroke, high blood pressure, blindness, kidney failure, nervous system damage, amputations, dental disease, pregnancy complications, diabetic ketoacidosis, hyperosmolar (nonketotic) coma, increased susceptibility to illness, and decreased functional capacity. Complications of diabetes can be decreased by controlling blood glucose levels, blood pressure, and blood lipids as well as receiving preventative care in a timely manner (CDC, 2008b).

Diabetic retinopathy, a diabetic eye disease, accounts for 12,000 to 24,000 new cases of blindness every year and is the leading cause of new cases of blindness in adults (American Diabetes Association [ADA], n.d.; CDC, 2008b). Diabetic retinopathy is seen in

40 to 45% of Americans diagnosed with diabetes (National Eye Institute [NEI], 2009). Individuals with type 1 or type 2 diabetes and individuals who have diabetes and are pregnant are at risk for diabetic retinopathy (NEI, 2009). The risk of developing diabetic retinopathy is increased with poor glycemic control, duration of diabetes, poor blood pressure control, and presence of nephropathy (ADA, 2007).

For every percentage drop in A1c (a blood test to measure average blood sugar) the risk of microvascular complications, including eye, kidney, and nerve disease, decreases by 40% (CDC, 2008b). Blood pressure control reduces microvascular complications by approximately 33% (CDC, 2008b). Vision loss can be reduced by 50-60% with the detection and treatment of diabetic eye disease and laser therapy (CDC, 2008b).

Purpose of the Study

As the prevalence of diabetes continues to increase nationwide as well as in North Dakota, the prevalence of diabetic complications such as diabetic retinopathy is also likely to increase. Since diabetic retinopathy may have no symptoms it is important for healthcare providers as well as those with diabetes to be aware of the disease and how to prevent and treat it. According to Blue Cross Blue Shield of North Dakota (2009), only 65% of those diagnosed with diabetes in ND have had an eye examination in the last year. Optometrists and ophthalmologists have a key opportunity to be the first to see damaged blood vessels which may indicate undiagnosed diabetes (American Dietetic Association, 2010). Preventative care and a healthy diet have been shown to be effective in decreasing diabetic complications. A review of recent literature on diabetes, diabetic retinopathy, and diet was completed and current diet recommendations and educational programs on diabetes, hypertension, and dyslipidemia were included. An educational program based on the

literature review was developed to target older adults as well as the general population and included a review of diabetic retinopathy and recommendations for diet. Lastly, the effectiveness of the educational program was evaluated.

Research Questions

1. Did knowledge and awareness of diabetic retinopathy and diet increase after an education program?
2. Did education affect planned lifestyle activities related to diabetic retinopathy and diet?
3. Was the program favorably received and what improvements could be made before finalizing the state-wide curriculum?

Limitations of the Study

The study was conducted at North Dakota State University (NDSU) in Fargo, ND. Participants were recruited from the university. Results may not apply to the population of North Dakota as a whole or to other regions of the United States. Results of the study may be affected by self-selection bias. Individuals who are interested in diabetic retinopathy would be more likely to participate. Statistical significance was limited by small sample size. Survey questions were developed to fit the education program. Validity and reliability of survey questions was increased by using some existing survey questions from previous studies (Blue Cross Blue Shield ND; Stastny & Garden-Robinson, 2011).

Definition of Terms

Diabetic nephropathy – disease of the kidney caused by diabetes complications (Medline Plus, 2009).

Diabetic retinopathy – most common diabetic eye disease caused by changes in the blood vessels of the retina (NEI, 2009).

Glycemic index (GI) - The glycemic index measures how quickly a carbohydrate containing food raises blood glucose compared to a reference food (glucose or white bread). Foods are ranked on a scale of 1 to 100 with 100 being the same as glucose or white bread. The higher the number the more the blood glucose rises. Foods are classified as low (< 55), medium (56-69), or high GI (> 70). Low GI foods include dried beans and legumes, some starchy vegetables, all non-starchy vegetables, most fruit, and whole grain breads and cereals such as whole wheat bread, rye bread, barley, and all-bran cereal. Some examples of high glycemic foods include white bread, bagels, cornflakes, white rice, and rice cakes. In general, more cooked or processed foods have a higher GI. Foods higher in fat and fiber tend to have a lower GI. Foods that do not contain carbohydrate such as fats and meats do not have a GI (ADA, 2010).

Glycemic load (GL) - The glycemic load is used to describe the quality (glycemic index) and quantity of carbohydrate consumed. To calculate the GL for a food the GI is multiplied by the grams of carbohydrate the food contains and then divided by 100. The glycemic loads of individual food items are then added together to calculate dietary glycemic load (Oregon State University, Linus Pauling Institute, 2009).

Glycohemoglobin (Hemoglobin A1c, HbA1c, A1c) - a blood test used to measure the amount of glucose bound to hemoglobin. The normal range for glycohemoglobin is 4% to 6%. Glycohemoglobin level is generally higher in people with diabetes. The glycohemoglobin A1c test is used to measure the average blood sugar for the past 2 to 3 months. It allows one to check long term control of blood sugars and diabetes (WebMD,

2008). For the literature review, this paper will use HbA1c, whether the study authors used glycohemoglobin, or other abbreviated form of the same marker.

Nephropathy – disease of the kidney (Medline Plus, 2009).

Nonproliferative retinopathy - refers to the leaking of fluid into the retina or the clogging of blood vessels (The Patient Education Institute, Inc., 2008).

Proliferative retinopathy - the formation, rupture, and bleeding of new blood vessels (NEI, 2009).

Retina – light sensitive tissue at the back of the eye (NEI, 2009).

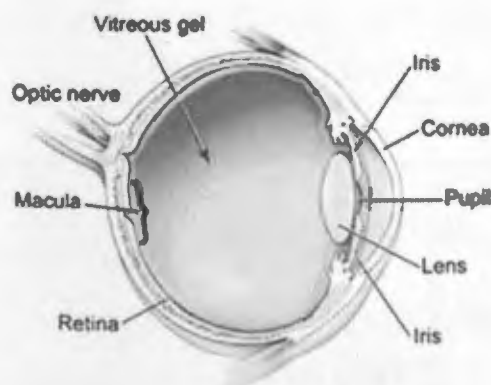
Retinal photocoagulation or scatter laser photocoagulation – laser treatment for proliferative retinopathy that shrinks abnormal blood vessels by placing 1,000 to 2,000 laser burns in the areas of the retina away from the macula (NEI, 2009).

Retinopathy - disease of the retina, the back portion of the eye, where central and peripheral vision is controlled (The Patient Education Institute, Inc., 2008).

Vitreous - thick, transparent substance that gives form and shape to the center of the eye (StLukesEye.com, 2008).

Figure 1 illustrates the anatomy of the eye.

Figure 1. Eye Anatomy (NEI, 2009).



CHAPTER 2. LITERATURE REVIEW

The ADA (2007) currently provides recommendations for the screening and treatment of diabetic retinopathy. Screening recommendations include regular dilated and comprehensive eye exams (ADA, 2007). According to the NEI (2009), individuals with diabetes should receive yearly comprehensive and dilated eye exams and pregnant women should receive a comprehensive and dilated eye exam as soon as possible during their pregnancy. Treatment recommendations include optimal blood glucose and blood pressure control and laser therapy (ADA, 2007). Specific national diet and lifestyle recommendations to prevent diabetic retinopathy or delay progression of diabetic retinopathy have not yet been developed although diet and lifestyle recommendations for diabetes and hypertension do exist. The NEI (2009) has publications on diabetic retinopathy but not diabetic retinopathy and diet. A review of the literature on diabetic retinopathy, current diabetes and hypertension recommendations for diet and lifestyle, and current education programs was conducted. In addition, a brief review of adult learning and learning theory was included. Because a similar program does not exist, an educational program about diabetic retinopathy, diet, and lifestyle was developed and piloted. The pilot educational program was evaluated using three research questions. Did knowledge and awareness of diabetic retinopathy and diet increase after an education program? Did education affect planned lifestyle activities related to diabetic retinopathy and diet? Was the program favorably received and what improvements could be made before finalizing the state-wide curriculum? In the future this pilot program will be used by NDSU Extension Service in educating the public about diabetic retinopathy and diet.

Overview of Diabetic Retinopathy

According to the Patient Education Institute (2008) retinopathy refers to disease of the retina, the back portion of the eye, where central and peripheral vision is controlled. Diabetic retinopathy occurs when the blood vessels in the eye become weak due to diabetes. When blood vessels become weak, they can leak and cause swelling in the retina. Blood vessels also can become clogged. Vision loss can result from leaking or clogged blood vessels. When blood vessels get clogged, new weaker ones are formed. These new blood vessels can then rupture leading to bleeding in the retina and vision loss. There are two types of diabetic retinopathy, nonproliferative retinopathy and proliferative retinopathy. Nonproliferative retinopathy refers to the leaking of fluid into the retina or the clogging of blood vessels. Proliferative retinopathy refers to the formation, rupture, and bleeding of new blood vessels. Diabetic retinopathy generally progresses from nonproliferative to proliferative retinopathy (The Patient Education Institute, Inc., 2008).

According to NEI (2009), there are four stages of diabetic retinopathy. The first stage, mild nonproliferative retinopathy, is characterized by small areas of swelling in the tiny blood vessels of the retina called microaneurysms. In the second stage, moderate nonproliferative retinopathy, blood vessels of the retina become blocked. In the third stage, severe nonproliferative retinopathy, additional blood vessels are blocked. This leads to decreased blood supply to the retina. The retina then sends signals to the body to grow new blood vessels to increase the blood supply. The last and final stage, proliferative retinopathy, is characterized by the growth of new blood vessels in response to signals sent by the retina. These blood vessels are abnormal and fragile. They do not cause vision loss or symptoms until they leak blood into the eye (NEI, 2009).

Macular edema causes additional vision changes in any stage of diabetic retinopathy. The macula controls sharp, straight-ahead vision. Macular edema occurs when fluid leaks into the center of the macula causing it to swell and blurring vision. Macular edema is more prominent in the later stages of diabetic retinopathy and is seen in about 50% of individuals with proliferative retinopathy (NEI, 2009).

Individuals with diabetic retinopathy often have no symptoms, especially in the early stages of the disease. If bleeding occurs, individuals will often see spots in their vision. Blurring of vision occurs when macular edema is present (NEI, 2009).

Treatment of diabetic retinopathy includes good blood glucose and blood pressure control, lipid control, healthy diet and exercise, and regular eye checkups to identify problems (NEI, 2009; The Patient Education Institute, Inc., 2008). Eye treatments such as laser surgery and eye surgery are generally not needed in the first three stages of diabetic retinopathy. Once proliferative retinopathy has occurred, laser surgery and eye surgery to remove the vitreous (clear gel in the eye) may be needed (NEI, 2009; The Patient Education Institute, Inc., 2008). Scatter laser treatment is used to treat proliferative retinopathy by shrinking abnormal blood vessels (usually prior to bleeding). Two or more sessions are generally needed and during sessions 1,000 to 2,000 laser burns are placed in the areas of the retina away from the macula (NEI, 2009). If severe bleeding occurs with proliferative retinopathy a surgical procedure called a vitrectomy may be needed to remove blood from the center of the eye. A vitrectomy is performed under anesthesia. A tiny incision in the eye is made and the vitreous gel that is clouded with blood is removed. The vitreous gel is then replaced with a salt solution (NEI, 2009).

Macular edema is treated, generally in one session, with a different type of laser surgery called focal laser treatment. Several hundred small laser burns are placed in the areas of retinal leakage surrounding the macula slowing the leakage of fluid and reducing the overall amount of fluid in the retina (NEI, 2009).

Scatter laser treatment and vitrectomy are effective in treating proliferative retinopathy and reducing vision loss. When individuals with proliferative retinopathy get timely and appropriate treatment they have less than a 5% chance of becoming blind within five years. Focal laser treatment is effective in treating macular edema and reduces the risk of vision loss by 50%. Although these treatments are effective they are not curative and may be needed more than once (NEI, 2009).

Diabetic Retinopathy Studies

The Diabetes Control and Complications Trial (DCCT) (1993) research team looked at blood glucose control and diabetic complications. It included patients with insulin dependent diabetes mellitus (IDDM) also known as type I diabetes, who either had no diagnosis of diabetic retinopathy or had mild to moderate nonproliferative diabetic retinopathy. Patients were randomized to receive either standard insulin therapy or intensive insulin therapy. The standard therapy group received one or two insulin injections per day while the intensive therapy groups received 3 or more insulin injections per day or an insulin pump. The goal of intensive therapy was to keep blood glucose levels as close to normal as possible. HbA1c levels were 7.1% in the intensive therapy group and 9.0% in the conventional treatment group. The results of the study showed that intensive insulin therapy delays the onset and slows the progression of diabetic retinopathy. A 54% average risk reduction of progression of diabetic retinopathy was seen in the intensive therapy

group compared to the control during the entire study period (The DCCT Research Group, 1993).

The United Kingdom Prospective Diabetes Study (UKPDS) (1998) group looked at individuals with type 2 diabetes. Subjects were divided into conventional and intensive treatment groups. Researchers found that over 10 years median HbA1c levels were significantly lower in the intensive treatment group compared to the conventional treatment group (median HbA1c level 7.0% versus 7.9%). When compared to DCCT results, UKPDS showed an 11% reduction in HbA1c over 10 years versus a 20% reduction seen in DCCT. A significant 25% risk reduction for microvascular endpoints (retinal photocoagulation, vitreous hemorrhage, renal failure and renal death) was seen when intensive therapy was used likely due to fewer cases of retinal photocoagulation in the intensive therapy group versus the conventional therapy group. A 21% decreased risk for progression of diabetic retinopathy was seen in UKPDS versus a 63% risk reduction in DCCT. These differences can be accounted for by the younger patients and slightly different methods used in DCCT (UK Prospective Diabetes Study Group, 1998).

Another study using data from the DCCT evaluated diet and lifestyle factors and diabetic retinopathy. The proportions of dietary fiber, protein, and carbohydrate were inversely associated with retinopathy progression. The proportion of dietary fats (saturated and monounsaturated fat) and cholesterol were positively correlated with retinopathy progression. Researchers also looked at subjects who received standard insulin therapy but adhered to the American Diabetes Association (ADA) recommendations at the time for saturated fat (<10% total calories) and total fat (<30% total calories) versus subjects who received standard insulin therapy but did not adhere to these ADA recommendations. A

33.2% reduced rate of retinopathy progression was seen in those who adhered to the ADA dietary recommendations. The HbA1c level of those adhering to the ADA recommendations was lower than those who did not (HbA1c 8.65% and 9.14%, respectively). In the intensive therapy group a non-significant decrease in HbA1c was seen between those who adhered to the ADA recommendations and those who did not. Additional studies on diet and lifestyle factors and diabetic retinopathy need to be conducted to provide support for these conclusions (Cundiff & Nigg, 2005).

Diet and Lifestyle Recommendations for Diabetes

Diabetes care is complex and should address many factors including glycemic control, diet, controllable lifestyle factors, and the prevention of complications of diabetes. Glycemic control over the past 2 to 3 months is evaluated using the HbA1c blood test. The general goal for HbA1c is <7%. Individuals are encouraged to try to attain a HbA1c as close to normal as possible. Some individuals with diabetes can reach their HbA1c goal with diet and exercise alone while others need medication (ADA, 2007).

To achieve glycemic control, carbohydrate intake should be monitored. Strategies to monitor carbohydrate intake include carbohydrate counting, use of exchanges, and experience based estimation. Each strategy helps to estimate the amount of carbohydrate consumed at a meal or snack and allows for individualized meal plans to be followed (ADA, 2007). The total amount of carbohydrate consumed should be the primary consideration when meal planning because it is a stronger predictor of blood glucose levels than the type of carbohydrate consumed. Considering the glycemic index (GI) and glycemic load (GL) of foods in addition to the total amount of carbohydrate consumed may provide an additional benefit for those who are highly motivated and want to fine tune

blood glucose management (ADA, 2010). In meal planning using the GI, medium GI foods can be combined with low GI foods to better balance the meal (ADA, 2010). Low carbohydrate diets (<130 g carbohydrate per day) are not recommended (ADA, 2007).

The ADA recommendations for diet are based on the United States Department of Agriculture (USDA) 2005 Dietary Guidelines for Americans and the Dietary Reference Intakes from the Institute of Medicine of the National Academies of Science. A range of 45-65% of energy from carbohydrate, 10-35% of energy from protein, and 20-35% of energy from fat can be used with individuals with diabetes. Additional diet recommendations include low saturated fat intake of < 7% of total calories and minimal intake of trans fat. If alcohol is consumed, it should be consumed in moderation, i.e., < 1 drink per day for women and < 2 drinks per day for men (ADA, 2007).

Lifestyle recommendations include those for weight loss and physical activity. Weight loss is recommended for individuals who are overweight or obese and should be accomplished through structured programs that emphasize lifestyle change. Programs with regular participant contact that emphasize education, reduced fat and energy intake, and regular physical activity have shown a long term 5-7% weight reduction from the starting weight (ADA, 2007).

Physical activity is recommended to improve glycemic control, reduce risk of cardiovascular disease, and assist with weight maintenance or loss. Moderate aerobic activity of at least 150 min/week and/or vigorous aerobic activity of at least 90 min/week is recommended. Resistance exercise is recommended 3 times per week (ADA, 2007). Updated guidelines from the American College of Sports Medicine (ACSM) (2007) for healthy adults under the age of 65 include 30 minutes per day of moderate intensity

cardiovascular activity five days per week or 20 minutes of vigorous intensity cardiovascular activity three days per week combined with strength training twice per week. Guidelines for adults over age 65 and adults ages 50-64 with chronic health conditions include 30 minutes per day of moderate intensity aerobic exercise five days per week or 20 minutes of vigorous intensity aerobic exercise 3 days per week and strength training two to three times per week. ASCM also recommends balance exercises for those at risk for falling and using a physical activity plan (ACSM, 2007).

The ADA (2007) recommends reducing cardiovascular risk factors in individuals with diabetes. Hypertension and dyslipidemia as well as diabetes are risk factors for cardiovascular disease. Hypertension is also a risk factor for microvascular complications such as nephropathy and diabetic retinopathy. Most diet and exercise studies have not addressed individuals with both hypertension and diabetes in chronic disease prevention and treatment (ADA, 2007). Lipid management is important for individuals with diabetes. Lifestyle modifications that include weight loss, exercise, and reduction of saturated fat, trans fat, and cholesterol have been shown to improve lipid profiles in individuals with diabetes. Glycemic control can also improve lipid levels (ADA, 2007).

Diet and Lifestyle Recommendations for Hypertension

Hypertension is defined as $> 140\text{mmHg}$ for systolic blood pressure and $> 90\text{mmHg}$ for diastolic blood pressure (U.S. Department of Health and Human Services [DHHS], 2006). Hypertension affects the majority of people with diabetes (ADA, 2007). Complications of uncontrolled hypertension include blindness, heart disease, stroke, and nephropathy (DHHS, 2006).

According to DHHS (2004) a healthy lifestyle is critical to the prevention and treatment of hypertension. Lifestyle modifications such as weight loss in individuals who are overweight or obese, physical activity, moderation of alcohol consumption, reduced sodium intake and adoption of the Dietary Approaches to Stop Hypertension (DASH) eating plan have been shown to lower blood pressure (DHHS, 2004). The combination of the DASH eating plan and a reduced sodium intake has been shown to be more effective than the eating plan or reduced sodium intake alone (DHHS, 2006).

The DASH Collaborative Research Group (1997) examined the effect of three different diets on blood pressure. Participants with and without hypertension were randomly assigned to a control diet that was low in dairy products, fruits, and vegetables and provided an amount of fat similar to the average United States diet, a diet high in fruits and vegetables, or a combination diet high in low fat dairy products, fruits, vegetables, and low in total fat and saturated fat. Sodium intake did not differ significantly between the three groups. Body weight remained stable throughout the study. Researchers found that the combination diet significantly reduced blood pressure when compared to the control diet and the high fruit and vegetable diet. The high fruit and vegetable diet reduced blood pressure more than the control group although this was only significant for systolic hypertension. Blood pressure was reduced more in participants with and without hypertension with the combination diet than the high fruit and vegetable diet or the control diet.

A second DASH study was completed by the DASH-Sodium Collaborative Research Group (2001) to determine the effects of the DASH diet or a control diet both with varying levels of sodium on blood pressure. Participants in the control group

consumed a typical American diet. Participants in the DASH group consumed a diet high in low fat dairy products, fruits, and vegetables that also included nuts, whole grains, poultry, and fish. Sugar-containing beverages, sweets, and red meat were minimized. Both the control and DASH diets used 3 different sodium levels, high sodium (150 mmol = 3.3g Na), intermediate sodium (100 mmol = 2.3g Na), and low sodium (50 mmol = 1.5g Na). The high sodium level (3.3g Na) reflected the typical American sodium consumption, the intermediate sodium level (2.3g Na) reflected the current national sodium recommendation, and the low sodium level (1.5g Na) was the level hypothesized to lower blood pressure by an additional amount. A crossover design was used so both groups of participants consumed the high, intermediate, and low sodium diets in random order. Body weight remained stable throughout the study. Researchers found that blood pressure was lowered significantly in a stepwise fashion with the reduction in sodium. The blood pressure lowering effect of reduced sodium intake was twice as great in the control group as the DASH group. At every sodium level, the DASH diet significantly lowered systolic blood pressure when compared with the control group. At high and intermediate sodium levels, the DASH diet significantly lowered diastolic blood pressure when compared with the control group. A significantly larger effect on blood pressure was seen at high sodium levels than low ones. The combination of DASH and low sodium had a greater effect in those with hypertension than those without hypertension. Results of this study suggest the DASH diet in combination with low sodium intake provide the greatest benefit for reducing blood pressure.

These studies were used in developing current dietary guidelines for hypertension from the National Heart, Lung, and Blood Institute. The DASH diet is the current diet

recommended for the treatment of hypertension. It also can be used by the general population as a healthy eating plan. Other benefits of the DASH diet include weight loss and decreased LDL cholesterol. The DASH diet is high in low-fat dairy products, fruits, and vegetables and low in total fat (27% of calories from fat), saturated fat, and cholesterol. It includes nuts, whole grains, fish, and poultry. Compared with the typical United States diet, it provides increased amounts of potassium, magnesium, calcium, protein and fiber and is reduced in sugar-containing beverages, sweets, added sugars and red meat. In general, the DASH diet provides per day 6-8 servings of grains (whole grains are recommended for most grain sources because of their fiber and nutrient content), 4-5 servings of vegetables, 4-5 servings of fruits, 2-3 servings of fat-free or low-fat milk and milk products, < 6 oz lean meat, poultry, and fish, 4-5 servings per week of nuts, seeds, and legumes, 2-3 servings of fats and oils per day, and 5 or fewer servings of sweets and added sugars per week (DHHS, 2006). Reduced sodium intake is recommended in addition to the DASH diet and should be between 1,500 mg and 2,300 mg. The lower level of sodium intake is more effective at lowering blood pressure.

Stages of Change Model

According to the revised version of transtheoretical model (TTM) developed by Prochaska and Velicer (1997) there are 5 stages an individual passes through when changing health behaviors. In the first stage, precontemplation, the individual is not intending to change in the near future (the next 6 months). In the second stage, the contemplation stage, the individual is thinking about making a change in the next 6 months. In the third stage, the preparation stage, the individual is actively considering changing behavior in the immediate future (usually in the next month). In the fourth stage, the action

stage, the individual has made behavioral changes in the past 6 months but these changes have not been well established yet. In the fifth and final stage, the maintenance stage, the individual has changed behavior and is working on sustaining that change after the first 6 months. Individuals may also relapse, or return to an earlier stage, at any point in the change process (Prochaska & Velicer, 1997). The likelihood of behavioral change increases when individuals use strategies that are appropriate to the stage of change they are currently in (Prochaska & Velicer, 1997; Spencer, Wharton, Moyle, & Adams, 2007).

Cognitive strategies such as dramatic relief, self-reevaluation, environmental reevaluation, consciousness raising, and social liberation are most effective for individuals in the pre-contemplation and contemplation stages. Dramatic relief produces an emotional response. Personal testimonies, role playing, psychodrama, and media campaigns are some techniques that can move people emotionally. Self-reevaluation combines assessments of self-image with and without an unhealthy habit. Techniques such as a focus on healthy role models, value clarification, and imagery can help with self-reevaluation. Environmental reevaluation looks at the presence or absence of an unhealthy habit and how it affects one's social environment. This could include whether or not one is perceived as a negative role model. Some strategies that can lead to environmental reevaluation are documentaries, family interventions, and empathy training. Consciousness raising includes increasing awareness of the causes, consequences, and cures for a particular unhealthy behavior. Some strategies to raise consciousness are education, feedback, confrontation, media campaigns, and interpretation. Social liberation involves an increase in social opportunities or alternatives. Examples include advocacy, empowerment procedures, and change in public policies (Prochaska & Velicer, 1997; Spencer et al., 2007).

Behavioral strategies such as helping relationships, counter-conditioning, self-liberation, stimulus control, and reinforcement management are most effective for individuals in the preparation, action, or maintenance stages. Helping relationships include caring, trust, acceptance, openness, and support for the behavioral change. Social support can come from counselor calls, rapport building, therapeutic alliance, and buddy systems. Counter-conditioning involves learning positive health behaviors that can be substituted for the unhealthy behavior. Examples include relaxation for stress or substituting low fat foods for high fat foods. Self-liberation is the belief that one can change and the commitment to that change. Multiple choices for behavior change are more effective than a single choice. Stimulus control removes the cues for unhealthy habits and adds cues for healthy behavior. Self-help groups, environmental reengineering, for example, removing sugary foods from the food environment, and avoidance are strategies that can be used. Reinforcement management uses rewards instead of punishments to assist with behavioral change. Reinforcement strategies include overt and covert reinforcements, group recognition, and positive self-statements (Prochaska & Velicer, 1997; Spencer et al., 2007).

In addition, behavioral change is also influenced by decisional balance, or the perceived pros and cons of that change. When the pros of change outweigh the cons, individuals move through the stages of change (Prochaska & Velicer, 1997; Spencer et al., 2007). Another factor in TTM is self efficacy or the confidence related to performing a behavior. Self efficacy also includes the confidence in coping with high risk situations, for example social settings such as holiday parties where sugary foods are present, and preventing relapse (Prochaska & Velicer, 1997; Spencer et al., 2007).

Effective Education Program Examples

Patient education is the foundation of diabetes care. The ADA (2007) recommends the use of diabetes self-management education (DSME) for the control of diabetes. The goals of self-management education are to prevent acute and chronic complications of diabetes, optimize metabolic control, optimize quality of life, and keep costs acceptable (Norris, Lau, Smith, Schmid, & Engelgau, 2002). DSME is a skill based approach that focuses on helping individuals with diabetes make informed self-management choices. DSME helps individuals initiate effective self-care after diagnosis of diabetes as well as maintain effective self-management as time goes on and new challenges or treatments are presented. DSME is associated with improved self-care behavior, improved diabetes knowledge, improved clinical outcomes, improved quality of life, and lower self-reported weight. Better outcomes were seen when DSME was tailored to the individual, addressed psychosocial issues, included follow up support, and was longer in duration (ADA, 2007).

Several studies examined the effects of behavioral and educational interventions on glycemic control. Norris et al. (2002) noted a clinically significant 0.76% decrease in HbA1c level in individuals with type 2 diabetes who underwent self-management education compared with the control group. After 1-3 months and > 4 months this decrease was 0.26%. Gary, Genkinger, Guallar, Peyrot, and Brancati (2003) also assessed the effect of behavioral and educational interventions on glycemic control in individuals with type 2 diabetes. A significant 0.43% reduction in HbA1c was seen in the intervention group. Ellis et al. (2003) noted a net decrease in HbA1c of 0.32 in patients who received an educational intervention compared with the control group. Norris, Engelgau, and Venkat Narayan (2001) also noted a positive, short-term effect on glycemic control in those with type 2 diabetes who had received self-management training. Increased contact between

individuals and educators as well as regular reinforcement of behaviors had positive effects on glycemic control (Norris et al., 2001; Norris et al., 2002). Ellis et al. (2003) found that the cognitive reframing teaching method, face-to-face intervention or inclusion of exercise content were effective in decreasing HbA1c. Group and individual interventions were both effective with respect to glycemic control (Gary et al., 2003; Norris et al., 2001; Norris et al., 2002).

Norris et al. (2001) found that self-management training positively affected self-monitoring of blood glucose, dietary habits, and knowledge short term (<6 months). Interventions that involved patient collaboration were more effective than didactic interventions in improving weight, blood lipids, and glycemic control. Didactic interventions aimed at providing information and knowledge showed positive effects on knowledge, mixed results on blood pressure and glycemic control, and had no effect on weight. In contrast, collaborative interventions that focused on knowledge showed positive effects on glycemic control short term but mixed results long term. Effects on blood pressure, blood lipids, and weight were mixed. Overall the authors concluded that to achieve long term behavioral change factors other than knowledge should be addressed. Changes in attitude and integration of education with other therapies is needed. A minimum baseline knowledge of diabetes is also needed for glycemic control (Norris et al., 2001). Lockington, Farrant, Meadown, Dowlatshahi, and Wise (1988) found that improved motivation and attitude are more important than knowledge in improving metabolic control.

Jones et al. (2003) compared a Treatment As Usual (TAU) education program with a Pathways to Change (PTC) education program to determine if readiness to change, self-

care, and diabetes control would increase with the PTC intervention. The PTC intervention included counseling via telephone, mailed self-help manuals and newsletters, and stage-based personal feedback reports. The TAU intervention involved regular physician visits and education sessions as prescribed.

Pathways to Change was based on the TTM. The difference between TTM based programs and traditional programs is that TTM programs are based on the stage the individual is in whereas traditional programs assume the individual is ready to change (Jones et al., 2003). Researchers found that the PTC intervention was significantly better than TAU in assisting individuals move into the action stage for diabetes care behaviors. Self-monitoring of blood glucose, healthy, low fat food choices, and smoking cessation were increased in the PTC group. A significant reduction in HbA1c was seen in those who tested blood glucose more often. This study showed that face-to-face intervention is not needed to affect diabetes behaviors. The PTC intervention is efficient and has a broader reach than face-to-face diabetes education (Jones et al., 2003).

Effective programming for didactic settings should include teaching strategies and curriculum development that work best in that environment. For example, McKeachie (2006) noted that to make lectures more effective they should include metaphors, demonstrations, and examples to help students connect prior knowledge to new learning. They should also include active learning activities. Problem-based learning is a form of active learning and includes case method, games, and simulations. Asking questions throughout class is another way to engage students in learning. Use of diagrams, charts, graphs, and other pictorial representations can also help with learning. In addition, periodic summaries during lecture can help students check for understanding as well as provide an

opportunity for students to ask questions on the material covered. It is better to use more highly structured lectures with students who have little prior subject knowledge. Instructor enthusiasm can help maintain student attention (McKeachie, 2006). These strategies may also be effective when used with the general adult population in a lecture setting.

Conclusions

Optimal glycemic and blood pressure control can reduce the risk and progression of diabetic retinopathy. To achieve glycemic control, carbohydrate intake should be monitored. A dietary pattern that follows the 2005 Dietary Guidelines for Americans is appropriate for diabetes. The DASH diet, which emphasizes low-fat dairy products, fruits, and vegetables, includes whole grains, nuts, fish, and poultry, is reduced in sugar-containing beverages, sweets, added sugars and red meat and is low in total fat, saturated fat, and cholesterol has been recommended for blood pressure control as well general population health. Reduced sodium intake is also recommended for enhanced control of hypertension. Additional recommendations such as moderation of alcohol intake, weight loss if overweight, and regular physical activity are recommended for both diabetes and hypertension. Most of the recommended diet and lifestyle interventions for diabetes and hypertension overlap. By modifying the carbohydrate content of the DASH diet to fit individual diabetic meal plans, both glycemic and blood pressure control could be affected thereby reducing the risk for diabetic retinopathy and its progression.

The TTM postulates that there are five stages of change one moves through when changing behaviors. In addition, there are 10 cognitive and behavior strategies used to assist with behavioral change. Cognitive and behavioral strategies should be stage matched

for best results. Decisional balance and self-efficacy are additional concepts utilized by the TTM.

Diabetes self-management education is associated with improved self-care behavior, improved diabetes knowledge, and improved clinical outcomes. Better outcomes were seen when DSME was tailored to the individual, included follow up support, and was longer in duration. Interventions that involved patient collaboration were more effective than didactic programs. Programs utilizing the stages of change model were more effective than traditional programs that were not individualized. To aid adult learners in learning, programs should allow participants to connect prior learning to new learning as well as include active learning activities such as case studies, games, and simulations. Engaging students in learning by asking questions throughout class and using diagrams, charts, and graphs can also increase learning.

CHAPTER 3. METHODOLOGY

Purpose of the Study

The purpose of the study was to develop an educational program about diabetic retinopathy and diet that integrates current research on diabetic retinopathy, diet, and educational programming and principles as well as measure the effectiveness of that program. Specifically, did knowledge and awareness of diabetic retinopathy and diet increase after an education program and did education impact planned lifestyle activities? In addition, after the initial pilot program was delivered, what improvements to the program could be made before providing it statewide?

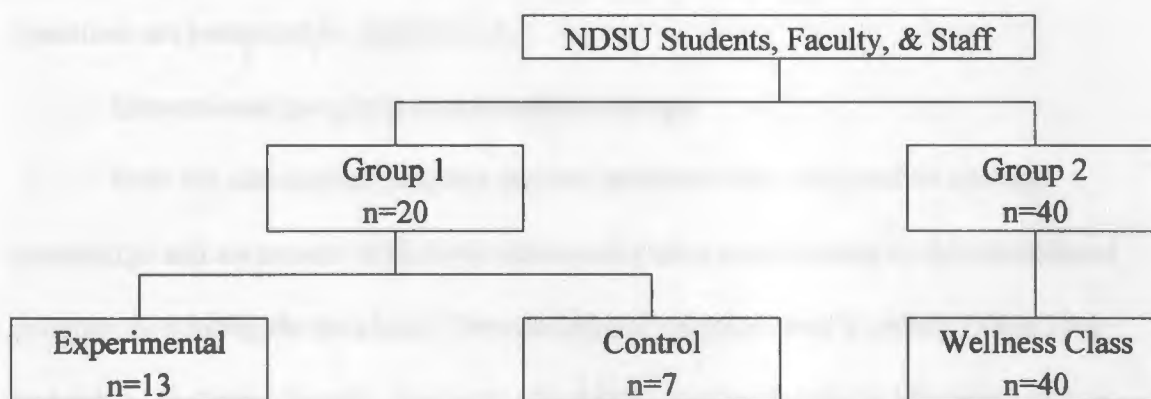
Population Sample and Sampling Procedures

The program was offered to faculty, staff, and students at NDSU. The target population was individuals with a diagnosis of diabetes, pre-diabetes, or individuals who would like to learn more about complications of diabetes. After Institutional Review Board (IRB) approval, participants were recruited through an e-mail to a listserv, flyers, posters, personal invitations, and word of mouth. Participants were recruited simultaneously for the control and intervention groups (Group 1). The control group received a brochure about diabetic retinopathy and diet as well as pre- and post-surveys via e-mail. The intervention group participated in the educational program, received educational materials and additional resources and was encouraged to follow up with their dietitian, primary care physician, and optometrist/ophthalmologist. The intervention group also completed pre- and post-surveys. See Figure 2 for additional information on population sample.

To obtain additional program feedback, a convenience sample (Group 2) was recruited from a required wellness classes at NDSU. The educational program was

provided in place of the class's regular lecture. Like the intervention group, students participated in the educational program, received educational materials and additional resources and were encouraged to follow up with their dietitian, primary care physician, and optometrist/ophthalmologist for prevention or if any problems developed. Students were also encouraged to share the information with individuals who may be affected by diabetes and hypertension. They also completed pre- and post-surveys.

Figure 2. Population Sample



Instrumentation

Pre-survey and post-survey

Short pre- and post-surveys were given to all participants. Questions on the pre-survey addressed the stage of change the participant was in, diabetic retinopathy diagnosis, treatment, prevention, diet, blood sugar control, and demographic information. Questions on the post-survey addressed the stage of change the participant was in, diabetic retinopathy diagnosis, treatment, prevention, diet, blood sugar control, blood pressure control, participants' willingness to make diet and lifestyle changes, and program evaluation. Post-survey questions were matched with pre-survey questions. Survey questions targeted at knowledge were scored in order to measure if an increase in

knowledge occurred. Stage of change and progression from one stage of change to the next was measured using two different survey questions. The first of these questions asked participants to categorize which stage of change they were in and was used on the pre- and post-survey to measure if participants moved from one stage of change to the next as a result of education. The second question addressed participants' willingness to make diet and lifestyle changes after receiving education and was used to measure planned behavioral change and therefore indirectly stage of change at the completion of the program. Survey questions are presented in Appendix A.

Educational program and brochure design

Both the educational program and the brochure were designed to increase knowledge and awareness of diabetic retinopathy after participating in the educational program or reading the brochure. The educational program used a variety of teaching techniques including lecture, handouts, class participation, hands on activities, and discussion. For example, the lecture included PowerPoint slides with pictures, charts, graphs, question slides, and future references. Handouts and the diabetic retinopathy brochure were also provided for future reference. Question slides and activities encouraged class participation and discussion. Participants used a vision simulator card in pairs to see how printed material looked to someone with diabetic retinopathy. Strategies such as active learning activities, connecting prior knowledge to new knowledge, collaboration, and individualization that have been identified as effective were used in the educational program (McKeachie, 2006). Participants worked together on an active learning activity using a modified version of the Idaho Plate Method (Idaho Plate Method, 2010). Participants were given information on the types and amounts of foods to include as

specified by the plate method. Guidelines for the total number of carbohydrate foods were given but participants chose the type of carbohydrate food to include. The program included active learning and collaboration between participants and participants and the presenter during the plate method activity. Participants were also able to connect prior knowledge with new knowledge during the activity. Individualization of the meal plan to each participant occurred when participants were allowed to choose which type of carbohydrate foods to include as well as which additional foods to include. The instructor facilitated class discussion during the activity and also assisted individual participants during the activity. The program lesson plan including PowerPoint slides and script is provided in Appendix G.

The educational program also used strategies to target each of the different stages of change. Cognitive strategies noted in the literature such as dramatic relief, self-reevaluation, and consciousness raising were used to target individuals in the first and second stages of change (Prochaska & Velicer, 1997; Spencer et al., 2007). For example, the program provided dramatic relief when participants were asked to look through the vision simulator card and see what it would be like to live with diabetic retinopathy. The presenter as a positive role model and photographs of positive behaviors were used to encourage self-reevaluation. Consciousness raising aspects such as increasing awareness, feedback, education, and interpretation were also used. To target individuals in the third, fourth, and fifth stages of change behavioral strategies noted in the literature such as helping relationships, counter-conditioning, self-liberation, and reinforcement management were used (Prochaska & Velicer, 1997; Spencer et al., 2007). For example, the opportunity to develop future helping relationships with other participants and the presenter was

provided. Counter-conditioning behaviors such as substituting one food item for another were taught in the class. Self-liberation was enhanced by providing participants with general guidelines about the types of foods to include in the meal plan and only specifying the number of carbohydrate foods to include. The presenter was very encouraging and provided positive feedback to participants to assist with reinforcement management.

Since the educational program was a one-time program focused on increasing awareness of diabetic retinopathy and studies have shown that clinical outcomes are improved with individualization, follow up support, and duration, participants were encouraged to follow up with their dietitian, primary care physician, and optometrist or ophthalmologist. A Diabetic Eye Examination Report card ("blue card") was distributed to participants to aid Blue Cross Blue Shield of North Dakota and the North Dakota Optometric Association in reaching their goal of increasing collaboration between primary care physicians and optometrists/ophthalmologists. The "blue card" also served as a reminder to participants to have their eyes checked. See Appendix F for "blue card".

The brochure was carefully designed to include the most relevant, science-based, yet user-friendly, information and survey questions were tailored to reflect information contained in the brochure. A copy of the brochure is provided in Appendix D.

Procedures

Prior to program implementation, content review by nutrition experts and protocol review by the IRB was completed. The program was provided to the Group 1 experimental group and Group 2 on campus at NDSU in a classroom setting. The Group 1 control group received a brochure and survey questions online.

Upon arrival to the venue, participants in Group 1 were provided with a writing utensil and a random number. Participants wrote the number on the top of the pre- and post-survey for the purpose of matching pre- and post-surveys. Participants were provided with packets of information including a study information sheet (Appendix B), pre- and post-surveys (Appendix A), contact information (Appendix C), brochure (Appendix D), and educational handouts on the modified plate method, portion sizes, label reading, and where to find additional information (Appendix E). Participants handed in pre-surveys to the presenter prior to program presentation. An education program about diabetic retinopathy and diet was then provided. This pilot program including lesson plan and PowerPoint slides is presented in Appendix F.

The same procedure was used for participants in the convenience sample (Group 2) except that participants in the convenience sample provided their names for the purpose of awarding participation points for their wellness class. Surveys from the convenience sample were then numbered in alphabetical order and matched.

After the educational program, participants completed the post-survey and handed it in to the program presenter. The program was presented three different times to three different groups to make up Group 1 experimental group and once to the Group 2 convenience sample. On average, the entire program lasted 45 minutes.

Participants in the control group received the brochure via e-mail. Prior to reading the brochure participants completed the pre-survey. After reading the brochure participants completed the post-survey. Participants handed in hard copies of the pre- and post- survey to the presenter when completed.

Statistical Analysis

Descriptive statistics were used for demographic data (gender, age, diabetic status, blood pressure status, and university occupation classification i.e. student, faculty, staff). A two by two ANOVA was used to test for differences in mean scores between and within subjects. Survey questions are presented in Appendix A. Mean scores on questions 2 through 6 on the pre- and post-surveys were used for analysis. Investigators looked for a difference between mean pre- and post-survey scores in the intervention group, in the control group, and between the intervention and control groups. Pre- and post-survey answers to question 1 were compared to determine change in the stage of change the participant reported. In addition, post-survey scores from the intervention and control groups were compared for question 7 which asked participants what they plan to do as a result of the education provided. Predictive Analytics Software (PASW) Statistics 17.0 was used for calculations and alpha was set at 0.05.

CHAPTER 4. RESULTS

Introduction

An educational program about diabetic retinopathy and diet that integrated current research on diabetic retinopathy, diet, and educational programming and principles was developed. Researchers' goals were to measure the effectiveness of the program, to measure if knowledge and awareness of diabetic retinopathy and diet increased after an education program, and to measure the impact if any on planned lifestyle activities. Additionally, researchers looked at how well the program was received and if any changes should be made before statewide implementation.

Descriptive Statistics Group 1

There were 20 total participants in Group 1. Group 1 was divided into an experimental (n=13) and a control group (n=7). There were a total of 3 males (experimental group n=3) and 17 females (experimental group n=10, control group n=7) in Group 1. Overall the most common age group selected was the 41-64 group (n=9) followed by the 18-25 (n=7) group. The most common age range selected for the experimental group was 41-64 (n=9) and for the control group 18-25 (n=5). Out of the 20 participants, 4 (20%) were diagnosed with diabetes (experimental n=3, control n=1), none were diagnosed with pre-diabetes, 1 (5%) was told blood sugar was high but was not diagnosed with diabetes (experimental n=1), 3 (15%) had been told by a medical provider that blood sugar was high (experimental n=3), 6 (30%) had been told by a medical provider that blood sugar was normal (experimental n=5, control n=1), and 7 (35%) had not had their blood sugar checked recently (experimental n=2, control n=5). Reported systolic blood pressure ranged from <120 mmHg to 140-159 mmHg (<120, n=12 (experimental n=6); 120-129, n=6

(experimental n=5); 130-139, n=1 (experimental n=1); 140-159, n=1 (experimental n=1)). Reported diastolic blood pressure ranged from <80 mmHg to 90-99 mmHg (<80 mmHg, n=13 (experimental n=7); 80-84 mmHg, n=5 (experimental n=4); 85-89 mmHg, n=1 (experimental n=1); 90-99 mmHg, n=1 (experimental n=1)). Of the 20 participants, 8 were students (experimental n=2, control n=6), 5 were faculty (experimental n=5), and 7 were staff (experimental n=6, control n=1). Table 1 illustrates descriptive statistics for participants in Group 1.

Table 1.

Demographic Characteristic of Group 1 Experimental and Control Groups

Demographic characteristic	Experimental	Control
Gender		
Male	3	0
Female	10	7
Age		
18-25	2	5
26-40	1	2
41->85	10	0
Occupation		
Student	2	6
Faculty	5	0
Staff	6	1
Diabetes and Blood Sugar		
DM diagnosis	3	1

Table 1. (continued)

Demographic characteristic	Experimental	Control
Diabetes and Blood Sugar		
Pre-DM diagnosis	0	0
High blood sugar/ No DM	1	0
High blood sugar	3	0
Normal blood sugar	5	1
Blood sugar not checked	2	5
Fasting Blood Glucose Level		
<100	4	1
100-109	1	0
110-124	2	1
Unknown	4	1
Never tested	1	4
Systolic Blood Pressure		
<120	6	6
120- \geq 160	7	1
Unknown	0	0
Never tested	0	0
Diastolic Blood Pressure		
<80	7	6
80- \geq 100	6	1
Unknown / Never tested	0	0

Descriptive Statistics Group 2

There were 40 total participants in Group 2 (male n=10, female n=29, missing n=1). All participants completed the educational program and no control group was used. The most common age group selected was the 18-25 group (n=36). Participants ranged in age from 18-64. Of the 40 participants, 1 was diagnosed with diabetes, none were diagnosed with pre-diabetes, 1 was told blood sugar was high but was not diagnosed with diabetes, none had been told by a medical provider that blood sugar was high, 13 had been told by a medical provider that blood sugar was normal, and 23 had not had their blood sugar checked recently. Reported systolic blood pressure ranged from <120 mmHg to 140-159 mmHg (<120, n=8; 120-129, n=10; 130-139, n=1; 140-159, n=4). Sixteen participants did not know their systolic blood pressure number and two had never had it tested. Reported diastolic blood pressure ranged from <80 mmHg to 90-99 mmHg (<80 mmHg, n=10; 80-84 mmHg, n=7; 85-89 mmHg, n=1; 90-99 mmHg, n=2). Sixteen participants did not know their diastolic blood pressure number and two had never had it tested. Of the 40 participants, all were students. Table 2 describes demographic data for Group 2.

Research Question 1: Did Knowledge and Awareness of Diabetic Retinopathy and Diet Increase After an Education Program?

Table 2.

Demographic Characteristic of Group 2

<u>Demographic Characteristic</u>	<u>Group 2</u>
	Gender
Male	10
Female	29

Table 2. (continued)

Demographic Characteristic	Group 2
Gender	
Missing	1
Age	
18-25	36
26->85	3
Missing	1
Occupation	
Student	39
Faculty	0
Staff	0
Missing	1
Diabetes and Blood Sugar	
DM diagnosis	1
Pre-DM diagnosis	0
High blood sugar/ No DM	1
High blood sugar	0
Normal blood sugar	13
Blood sugar not checked	23
Fasting Blood Glucose Level	
<100	5
100-124	3

Table 2. (continued)

Demographic Characteristic	Group 2
Fasting Blood Glucose Level	
Unknown	18
Never tested	14
Systolic Blood Pressure	
<120	8
120- \geq 160	13
Unknown	16
Never tested	2
Diastolic Blood Pressure	
<80	10
80- \geq 100	10
Unknown	16
Never tested	2

Statistical analysis Group 1: Tests for knowledge and awareness

Mean scores for questions 2 through 6 on the pre-survey were 12.57 (s.d. 2.878, n=7) for the control group, 12.54 (s.d. 2.222, n=13) for the experimental group, and 12.55 (s.d. 2.395, n=20) total. Mean scores for the same questions on the post-survey were 14.57 (s.d. 1.618, n=7) for the control group, 13.69 (s.d. 2.287, n=13) for the experimental group, and 14.00 (s.d. 2.077, n=20) total. Mean scores were compared individually for each group and a t-test was used to check for significance. A significant difference in mean pre- and

post-survey scores was seen in both the experimental group ($p=0.000$) and the control group ($p=0.000$). Means for Group 1 are displayed in Table 3.

Wilks' Lambda was used to check for significance in the combined groups. A significant ($p=.016$, $F=7.041$) change in mean score was seen in both groups combined. There was no significant interaction between and within subjects ($p=.486$, $F=.507$). Table 4 shows a tabular presentation of change in mean score. A t-test was conducted to check for differences between the experimental and control groups in mean pre- and post-survey scores. No significant difference between groups was seen ($p=.978$ for mean pre-survey score and $p=.381$ for mean post-survey score).

Table 3.

Mean Pre- and Post-Survey Scores (Group 1)

	Group	<i>M</i>	Std. Deviation	<i>n</i>
<i>M-pre</i>	C	12.57	2.878	7
	E	12.54	2.222	13
	Total	12.55	2.395	20
<i>M-post</i>	C	14.57	1.618	7
	E	13.69	2.287	13
	Total	14.00	2.077	20

Note. C indicates Group 1 control group and E indicates Group 1 experimental Group

Statistical analysis Group 2: Tests for knowledge and awareness

A t-test was used to test for differences in pre- and post-survey scores. The mean pre-survey score was 11.58 ($n=40$, $s.d.=2.448$). The mean post-survey score after program

Table 4.

t-test for Equality of Means (Group 1)

		Levene's Test for equality of variances		t-test for equality of means	
		F	Sig.	T	df
M-post	Equal variances assumed	1.469	.241	-.898	18
	Equal variances not assumed			-.998	16.375
M-pre	Equal variances assumed	1.055	.318	-.029	18
	Equal variances not assumed			-.026	9.954
t-test for equality of means					
		Sig. (2-tailed)	Mean difference	Std. error difference	
M-Post	Equal variances assumed	.381	-.879	.979	
	Equal variances not assumed	.333	-.879	.881	
M-Pre	Equal variances assumed	.978	-.033	1.153	
	Equal variances not assumed	.979	-.033	1.250	

presentation was 12.78 (n=40, s.d.=1.941). A significant change in scores was seen ($p=.000$, df 39, $t=4.183$). See Tables 5 and 6 for additional information.

Questions 2 through 6 on the pre- and post-surveys were scored knowledge

Table 5.

Mean Pre- and Post-Survey Scores (Group 2)

	<i>M</i>	Std. Deviation	N
<i>M</i> -pre	11.58	2.448	40
<i>M</i> -post	12.78	1.941	40

Table 6.

Paired Samples Statistics, Correlations, and t-test (Group 2)

Paired Samples Statistics				
	<i>M</i>	N	Std. Deviation	Std. Error Mean
<i>M</i> -post	12.78	40	1.941	.307
<i>M</i> -pre	11.58	40	2.448	.387

Paired Samples Correlations			
	N	Correlation	Sig.
<i>M</i> -post & <i>M</i> -pre	40	.681	.000

Paired Samples Test			
	Paired Differences <i>M</i>	Std. Deviation	Std. Error Mean

Table 6. (continued)

Paired Samples Test					
	Paired Differences				
	<i>M</i>	Std. Deviation	Std. Error Mean		
<i>M</i> -Post – <i>M</i> -pre	1.200	1.814	.287		
	Paired Differences 95% Confidence Interval of the Difference				Sig. (2-tailed)
	Lower	Upper	<i>t</i>	<i>df</i>	
<i>M</i> -Post – <i>M</i> -pre	.620	1.780	4.183	39	.000

questions. Question 2 asked “what can you do to prevent diabetic retinopathy”. In Group 1 experimental and control groups the most common responses were to “eat lots of carbohydrate foods” and “exercise”. The most common response in both groups on the post-survey was “to exercise”. Almost half of the control group, but few participants in the experimental group, chose the incorrect answer to “eat lots of carbohydrate foods” on the post-survey.

In Group 2, the most common responses on the pre-survey were to “eat a healthy diet” and “eat high-sodium foods”. On the post-survey the most common responses were to “control blood sugar”, “eat a healthy diet”, “get a yearly comprehensive and dilated eye exam”, and “eat high-sodium foods”. Many participants chose all answers on the post-

survey and 92.5% of participants still chose the incorrect answer to “eat high-sodium foods” on the post-survey.

Question 3 asked “which foods can cause blood sugar to rise if not eaten in balance”. The most common response in Group 1 experimental and control on the pre- and post-survey was “carbohydrates”. Most participants answered this question correctly. Only 67% of Group 2 participants answered this question correctly on the pre-survey and 75% of participants answered this question correctly on the post survey.

Question 4 asked “what the hemoglobin A₁C goal is for people with diabetes”. In Group 1 experimental group 61.5% of participants answered the question correctly on the pre-survey and 84.6% of participants answered the question correctly on the post-survey. In the Group 1 control group 71.4% of participants answered the question on the pre-survey correctly and 85.7% answered the post-survey question correctly. In Group 2, 40% of participants answered the question correctly on the pre-survey and 57.5% of participants answered the question correctly on the post-survey.

Question 5 asked “which foods are recommended for blood pressure control”. In Group 1 experimental group the most common response on the pre- and post-survey was to “eat low-fat dairy products”. In Group 1 control group, the most common response on the pre-survey was to “eat nuts” and the most common response on the post-survey was to “eat low-fat dairy products”. In Group 2, the most common responses on the pre-survey were to “eat vegetables”, “fruits”, and low fat dairy products”. The most common responses on the post survey were to “eat vegetables” and “low-fat dairy products”.

Question 6 asked “which mineral should be limited to control blood pressure”. In Group 1 experimental group 84.6% of participants chose the correct answer on the pre-

survey and 92.3% chose the correct answer on the post-survey. All participants in Group 1 control group selected the correct answer on the pre- and post-surveys. In Group 2, 85% of participants chose the correct answer on the pre-survey and 95% chose the correct answer on the post-survey.

Research Question 2: Did Education Affect Planned Lifestyle Activities Related to Diabetic Retinopathy and Diet?

Group 1 results: Tests for lifestyle interventions

Question 1 on the pre- and post-survey addressed what stage of change the participant was in prior to and after education. This question was used to measure planned change in behavior, i.e. movement from one stage of change to the next due to program elements aimed at increasing knowledge and awareness and changing attitude and motivation. Answers to question one were compared on the pre-and post-survey using the McNemar Test for agreement. No significant difference in answers for questions 1 a through 1 e was seen (Exact sig.=1.000 for all questions). Appendix A lists survey questions.

Pearson Chi-Square was used to compare the experimental and control groups' answers to question 7 on the post-survey. This question addressed what participants plan to do as a result of the education provided. No significant difference in answers was seen. All participants planned to do something as a result of the education provided. More participants (89.5%), whether in the control or intervention group, planned to eat more fruits and vegetables after receiving the program or brochure than any other planned lifestyle change. The second most common behavior change participants planned to implement was to be aware of the carbohydrate content of foods (68.4%), followed by

eating more low fat dairy products (63.2%), decreasing intake of salt and sodium (63.2%), and getting more physical activity (63.2%). Only 21% of participants planned to work with their dietitian to help lower blood sugars. Table 7 lists results of question 7 for Group 1.

Table 7.

Behavior Change Analysis Group 1: Combined Results

Question	Answer: Yes n, (%)	Answer: No n, (%)
Post 7a Share the vision card with others	8 (42.1)	11 (57.9)
Post 7b Share the blue Diabetic Eye Examination card with physician and optometrist/ophthalmologist	5 (26.3)	14 (73.7)
Post 7c Get a comprehensive and dilated eye exam	6 (31.6)	13 (68.4)
Post 7d Eat more fruits and vegetables	17 (89.5)	2 (10.5)
Post 7e Eat more low fat dairy products	12 (63.2)	7 (36.8)
Post 7f Decrease intake of salt and sodium containing food	12 (63.2)	7 (36.8)
Post 7g Work with your dietitian to control blood sugars	4 (21.1)	15 (78.9)
Post 7h Be aware of the importance of carbohydrate balance (consistent carbohydrate intake)	13 (68.4)	6 (31.6)
Post 7i Use the resources provided	11 (57.9)	8 (42.1)
Post 7j Get more physical activity	12 (63.2)	7 (36.8)
Post 7k Nothing*	0 (0)	19 (100)

Note. A "Yes" response indicates the participant is going to do something as a result of the lesson. *A "Yes" response indicates the participant plans to do nothing as a result of the education.

Group 2 results: Tests for lifestyle interventions

Answers to question 1 were compared on the pre-and post-survey using the McNemar test for agreement. No significant difference was seen between pre- and post-survey answers for all question 1 a through 1 e (Exact Sig.=1.000 for all questions 1 a through 1 e). Appendix A provides a list of survey questions.

Question 7 on the post-survey addressed what participants planned to do as a result of the lesson. All participants planned to do something as a result of the lesson. The most common response was to “increase intake of fruits and vegetables” (65%) followed by “getting more physical activity” (60%) and “decreasing intake of salt and sodium” (55%). The least common responses were to “share the blue Diabetic Eye Examination card with physician or optometrist/ophthalmologist” (12.5%) and “work with a dietitian to control blood sugars” (15%). Results are summarized in Table 8.

Research Question 3: Was the Program Favorably Received and What Improvements Could be Made Before Finalizing the State-Wide Curriculum?

Participant suggestions

Participants provided feedback on the presentation and brochure. Comments are summarized in Table 9.

Table 8.

Behavior Change Analysis (Group 2)

Question	Answer: Yes N, (%)	Answer: No N, (%)
Post 7a Share the vision card with others	12 (30.0)	28 (70.0)
Post 7b Share the blue Diabetic Eye Examination card with physician and optometrist/ophthalmologist	5 (12.5)	35 (87.5)
Post 7c Get a comprehensive and dilated eye exam	7 (17.5)	33 (82.5)
Post 7d Eat more fruits and vegetables	26 (65.0)	14 (35.0)
Post 7e Eat more low fat dairy products	19 (47.5)	21 (52.5)
Post 7f Decrease intake of salt and sodium containing food	22 (55.0)	18 (45.0)
Post 7g Work with your dietitian to control blood sugars	6 (15.0)	34 (85.0)
Post 7h Be aware of the importance of carbohydrate balance (consistent carbohydrate intake)	17 (42.5)	23 (57.5)
Post 7i Use the resources provided	10 (25.0)	30 (75.0)
Post 7j Get more physical activity	24 (60.0)	16 (40.0)
Post 7k Nothing*	0 (0)	40 (100)

Note. A "Yes" response indicates the participant is going to do something as a result of the teaching. *A "Yes" response indicates the participant plans to do nothing as a result of the education.

Table 9.

Presentation and Brochure Feedback

Group 1 Participant Comments

Table 9. (continued)

Group 1 Participant Comments

Need more hands on exercises versus PowerPoint

Presenter was very open to questions, non-judgmental.

Good information for people who don't have diabetes.

Go Lindsay! Try BCBS brown bag lunches.

Nice job.

Thank you for the information.

I love the props.

Good job. (2)

Informative and professional.

Great job! (2) Very informative.

I liked the plate method handouts because it was easy to visualize and follow.

Group 2 Participant Comments

Good! (2)

Great to show real examples, easier to understand what it looks like.

Nice, very informative.

Slow down a little the slides and talk were very fast. Great job overall though.

Too many papers! Information is too much but great topic.

Great presentation.

You were fun to listen to good job

Table 9. (continued)

Group 2 Participant Comments

Good work – done well!

Good presentation, well prepared.

Very interesting!

Participant Brochure Comments

Lovely.

Great information.

The size of brochure text limited the amount of information for the brochure.

I don't feel I have a better understanding of diabetic retinopathy.

CHAPTER 5. DISCUSSION

Introduction

An educational program about diabetic retinopathy and diet that integrated current research on diabetic retinopathy, diet, and educational programming and principles was developed. The effectiveness of the program was pilot tested with several audiences. Researchers examined if knowledge and awareness of diabetic retinopathy and diet increased after an education program by comparing mean scores on a pre- and post-survey. They also examined if education impacted stage of change and planned lifestyle activities. Ultimately, this program will be used by NDSU Extension agents and other nutrition education professionals throughout North Dakota. Therefore, researchers also looked at how well the program was received and what changes to the program could be made to increase effectiveness of education.

Discussion

Research question 1: Did knowledge and awareness of diabetic retinopathy and diet increase after an education program?

Group 1 – Mean score analysis regarding knowledge and awareness

Mean scores for knowledge questions on the pre- and post-survey were compared for the experimental and control groups. Mean pre-scores were 12.54 for the experimental group and 12.57 for the control group. Mean post-scores were 13.69 for the experimental group and 14.57 for the control group. When analyzed individually, a significant change in scores was seen in both the experimental ($p=0.000$) and control groups ($p=0.000$). When both groups were combined and mean scores on the pre- and post-survey were compared, a significant ($p=.016$, $F=7.041$) change in mean score was seen. Scores were out of 16 total

points. Average mean percentage score for the experimental group was 78% on the pre-survey and 86% on the post-survey which represents an 8% increase in score. Average mean percentage score for the control group was 79% on the pre-survey and 91% on the post-survey which represents a 12% increase in score. Average mean percentage score for the combined experimental and control groups was 78% on the pre-survey and 88% on post-survey representing a 10% increase in score. If grading on a normal 90, 80, 70, 60 scale a 10% increase in score would increase the grade by one letter grade. This is not only statistically significant but also practically significant. Knowledge and awareness of diabetic retinopathy increased after an educational program and after reading a brochure.

There was no significant interaction between and within subjects ($Sig=.486$, $F=.507$). In other words, both the educational program and the brochure were effective at increasing knowledge and awareness of diabetic retinopathy and diet, at least for the small sample of participants presented here. The educational program was not shown to be more effective than only reading a brochure in this study. This could be because researchers used the university population and individuals from that population were highly educated. The brochure was carefully designed and survey questions were tailored to reflect information contained in the brochure. Perhaps participants gained knowledge quickly because of brochure design or maybe the survey questions used were too easy for this population. The small sample size could also influence results. According to McKeachie (2006), print material is effective for student learning and students should be encouraged to read the text as well as attend class. The educational program provided additional benefits to the participants. Participants received one on one attention and were encouraged to ask questions and participate. Participants also had to opportunity to network with others who

were interested in diabetic retinopathy. Social support is important when making behavioral change as noted by Spencer et al. (2007) and Prochaska and Velicer (1997).

A t-test was conducted to test for differences between the experimental and control groups in mean pre- and post-survey scores. No significant difference between groups was seen (Sig=.978 for mean pre-survey score and Sig=.381 for mean post-survey score). In other words, both groups had about equal scores on the pre- and post-surveys.

Group 2 – Mean score analysis regarding knowledge and awareness

Mean scores on the pre- and post-survey were compared and a significant (Sig =.000, df 39, t=4.183) change in mean score was seen. Again, scores were out of 16 total points. Average mean percentage score for Group 2 was 72% on pre-survey and 80% on post-survey. This represents an 8% increase in score. The increase in score was slightly lower than Group 1 but still statistically and practically significant. Knowledge and awareness of diabetic retinopathy increased after the educational program, however, participants in Group 1 may have learned more. Group 1 participants were likely more motivated as indicated by their self-mentioned markers for chronic disease compared to Group 2. Group 2 participants were part of a required wellness class and did not freely choose to participate in the program.

Research question 2: Did education affect planned lifestyle activities related to diabetic retinopathy and diet?

Group 1 – Stages of change analysis

Question one addressed which stage of change participants were in. Answers to question one were compared on the pre-and post-survey using the McNemar Test for agreement and revealed no significant difference in answers for questions 1 a through 1 e

(exact sig.=1.000 for all questions). The majority of participants were in the last two stages of change, i.e. have made behavioral changes in the past 6 month (35%) or have made behavioral changes for greater than 6 months and working on sustaining those changes (40%). One participant was in the first stage of change, i.e. did not plan on making behavioral change in the near future and moved to the second stage of change, i.e. thinking about making a change in the next 6 months.

Behavioral strategies such as helping relationships, counter-conditioning, self-liberation, stimulus control, and reinforcement management are most effective for individuals in the third, fourth, and fifth stages of change, preparation, action, or maintenance, respectively (Prochaska & Velicer, 1997; Spencer et al., 2007). Participants were given the opportunity to meet others who were interested in diabetic retinopathy and diet and therefore given the opportunity to develop helping relationships in the future. Participants did learn counter-conditioning behaviors like substituting one food item for another. Self-liberation was enhanced by giving participants multiple choices for their meal plans. Meal plans were designed using a modified version of the Idaho plate method. Participants were given guidelines about the total number of carbohydrate foods to include but chose the type of carbohydrate food to consume. The presenter was available for future questions as needed but did not remain in contact with participants on a scheduled or regular basis. Future follow-up, or continuous follow-up would likely help motivate Group 1 participants to move to the next stage of change. An example would be follow-up calls or e-mails from registered dietitians or dietetic students who may offer to help answer questions that the participant may have after the program. Stastny and Garden-Robinson

found that participants in “Eating for your eyes” had made changes that they claimed they planned on doing in the “Eating for your eyes” program (2011).

Group 2 – Stages of change analysis

Answers to question 1 were compared on the pre-and post-survey using the McNemar test for agreement. No significant difference was seen between pre- and post-survey answers for all questions 1 a through 1 e (Exact Sig.=1.000 for all questions 1 a through 1 e). In contrast to Group 1, most participants were in the first stage of change (27.5%), i.e. were not planning on making any changes in the near future or the fourth stage of change (30%), i.e. have made behavioral changes in the past 6 months. One of the main differences between Groups 1 and 2 was that participants in Group 1 chose to attend the educational program versus participants in Group 2 were required to attend the educational program as part of a required wellness class. This may account for the differences in stage of change between the two groups.

Cognitive strategies such as dramatic relief, self-reevaluation, environmental reevaluation, consciousness raising, and social liberation are most effective for individuals in the first and second stages of change (Prochaska & Velicer, 1997; Spencer et al., 2007). The educational program encompassed many of these cognitive strategies. It provided some dramatic relief when participants were asked to look through the vision simulator card and see what it would be like to live with diabetic retinopathy. It also included photographs of positive behaviors and the presenter as a positive role model to assist with self-reevaluation. The program also included aspects of consciousness raising such as increasing awareness, feedback, education, and interpretation. Consciousness raising aims

to increase awareness of the causes, consequences, and cures for a particular behavior. This was one of the main goals of the program.

The program targeted many strategies for behavior change including a major focus on consciousness raising which is effective for participants in the first or second stage of change. Because of the major focus on consciousness raising perhaps not enough time was devoted to strategies targeted at the third, fourth, and fifth stage of change. A significant change in moving from one stage to the next was not seen in either group as noted by self-reported stage of change on the post-survey. For Group 1 this could be because the majority of participants were in the last stages of change and since the program was a onetime educational opportunity, could not target all strategies for behavioral change in the later stages. This could also apply to those participants in Group 2 who were in the fourth stage of change. The majority of participants in Group 1 chose to attend the educational program for their own benefit and had already been working on behavioral change as indicated by self-reported stage of change on the pre-survey. Some Group 1 participants were attending the program for someone other than themselves and therefore planning no behavioral change. Many Group 2 participants were in the first stage of change and therefore had increased opportunity to change to the next stages relative to Group 1. Nevertheless, a significant change in moving from one stage to another was not seen. This could be because participants were required to attend the educational program as part of a class versus being motivated to attend the program on their own like Group 1 participants. In addition, all participants may have needed more time to think about making behavioral change before moving from one stage to the next.

Group 1 – Behavior change analysis

Question 7 on the post-survey addressed what participants planned to do as a result of education. Pearson Chi-Square was used to compare the experimental and control groups' answers to question 7 on the post-survey. No significant difference in answers was seen. Both methods of education were effective and all participants planned on doing something as a result of the education. The most common responses to question 7 were to "eat more fruits and vegetables" as a result of the lesson and to "be aware of the importance of carbohydrate balance (i.e. consistent carbohydrate intake)". Eating fruits and vegetables and consistent carbohydrate intake were stressed greatly in the lesson. The least common responses were to "do nothing" as a result of the lesson (n=0) and "to work with your dietitian to control blood sugars" (n=4). This would be reasonable because few participants noted having problems with blood sugar control. See Table 7 for frequencies.

Group 2 – Behavior change analysis

Question 7 on the post-survey was used to assess what participants planned to do as a result of education. All participants in Group 2 planned on doing something as a result of education. The most common responses were to "increase fruit and vegetable intake", "get more physical activity", and "decrease intake of salt and sodium". Unlike Group 1, Group 2 did not identify "being aware of the importance of carbohydrate balance (i.e. consistent carbohydrate intake)" as something to do as a result of education. This may be because the Group 2 sample consisted of only one person with a diagnosis of diabetes in an otherwise healthy population of students. The least common responses were to "do nothing" (n=0), "share the blue card with your physician or optometrist/ophthalmologist", "work with your dietitian to control blood sugars", and "get a comprehensive and dilated eye exam". Again these responses may be due to the population selected, i.e. students, most of which do not

have a diagnosis of diabetes. Since the programming was not specifically targeted towards younger participants in Group 2, and more towards older adults, this educational program may not have been effective in motivating change in planned behaviors. See Table 8 for frequencies.

All participants, whether from Group 1 or Group 2, independent of stage of change, planned to do something as a result of the lesson. This could be because the program used strategies to target each stage of change.

Research question 3: Was the program favorably received and what improvements could be made before finalizing the state-wide curriculum?

Future of the program

The program was favorably received as evidenced by the many positive comments received on the post-survey. Table 9 provide a list of comments. Many participants also verbally told the presenter how much they enjoyed the presentation. Additional activities could be added to the presentation to decrease the amount of lecture/PowerPoint as suggested by one participant. Another suggestion was to decrease the number of handouts provided. The program is set up to include optional modules and therefore could be expanded or condensed depending on the goals of the presenter and needs of the population. Since this program will be provided to a diverse population throughout North Dakota it is important to have some flexibility with respect to program duration, content, and activities. Flexibility with the program will also help target the stage of change the majority of participants are in.

Conclusions

Knowledge and awareness of diabetic retinopathy and diet increased after reading a brochure and after attending an educational program. Overall the program was not shown to affect the reported stage of change participants were in. In Group 1 this could be because participants were already working on making behavioral changes and may have needed a more intensive program to assist in continuation of these behaviors or moving forward in the stage of change model. In Group 2 this could be because of the population selected, i.e. a required wellness class at NDSU. Participants may not have been interested in the topic or in making lifestyle changes. Although the program targeted many strategies to move from the first to second stage of change it may not have been effective in this population because the majority of participants did not have diabetes and may not have felt that behavioral change was needed. Participants may also have needed more time to think about making behavioral change and could always make a change weeks or months after the presentation. In a second question that asked about changing behavior, all participants planned to do something after the program, i.e. eat more fruits and vegetables or share the vision card with others. This shows that the educational program had some impact on planned behaviors. Participants provided many positive comments on the program and in the future it will be provided through NDSU Extension agents in North Dakota.

The populations assessed are somewhat different than the population of North Dakota as a whole. Participants in the statewide program would likely be more like Group 1 than Group 2 because they would be choosing to participate in the program and probably thinking about or already making behavioral changes. The opportunity to bring a spouse or significant other to the educational program could also increase likelihood of making behavioral changes.

Limitations

The population used may not be representative of North Dakota as a whole since only students, faculty, and staff from NDSU were included. Most of the participants were young adults and had some college education. The demographic characteristics of Group 1 control were somewhat different than Group 1 experimental and that may have affected the results of the study. In general, Group 1 control participants were younger and more likely to be students than Group 1 experimental. Self-selection bias may also have limited the study as those individuals more interested in diabetic retinopathy would be more likely to attend. The small sample size also limited statistical significance.

Recommendations Regarding Utilization of Findings

Further research with a larger and more heterogeneous population is warranted to validate these results. An increased number of recruitment periods as well as offering more small programs could assist in increasing sample size. Survey questions may need to be changed to obtain better results. For the graded part of the surveys (questions 2-6) an increased number of wrong answer choices could affect results. Additional follow-up information on retention of knowledge from the program and behavioral change could be obtained from those participants who filled out optional contact information at a later date.

The diabetic retinopathy educational program in Appendix G is a pilot program and has undergone revision. This program can be expanded or condensed depending on the needs of the extension agents and the population served. The final curriculum guide, PowerPoint slides, and brochure will be polished by professional graphic staff prior to becoming part of NDSU Extension Service's educational programs. The goal of the pilot program was geared towards content.

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APPENDIX A. SURVEY QUESTIONS

Questions for Pre-Survey

1. Which options best describes your diet and lifestyle?
 - a. I do not plan on making any changes in the near future (the next 6 months).
 - b. I am thinking about making a change in the next 6 months.
 - c. I am actively considering changing behavior in the next month.
 - d. I have made behavioral changes in the past 6 months.
 - e. I have made behavioral changes for greater than 6 months and am working on sustaining those changes.

2. Diabetic retinopathy is a diabetic eye disease that can lead to blindness. What can you do to prevent it? Please circle all answers that apply.
 - a. Control blood sugar
 - b. Control blood pressure
 - c. Eat a healthy diet
 - d. Eat lots of carbohydrate foods
 - e. Exercise
 - f. Get a yearly comprehensive and dilated eye exam
 - g. Eat high sodium foods

3. Which foods can cause blood sugar to rise if not eaten in balance?
 - a. carbohydrates
 - b. protein
 - c. fat

4. What is the hemoglobin A1c (average blood sugar) goal for people with diabetes?
 - a. <5%
 - b. <6%
 - c. <7%
 - d. <8%

5. Which foods are recommended for blood pressure control? Please circle all foods that apply.
 - a. Fruits
 - b. Vegetables
 - c. Nuts
 - d. Low-fat dairy products
 - e. Low-fat meat
 - f. Grains

6. Which mineral should be limited to help control blood pressure?
 - a. Potassium
 - b. Magnesium
 - c. Sodium
 - d. Calcium

7. What was your fasting blood glucose level the last time you had it checked?
- a. Less than 100 b. 100-109 c. 110-118
d. 119-124 e. I don't know f. I've never had it tested
8. What was your systolic (top number) blood pressure the last time you had it checked?
- a. Less than 120 b. 120-129 c. 130-139 d. 140-159
e. 160 or more f. I don't know g. I've never had it tested
9. What was your diastolic (bottom number) blood pressure the last time you had it checked?
- a. Less than 80 b. 80-84 c. 85-89 d. 90-99
e. 100 or more f. I don't know g. I've never had it tested
10. Circle all statements that apply to you?
- a. I have been told by a medical provider that I have diabetes.
b. I have been told by a medical provider that I have pre-diabetes.
c. I have been told by a medical provider that my blood sugar is high but I do not have diabetes.
d. I have been told by a medical provider that my blood sugar is high.
e. I have been told by a medical provider that my blood sugar is normal.
f. I have not had my blood sugar checked recently.
11. How old are you?
- a. 18-25 d. 65-75
b. 26-40 e. 76-84
c. 41-64 f. More than 85
12. Are you: a. Male b. Female
13. Are you: a. Student b. Faculty c. Staff d. Other

Questions for Post-Survey

1. Which option best describes your diet and lifestyle?
 - a. I do not plan on making any changes in the near future (the next 6 months).
 - b. I am thinking about making a change in the next 6 months.
 - c. I am actively considering changing behavior in the next month.
 - d. I have made behavioral changes in the past 6 months.
 - e. I have made behavioral changes for greater than 6 months and am working on sustaining those changes.

2. Diabetic retinopathy is a diabetic eye disease that can lead to blindness. What can you do to prevent it? Please circle all answers that apply.
 - a. Control blood sugar
 - b. Control blood pressure
 - c. Eat a healthy diet
 - d. Eat lots of carbohydrate foods
 - e. Exercise
 - f. Get a yearly comprehensive and dilated eye exam
 - g. Eat high sodium foods

3. Which foods can cause blood sugar to rise if not eaten in balance?
 - a. carbohydrates
 - b. protein
 - c. fat

4. What is the hemoglobin A1c (average blood sugar) goal for people with diabetes?
 - a. <5%
 - b. <6%
 - c. <7%
 - d. <8%

5. Which foods are recommended to increase blood pressure control? Please circle all foods that apply.
 - a. Fruits
 - b. Vegetables
 - c. Nuts
 - d. Low-fat dairy products
 - e. Low-fat meat
 - f. Grains

6. Which mineral should be limited to help control blood pressure?
 - a. Potassium
 - b. Magnesium
 - c. Sodium
 - d. Calcium

7. What do you plan to do as a result of this lesson?
- a. Share the vision card with others
 - b. Share the blue Diabetic Eye Examination Report card with your family practice doctor or eye doctor
 - c. Get a comprehensive and dilated eye exam
 - d. Eat more fruits and vegetables
 - e. Eat more low fat dairy products
 - f. Decrease intake of salt and sodium containing foods
 - g. Work with your dietitian to control blood sugars
 - h. Be aware of the importance of carbohydrate balance (consistent carbohydrate intake).
 - i. Use the resources provided to learn more about diabetes, diabetic retinopathy and diet
 - j. Get more physical activity
 - k. Nothing

8. Will you share this information with family and friends?

a. Yes b. No

9. Please rate your understanding of the information presented in this presentation (1= poor, 5 = very good).

1 2 3 4 5

10. Please rate how easy the handouts were to read (1= difficult; 5 = easy)

1 2 3 4 5

Comments: _____

APPENDIX B. STUDY INFORMATION SHEET**INFORMATION SHEET FOR QUESTIONNAIRE PARTICIPANTS IN DIABETIC
RETINOPATHY PROGRAM****Research Project Information**

1. Diabetic Retinopathy education program
2. The Dept of HNES invites you to complete a questionnaire before and after the presentation.
3. The questionnaire will have questions on diet and lifestyle change, diabetic retinopathy, diet, blood sugar control, blood pressure control, demographic information, and program evaluation.
4. The questionnaire should take about 5 minutes.
5. Completion of the questionnaire is voluntary.
6. The purpose of the study is to evaluate if knowledge and awareness of diabetic retinopathy and diet increase after an education program as well as evaluate if education affects planned lifestyle activities related to diabetic retinopathy and diet.
7. All information provided on the questionnaire is confidential.

Contact Information

If you have any questions regarding this project please contact the researcher at:

Sherri Nordstrom Stastny, PhD, LRD, CSSD

Asst. Professor

HNES, NDSU

701-231-7479

Sherri.stastny@Ndsu.edu

If you have questions about your rights as a research participant, or would like to report a research-related problem, please contact NDSU Institutional Review Board at:

NDSU IRB Office

701-231-8908

Ndsu.irb@ndsu.edu

APPENDIX C. CONTACT INFORMATION SHEET

May we contact you at a later date to follow up on how effective the education program was? If so, please indicate the following:

Name: _____
Address: _____
Phone: _____
E-mail: _____
Number: _____

Know Your Numbers

Fasting Blood Glucose Level

Normal: 70-100 mg/dl
Pre-Diabetes: > 100 mg/dl
Diabetes: >126 mg/dl

Hemoglobin A1c

Normal: 4-6%
Goal for Diabetes: <7%

Blood Pressure (mmHG)

Normal: <120/80
Hypertension: \geq 140/90

Prevention is Key

- Eat a healthy diet to help control blood sugar, blood pressure, and cholesterol levels

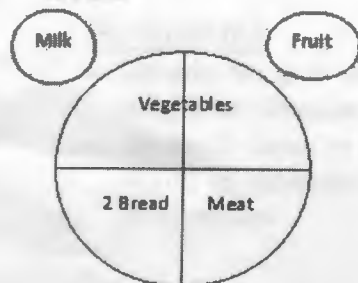


Plate Example

Plate Method for Healthy Meals

Vegetables - ½ plate

- Watery **NOT** starchy

Meat/fish/poultry/tofu/eggs/nuts - ¼ plate

- Protein foods

Bread/starch/grain - ¼ plate for 1 serving, may have 2 servings

- Includes starchy vegetables and dried beans
- Preferably whole grains

Milk & yogurt – use 1 C small cup or coffee cup

- Skim or 1% milk, low fat or fat free yogurt

Fruit – Use ½ C dessert dish or 1 C small cup or coffee cup

- 1 small fruit, ½ C sliced fruit or applesauce, ½ C fruit juice, 1 C melons or berries

Diabetic Retinopathy

Prevention, Treatment, & Diet

Normal Vision



Same scene viewed by a person with Diabetic Retinopathy



Diabetic Retinopathy

- Is a complication of diabetes that can lead to blindness
- Most common diabetic eye disease
- Caused by changes in the blood vessels of the retina

Risk Factors

- Presence of Type 1 or 2 diabetes
- Diabetes diagnosis and pregnant
- Poor blood sugar control
- Poor blood pressure control
- Presence of kidney disease
- Duration of diabetes

Symptoms

- Usually none in early stages of disease
- Spots in vision or blurred vision as disease progresses

Prevention & Treatment

Control Blood Sugar

- Consistent intake of carbohydrate foods at meals
 - bread/starch/grain, milk/yogurt, fruit/fruit juice, sweets

Control Blood Pressure

- Increase intake of fruits, vegetables, whole grains, low fat or fat free dairy products and nuts
- Decrease sodium intake
- Moderate alcohol intake

Control Cholesterol Levels

- Choose foods moderate in fat and low in saturated fat, cholesterol, and trans fat

Regular Physical Activity

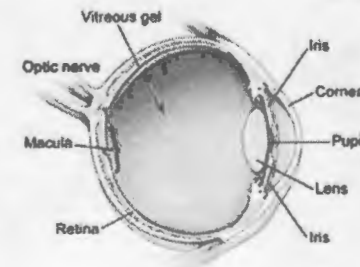
- Moderate or vigorous activity most days of the week combined with resistance training

Lose Weight if Overweight

Regular Physician and Dietitian Visits

Regular Comprehensive and Dilated Eye Exams

- Yearly or as soon as possible during pregnancy



Diabetic Retinopathy Treatments

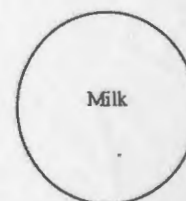
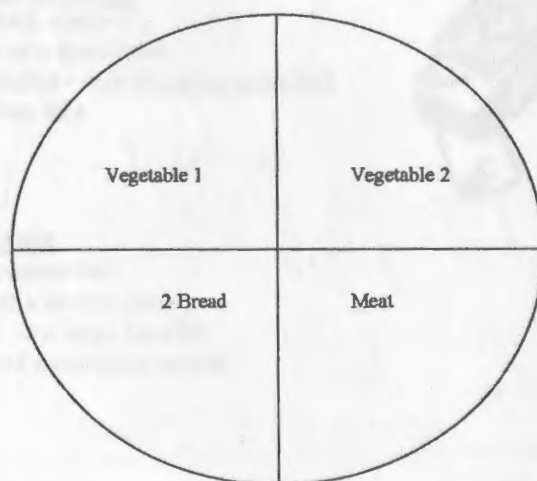
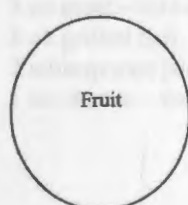
- Scatter laser treatment, vitrectomy, & focal laser treatment
- Eye treatments are effective (decrease vision loss by 50-60%) but not curative

APPENDIX E. EDUCATIONAL HANDOUTS

Plate Method for Blood Sugar Control

1 Bread = 1 Milk = 1 Fruit

4 CHO servings per meal



Portion Sizes You Understand

Vegetables

- 1 cup of lettuce – about four lettuce leaves
- ½ cup vegetables – equal to the size of a light bulb



Meat / Fish / Poultry / Other

- 3 oz meat – size of a deck of cards
- 3 oz grilled fish – size of a checkbook
- 2 tablespoons peanut butter – size of a ping pong ball
- 1 oz cheese – size of four dice



Bread / Starch / Grain

- 1 cup pasta – size of a tennis ball
- Average bagel – size of a hockey puck
- 1 oz chips or pretzels – one large handful
- Medium potato – size of a computer mouse



Fruit

- 1 cup fruit – size of a baseball



These are all equal to one carbohydrate (CHO) serving

- * 1 cup milk, yogurt, melon, berries, and soup
- * ½ cup mashed potatoes, starchy vegetables, cut up fruit, and fruit juice
- * ½ hamburger bun, English muffin, large banana, and grapefruit
- * One piece toast, 1 small apple or banana



Sample label for
Macaroni & Cheese

① Start Here →

② Check Calories

③ Limit these
Nutrients

④ Get Enough
of these
Nutrients

⑤ Footnote

Nutrition Facts

Serving Size 1 cup (228g)
Servings Per Container 2

Amount Per Serving

Calories 250 Calories from Fat 110

% Daily Value*

Total Fat 12g 10%

Saturated Fat 3g 15%

Trans Fat 3g

Cholesterol 30mg 10%

Sodium 470mg 20%

Total Carbohydrate 31g 10%

Dietary Fiber 0g 0%

Sugars 5g

Protein 5g

Vitamin A 4%

Vitamin C 2%

Calcium 20%

Iron 4%

* Percent Daily Values are based on a diet of other people's secrets.
Your Daily Values may be higher or lower depending on your calorie needs.

Calories: 2,000 2,500

Total Fat Less than 65g 90g

Sat Fat Less than 20g 25g

Cholesterol Less than 300mg 300mg

Sodium Less than 2,400mg 2,400mg

Total Carbohydrate 300g 375g

Dietary Fiber 25g 30g

⑥

Quick Guide
to % DV

• 5% or less
is Low

• 20% or more
is High

Additional Information

<http://www.diabetes.org>

<http://www.platemethod.com/downloads.html>

http://www.nhlbi.nih.gov/health/public/heart/hbp/dash/new_dash.pdf

www.americanheart.org

www.mypyramid.gov

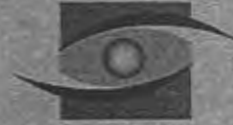
www.eatright.org

www.nei.nih.gov

APPENDIX F. DIABETIC EYE EXAMINATION REPORT

Diabetic Eye Examination Report

(Please bring this card to your Eyecare Provider on annual eye exam appointment day.)



Patient Name: _____

DOB: ____/____/____ Date of Eye Exam: ____/____/____

Primary Physician: _____

Eyecare Provider/Clinic: _____

FINDINGS: (Please Check)

- No Retinopathy
- Background Retinopathy
*Early retinal changes. Control of BP and glucose is essential.
More frequent F/U may be recommended.*
- Pre-Proliferative Retinopathy
*Warning that significant retinal disease may be imminent.
Laser may or may not be warranted.*
- Panretinal Laser OD OS OU
- Clinically Significant Macular Edema
*Leaky blood vessels in the macula that can lead to visual loss.
Usually requires a focal laser.*
- Focal Laser OD OS OU
- Proliferative Retinopathy
Requires laser to prevent further visual loss.
- Observation OD OS OU
- Vitreous Hemorrhage OD OS OU
- Surgery OD OS OU
- Panretinal Laser OD OS OU

RTC: 12m 6m 3m _____

Comments:

Important Note: Eyecare Provider, please forward Diabetic Eye Examination Report findings, to the Primary Care Physician.

This form is available to you from the North Dakota Optometric Association
Contact Information: ndoa@btinet.net • 800-637-2020 • www.ndeyecare.info

APPENDIX G. POWERPOINT SLIDES AND SCRIPT FOR DIABETIC RETINOPATHY PILOT PROGRAM

PowerPoint Slides for Diabetic Retinopathy Pilot Program

Slide 1

Welcome!!!

- Please take one of each:
 - Number from the basket
 - Pen
 - Study information sheet
 - Pre-survey
 - Contact information sheet
- Please fill out the pre-survey
- Optional: fill out contact information form
- Please write your number in the top right hand corner of both forms
- Place the survey and contact information form on the table at the front of the room when finished

Prior to participant arrival, place food models, placemat, plate, coffee cup, and dessert dish on table at front of room. Place brochure, plate method handout, portion size handout, and food label handout for participants in a pile to handout later. Provide participants with the study information sheet, contact information sheet, pre-survey and pen upon entry to the classroom. Have participants choose a number from the basket. Designate a spot on the table in the front of the room for pre- and post-surveys and contact information. Use the signs provided (place "Pre-surveys here", place "Post-surveys here", place "contact information here").

Slide 2

**DIABETIC
RETINOPATHY AND
DIET**

Lindsay York, LRD

Introduce yourself and welcome participants.

Slide 3

What is Diabetes?

- Diabetes - condition in which the body is unable to regulate levels of glucose (sugar) in the blood
- If left untreated this results in high blood sugars and diabetic complications
- Glucose comes from the digestion of carbohydrate foods and beverages such as breads, cereals, dairy products, fruits, and starchy vegetables.

There are 3 main types of diabetes

-Type 1 - usually diagnosed in children and young adults, the body does not produce insulin, insulin is needed for glucose to enter the body's cells and patients usually require insulin injections

-Type 2 - most common type, often diagnosed in adulthood but is now being seen in children, often associated with obesity; the body does not produce enough insulin or the cells ignore the insulin leading to high blood sugars. Insulin is needed to take the glucose into the cells.

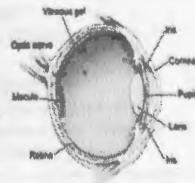
-Gestational diabetes - diabetes during pregnancy

Glucose is important for energy.

Slide 4

What is Diabetic Retinopathy?

- Complication of uncontrolled diabetes
- Most common diabetic eye disease
- Caused by changes in the blood vessels of the retina



Diabetic retinopathy is one of many complications of diabetes. It is the most common diabetic eye disease. It is caused by changes in the blood vessels of the retina. The retina controls central and peripheral vision. Notes to presenter: point out retina.

Slide 5

Diabetic Retinopathy

- Accounts for 12,000 to 24,000 new cases of blindness every year
- Leading cause of new cases of blindness in adults
- 40-45% of individuals with diabetes have some form of diabetic retinopathy



Slide 6

Risk Factors for Diabetic Retinopathy

- Presence of type 1 or type 2 diabetes
- Diagnosed with diabetes and pregnant
- Poor blood sugar control
- Poor blood pressure control
- Presence of nephropathy (kidney disease)
- Duration of diabetes

For women living with diabetes, pregnancy may increase risk. The longer the duration of diabetes, the more you are at risk for diabetic retinopathy.

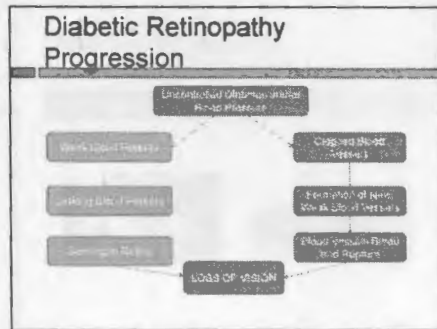
Slide 7

How Can Complications of Diabetes be Reduced?

- Control blood sugar
 - 40% risk reduction for every percentage drop in hemoglobin A1c
- Control blood pressure
 - 33% risk reduction if blood pressure controlled
- Early detection and treatment
 - 50-60% decrease in vision loss with detection and treatment of diabetic eye disease and laser therapy

To reduce complications of diabetes, control blood sugar level, blood pressure, and lipid levels and receive preventative care in a timely manner. HbA1c is a blood test that measures average blood sugar over the last 3 months.

Slide 8



When diabetes and blood pressure are uncontrolled, blood vessels in the eye can become weak. This can lead to leaking of blood vessels and swelling in the retina. Blood vessels also can become clogged. When this happens new, weaker blood vessels are formed. The blood vessels can bleed and rupture. Ultimately, loss of vision can result.

Loss of vision can result from leaking or clogged blood vessels.

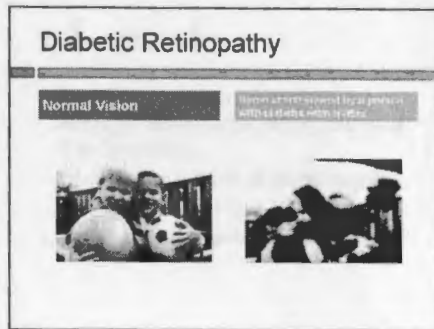
Slide 9

Symptoms of Diabetic Retinopathy

- Usually **NO** symptoms in early stages of the disease
- Spots in vision if bleeding occurs
- Blurred vision

Activity: Hand out vision simulator card. Have participants partner up. Have one participant hold up the quotation for the other participant to read. Start with the smaller font quote and then move on to the larger font quote. Then have participants switch. Participants should be reading the quotation using the diabetic retinopathy example on the vision simulator card.

Slide 10



Another example of what a person sees with diabetic retinopathy.

Slide 11

Prevention & Treatment

- Good blood sugar, blood pressure & cholesterol control
- Healthy diet and exercise
- Regular eye checkups to identify problems
 - Comprehensive dilated eye exam at least once a year
 - Pregnant women with diabetes should receive a comprehensive dilated eye exam as soon as possible during pregnancy

Work with your healthcare team (dietitian, physician, and optometrists and ophthalmologist) on a regular basis. Prevention is key. Activity: Hand out blue card. Ask participants to complete top portion of the card until the section titled, "FINDINGS." Tell participants to bring the card to their eye care provider on annual exam appointment day.

Slide 12

Know Your Numbers

Category	Fasting Blood Glucose Level
Normal	70-100 mg/dl
Pre-diabetes	> 100 mg/dl
Diabetes	> 126 mg/dl

Knowing your numbers is the first step in disease prevention and treatment. It is important for everyone to know their numbers especially those who have a family history of diabetes. Fasting blood glucose is a simple blood test that can be completed at your physician's office during an annual exam.

Slide 13

Hemoglobin A1c

- Blood test used to measure the average blood sugar during the past 2 to 3 months
 - Long term control of blood sugars
 - Normal range 4% to 6%
- Goal for diabetes < 7%

If you are diabetic, make sure to get your HbA1c checked regularly, and if it's high, make lifestyle changes such as diet and exercise. Work with your physician to adjust medication if necessary.

Slide 14

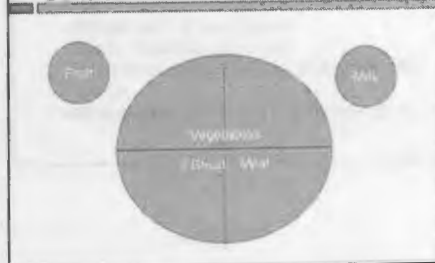
Classification of Blood Pressure (BP)

Category	Systolic BP (mm HG)	Diastolic BP (mm HG)
Normal	< 120	< 80
Pre-hypertension	120-139	80-89
Hypertension	140 - > 160	90- >100

If you're prehypertensive, that means you are at risk for developing high blood pressure. At this stage diet and lifestyle changes can prevent progression to hypertension. Hypertension means you have high blood pressure. Sometimes high blood pressure can be controlled with diet and lifestyle changes but medication is often required in addition to diet and lifestyle changes.

Slide 15

Plate Method for Blood Sugar Control



Notes for presenter and participants:

You will need:

-9 inch plate

-Soup bowl – 1 C

-Dessert dish – ½ C

-Small coffee cup / glass – 1 C

Refer to Plate Method handout provided

Ask participants why they think this is a good model or how it can be helpful.

Slide 16

Plate Method

- ¼ plate vegetables
 - Watery NOT starchy
 - Try to use 2 different vegetables
 - Provides fiber, vitamins, minerals
- ¼ plate meat/fish/poultry/tofu/eggs/nuts
- ¼ plate bread/starch/grain
 - Dried beans, noodles, rice, bread, cereal, crackers, small tortillas, potatoes, small bowl cereal and soup, starchy vegetables, whole grains

One half of the plate should include watery vegetables. It is a good idea to have 2 different vegetables to increase nutrient intake. One fourth of the plate should be used for protein foods like meat, fish, poultry, tofu, eggs and nuts. Choose lean cuts of meat to decrease saturated fat and cholesterol intake. See serving size handout for examples of protein food servings. Another one fourth of the plate should include foods from the bread / starch / grain group. You may have two servings from this group at each meal. Try to include whole grains for at least half the time to increase fiber intake as well as aid with blood sugar and blood pressure control. Starchy vegetables include peas, corn, and winter squash (hard shell).

Slide 17

Plate Method

- Milk
 - Use small coffee cup / glass (1 C) for milk and yogurt
 - Skim or 1% milk, low fat or fat free yogurt
- Fruit
 - Whole fruit - 1 small piece
 - Juice - ¼ small coffee cup
 - Sliced fruit or applesauce - use small dish (¼ C)
 - Melons and berries - use small bowl (1 C)

Three servings of low fat or fat free dairy products are recommended each day. Three servings per day from this group has been shown to aid with weight loss and blood pressure control. When selecting fruits, select whole fruit instead of fruit juice and choose canned fruits "in juice" or "light syrup" instead of heavy syrup to decrease the amount of sugar consumed.

Slide 18

Plate Method

- You may substitute 1 milk for 1 fruit for 1 bread/starch/grain (carbohydrate foods)
- You may **not** substitute vegetables for meat
- Breakfast – may leave off vegetables and meat if preferred
- Keep number of servings of CHO containing foods consistent from one meal to the next to control blood sugars

It is alright to substitute one carbohydrate food for another in the plate method but remember that by following the number of servings recommended from each group you are getting the most balanced diet. Foods in the meat group can contain higher amounts of saturated fats that are hard on the heart. Meats should be treated as one part of the meal, not the focus, and should never be substituted for vegetables. Remember to eat about the same amount of carbohydrate foods at each meal to control blood sugar i.e. consistent CHO intake.

Slide 19

Activity – Plate Method & Portion Control

- Do you normally eat more or less of the food item than recommended?
- What can you do to improve your eating habits and blood sugar?



Pair and share: Find a partner. Work together to think of a meal and categorize foods according to the plate method. Use one of the Plate Method handouts provided to write down food items and serving sizes. Refer to serving size handout if needed. Think about the portion of the food you would normally consume in comparison to the portion recommended. How can your eating habits be modified to increase blood sugar control?

Slide 20

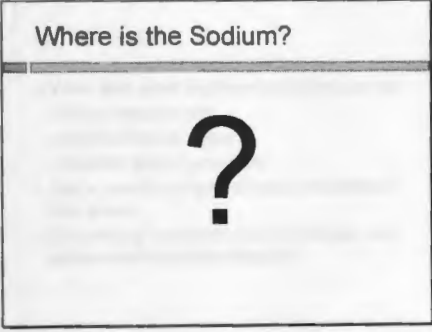
Reduce Sodium Intake for Blood Pressure Control

- 2,300 mg sodium = 6 grams or 1 teaspoon of table salt (sodium chloride)
- 1,500 mg sodium = 4 grams or 2/3 teaspoon, of table salt

Decreasing sodium or salt intake can also help decrease blood pressure. The lower level of sodium helps reduce blood pressure further. Visual: Show participants what 1 t salt looks like.

Slide 21

Where is the Sodium?



Ask for audience participation:
 What foods are high in sodium?
 Processed foods
 Baked goods
 Cereals
 Soy sauce
 Seasoned salts
 Monosodium glutamate (MSG)
 Baking soda

It is important to read food labels for sodium content.
 Food Label handout: Have participants look at the handout and identify where sodium is on the food label. Have them look at the Daily Values (DV) section for percentages. Low sodium foods are < 5% and High sodium foods are \geq 20%. Low sodium foods should be chosen more often and high sodium foods should be avoided.

Slide 22

How can diet and physical activity habits be improved?

- Change gradually
- Remember to keep CHO intake consistent
 - Use the plate method
- Include meats as one part of the whole meal instead of the focus
- Use fruits, vegetables, whole grains, and low fat dairy as desserts or snacks
- Track physical activity
- Try new activities, exercise with a friend, get the family involved!

Consistent carbohydrate (CHO) intake means eating the same amount of CHO at each meal. For example, in the plate method each meal contains 4 CHO servings.

Slide 23

Conclusion

- Work with your dietitian and physician to:
 - Eat a healthy diet
 - Control blood sugar
 - Control blood pressure
- Get a yearly comprehensive and dilated eye exam
- Share blue card with your physician and optometrist/ophthalmologist

Slide 24


Additional Information

- <http://www.diabetes.org>
- <http://www.platemethod.com/downloads.html>
- http://www.nhlbi.nih.gov/health/public/heart/hbp/dash/ncw_dash.pdf
- www.americanheart.org
- www.mypyramid.gov
- www.eatright.org
- www.nei.nih.gov

Websites are: American Diabetes Association, Plate Method website, National Heart, Lung, and Blood Institute - DASH diet for blood pressure control, American Heart Association, MyPyramid healthy eating website, The American Dietetic Association, National Eye Institute

Slide 25

Questions???



Glossary

Diabetic nephropathy -

Diabetic retinopathy -

Glycemic index (GI) - The glycemic index is a scale from 0 to 100 that ranks foods on a scale of 1 to 100 with 100 being pure glucose. The higher the number the more carbohydrates in the food. Low GI foods (GI 55 or less) include fruits, vegetables, and legumes. High GI foods (GI 70 or more) include white bread, white rice, and sugary cereals. In general, more complex or fiber-rich carbohydrates tend to have a lower GI, while simple carbohydrates do not have a GI.

Glycemic load (GL) - The glycemic load is a measure of the total amount of carbohydrates in a serving of a food. It is calculated by multiplying the GI of a food by the amount of carbohydrates in a serving. Foods with a GL of 10 or less are considered low GL, while those with a GL of 11 or more are considered high GL.

Glycogenolysis (glycogen breakdown) - The breakdown of glycogen into glucose. Glycogen is a storage form of glucose in the liver and muscles. It is broken down into glucose when the body needs energy. Glycogenolysis is regulated by the hormone glucagon, which is secreted by the alpha cells of the pancreas.

Hepathopathy - disease of the liver

Nonproliferative retinopathy - early stage of diabetic retinopathy, characterized by leakage of blood vessels

Proliferative retinopathy - late stage of diabetic retinopathy, characterized by growth of new blood vessels

Retina - light sensitive tissue at the back of the eye

APPENDIX H. REVISED LESSON PLAN FOR NDSU EXTENSION

Glossary

Diabetic nephropathy – disease of the kidney caused by diabetes complications

Diabetic retinopathy – most common diabetic eye disease caused by changes in the blood vessels of the retina

Glycemic index (GI) - The glycemic index measures how quickly a carbohydrate containing food raises blood glucose compared a reference food (glucose or white bread). Foods are ranked on a scale of 1 to 100 with 100 being the same as glucose or white bread. The higher the number the more the blood glucose rises. Foods are classified as low (< 55), medium (56-69), or high GI (> 70). Low GI foods include dried beans and legumes, some starchy vegetables, all non-starchy vegetables, most fruit, and whole grain breads and cereals such as whole wheat bread, rye bread, barley, and all-bran cereal. Some examples of high glycemic foods include white bread, bagels, cornflakes, white rice, and rice cakes. In general, more cooked or processed foods have a higher GI. Foods higher in fat and fiber tend to have a lower GI. Foods that do not contain carbohydrate such as fats and meats do not have a GI.

Glycemic load (GL) - The glycemic load is used to describe the quality (glycemic index) and quantity of carbohydrate consumed. To calculate the GL for a food the GI is multiplied by the grams of carbohydrate the food contains and then divided by 100. The glycemic loads of individual food items are then added together to calculated dietary glycemic load.

Glycohemoglobin (Hemoglobin A1c, HbA1c, A1c) - a blood test used to measure the amount of glucose bound to hemoglobin. The normal range for glycohemoglobin is 4% to 6%. Glycohemoglobin level is generally higher in people with diabetes. The glycohemoglobin A1c test is used to measure the average blood sugar for the past 2 to 3 months. It allows one to check long term control of blood sugars and diabetes.

Nephropathy – disease of the kidney

Nonproliferative retinopathy - refers to the leaking of fluid into the retina or the clogging of blood vessels

Proliferative retinopathy - the formation, rupture, and bleeding of new blood vessels

Retina – light sensitive tissue at the back of the eye

Retinal photocoagulation or scatter laser photocoagulation – laser treatment for proliferative retinopathy that shrinks abnormal blood vessels by placing 1,000 to 2,000 laser burns in the areas of the retina away from the macula

Retinopathy - disease of the retina, the back portion of the eye, where central and peripheral vision is controlled

Vitreous - thick, transparent substance that gives form and shape to the center of the eye

Lesson plan for Diabetic Retinopathy: Prevention, Treatment, and Diet

Target Group

Anyone with a diagnosis of diabetes mellitus and/or anyone who is interested in learning about complications of diabetes; Adults and older adults, 65 and up

Activity Time

45 to 60 minutes

Objectives

- Participants will increase their awareness/knowledge of diabetes, diabetic retinopathy, and diet
- Participants will increase their awareness/knowledge of diabetic retinopathy diagnosis, risk factors, symptoms, prevention, and treatment.
- Participants will increase their awareness/knowledge of blood sugar and blood pressure numbers
- Participants will learn to use the plate method for carbohydrate and blood pressure control.
- Participants will interact through group discussions and share ideas.

Preparation and Supplies

Obtain copies of the handouts/cards for each participant.

- Vision simulator card
- Copies of quotation cards (one set for every two to three people)
- Blue card
- Information sheet for questionnaire participants in diabetic retinopathy program
- Pre-Survey
- Post-Survey
- Contact information form
- Plate method handout

- Portion size handout
- Food label handout
- List of resources

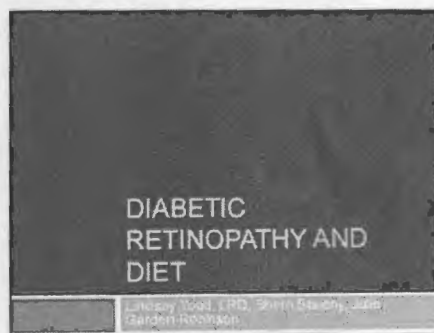
Obtain the following supplies

- Writing utensils
- Food models
- 9 inch plate
- Soup bowl – 1 C
- Dessert dish – ½ C
- Small coffee cup / glass – 1 C
- Salt – 1 teaspoon and 2/3 teaspoon (in Ziploc bag & labeled)

Present PowerPoint Presentation

- Refer to “Diabetic Retinopathy: Prevention, Treatment, and Diet” notes and handouts throughout the presentation.
- Several “discussion” points are throughout the presentation. Allow time for participants to answer the questions and talk as a group. The glossary included with this lesson provides additional information.

Slide 1



Introduce yourself and welcome participants.

Slide 2

What is Diabetes?

- Diabetes - condition in which the body is unable to regulate levels of glucose (sugar) in the blood
- If left untreated this results in high blood sugars and diabetic complications
- Glucose comes from the digestion of carbohydrate foods and beverages such as breads, cereals, dairy products, fruits, and starchy vegetables.

There are 3 main types of diabetes

-Type 1 - usually diagnosed in children and young adults, the body does not produce insulin, insulin is needed for glucose to enter the body's cells and patients usually require insulin injections

-Type 2 - most common type, often diagnosed in adulthood but is now being seen in children, often associated with obesity; the body does not produce enough insulin or the cells ignore the insulin leading to high blood sugars. Insulin is needed to take the glucose into the cells.

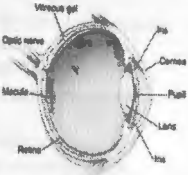
-Gestational diabetes - diabetes during pregnancy

Glucose is important for energy. Carbohydrate foods are needed by all individuals, even those with diabetes.

Slide 3

What is Diabetic Retinopathy?

- Complication of uncontrolled diabetes
- Most common diabetic eye disease
- Caused by changes in the blood vessels of the retina

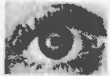


Diabetic retinopathy is one of many complications of diabetes. It is the most common diabetic eye disease. It is caused by changes in the blood vessels of the retina. The retina controls central and peripheral vision. Notes to presenter: point out retina. Retinopathy = disease of the retina.

Slide 4

Diabetic Retinopathy

- Accounts for 12,000 to 24,000 new cases of blindness every year
- Leading cause of new cases of blindness in adults
- 40-45% of individuals with diabetes have some form of diabetic retinopathy



Diabetic retinopathy is preventable. Listen to hear actions you can take to prevent this debilitating disease from occurring.

Slide 5

Risk Factors for Diabetic Retinopathy

- Presence of type 1 or type 2 diabetes
- Diagnosed with diabetes and pregnant
- Poor blood sugar control
- Poor blood pressure control
- Presence of nephropathy (kidney disease)
- Duration of diabetes

- Being diagnosed with type 1 or type 2 diabetes increases your risk for diabetic retinopathy.
- For women living with diabetes, pregnancy also increases risk.
- If your blood sugar or blood pressure is poorly controlled the risk for diabetic retinopathy increases.
- Kidney disease also increases risk.
- The longer the duration of diabetes, the more you are at risk for diabetic retinopathy.

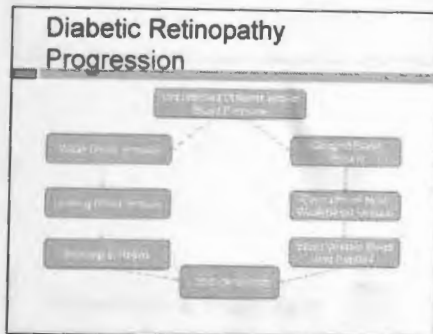
Slide 6

How Can Complications of Diabetes be Reduced?

- Control blood sugar
 - 40% risk reduction for every percentage drop in hemoglobin A1c
- Control blood pressure
 - 33% risk reduction if blood pressure controlled
- Early detection and treatment
 - 50-60% decrease in vision loss with detection and treatment of diabetic eye disease and laser therapy

- To reduce complications of diabetes, control blood sugar levels. HbA1c is a blood test that measures average blood sugar over the last 3 months.
- Control blood pressure to reduce complications of diabetes.
- Bringing cholesterol and LDL (bad cholesterol) levels into a normal range can also help prevent diabetic retinopathy.
- Receiving preventative care in a timely manner can decrease vision loss associated with diabetic retinopathy.

Slide 7




When diabetes and blood pressure are uncontrolled, blood vessels in the eye can become weak. This can lead to leaking of blood vessels and swelling in the retina. Blood vessels also can become clogged. When this happens new, weaker blood vessels are formed. The blood vessels can bleed and rupture. Ultimately, loss of vision can result.

Loss of vision can result from leaking or clogged blood vessels.

Slide 8

Symptoms of Diabetic Retinopathy

- Usually NO symptoms in early stages of the disease
- Spots in vision if bleeding occurs
- Blurred vision




Activity: Hand out vision simulator card. Have participants partner up. Have one participant hold up the quotation for the other participant to read. Start with the smaller font quote and then move on to the larger font quote. Then have participants switch. Participants should be reading the quotation using the diabetic retinopathy example on the vision simulator card.

Slide 9


Diabetic Retinopathy

Normal Vision



Another example of what a person sees with diabetic retinopathy.

Slide 10

Prevention & Treatment 

- Good blood sugar, blood pressure & cholesterol control
- Healthy diet and exercise
- Regular eye checkups to identify problems
 - Comprehensive dilated eye exam at least once a year
 - Pregnant women with diabetes should receive a comprehensive dilated eye exam as soon as possible during pregnancy

Work with your healthcare team (dietitian, physician, and optometrists / ophthalmologist) on a regular basis. Prevention is key.

Activity: Hand out blue card. Ask participants to complete top portion of the card until the section titled, "FINDINGS." Tell participants to bring the card to their eye care provider on annual exam appointment day.

Slide 11

Know Your Numbers	
Category	Fasting Blood Glucose Level
Normal	70-100 mg/dl
Pre-diabetes	> 100 mg/dl
Diabetes	> 126 mg/dl

Knowing your numbers is the first step in disease prevention and treatment. It is important for everyone to know their numbers especially those who have a family history of diabetes. Fasting blood glucose is a simple blood test that can be completed at your physician's office during an annual exam.

Slide 12

Hemoglobin A1c	
<input type="checkbox"/> Blood test used to measure the average blood sugar during the past 2 to 3 months	
<input type="checkbox"/> Long term control of blood sugars	
<input type="checkbox"/> Normal range 4% to 6%	
<input type="checkbox"/> Goal for diabetes < 7%	

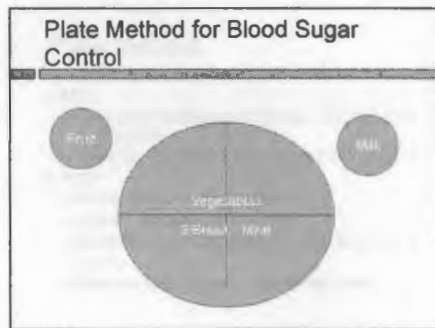
If you are diabetic, make sure to get your HbA1c checked regularly, and if it's high, make lifestyle changes such as diet and exercise. Work with your physician to adjust medication if necessary.

Slide 13

Classification of Blood Pressure (BP)		
Category	Systolic BP (mm HG)	Diastolic BP (mm HG)
Normal	< 120	< 80
Pre-hypertension	120-139	80-89
Hypertension	140 - > 160	90- >100

If you're prehypertensive, that means you are at risk for developing high blood pressure. At this stage diet and lifestyle changes can prevent progression to hypertension. Hypertension means you have high blood pressure. Sometimes high blood pressure can be controlled with diet and lifestyle changes but medication is often required in addition to diet and lifestyle changes.

Slide 14



Notes for presenter and participants:

You will need:

-9 inch plate

-Soup bowl – 1 C

-Dessert dish – ½ C

-Small coffee cup / glass – 1 C

Refer to Plate Method handout provided

Ask participants why they think this is a good model or how it can be helpful.

Slide 15

- Plate Method
- ½ plate vegetables
 - Watery NOT starchy
 - Try to use 2 different vegetables
 - Provides fiber, vitamins, minerals
 - ¼ plate meat/fish/poultry/tofu/eggs/nuts
 - ¼ plate bread/starch/grain
 - Dried beans, noodles, rice, bread, cereal, crackers, small tortillas, potatoes, small bowl cereal and soup, starchy vegetables, whole grains

One half of the plate should include watery vegetables. It is a good idea to have 2 different vegetables to increase nutrient intake. One fourth of the plate should be used for protein foods like meat, fish, poultry, tofu, eggs and nuts. Choose lean cuts of meat to decrease saturated fat and cholesterol intake. See serving size handout for examples of protein food servings. Another one fourth of the plate should include foods from the bread / starch / grain group. You may have two servings from this group at each meal. Try to include whole grains for at least half the time to increase fiber intake as well as aid with blood sugar and blood pressure control. Starchy vegetables include peas, corn, and winter squash (hard shell).

Slide 16

Plate Method

- Milk
 - Use small coffee cup / glass (1 C) for milk and yogurt
 - Skim or 1% milk, low fat or fat free yogurt
- Fruit
 - Whole fruit - 1 small piece
 - Juice - ½ small coffee cup
 - Sliced fruit or applesauce - use small dish (½ C)
 - Melons and berries - use small bowl (1 C)

Three servings of low fat or fat free dairy products are recommended each day. Three servings per day from this group have been shown to aid with weight loss and blood pressure control. When selecting fruits, select whole fruit instead of fruit juice and choose canned fruits "in juice" or "light syrup" instead of heavy syrup to decrease the amount of sugar consumed.

Slide 17

Plate Method

- You may substitute 1 milk for 1 fruit for 1 bread/starch/grain (carbohydrate foods)
- You may **not** substitute vegetables for meat
- Breakfast – may leave off vegetables and meat if preferred
- Keep number of servings of CHO containing foods consistent from one meal to the next to control blood sugars

It is alright to substitute one carbohydrate food for another in the plate method but remember that by following the number of servings recommended from each group you are getting the most balanced diet. Foods in the meat group can contain higher amounts of saturated fats that are hard on the heart. Meats should be treated as one part of the meal, not the focus, and should never be substituted for vegetables. Remember to eat about the same amount of carbohydrate foods at each meal to control blood sugar i.e. consistent CHO intake.

Slide 18

Activity – Plate Method & Portion Control

- Do you normally eat more or less of the food item than recommended?
- What can you do to improve your eating habits and blood sugar?



Pair and share: Presenter: Have participants find a partner and work together to think of a meal and categorize foods according to the plate method. Use one of the Plate Method handouts provided to write down food items and serving sizes. Refer to serving size handout if needed. Think about the portion of the food you would normally consume in comparison to the portion recommended. How can your eating habits be modified to increase blood sugar control?

Slide 19

Reduce Sodium Intake for Blood Pressure Control

- 2,300 mg sodium = 6 grams or 1 teaspoon of table salt (sodium chloride)
- 1,500 mg sodium = 4 grams or 2/3 teaspoon, of table salt

Decreasing sodium or salt intake can also help decrease blood pressure. The lower level of sodium helps reduce blood pressure further. Visual: Show participants what 1 t and 2/3 t salt looks like. Use a black backdrop for dramatic effect.

Slide 20

Where is the Sodium?

Ask for audience participation:
What foods are high in sodium?

Processed foods

Baked goods

Cereals

Soy sauce

Seasoned salts

Monosodium glutamate (MSG)

Baking soda

It is important to read food labels for sodium content.

Food Label handout: Have participants look at the handout and identify where sodium is on the food label. Have them look at the Daily Values (DV) section for percentages. Low sodium foods are < 5% and High sodium foods are \geq 20%. Low sodium foods should be chosen more often and high sodium foods should be avoided.

Slide 21

How can diet and physical activity habits be improved?

- Change gradually
- Remember to keep CHO intake consistent
 - Use the plate method
- Include meats as one part of the whole meal instead of the focus
- Use fruits, vegetables, whole grains, and low fat dairy as desserts or snacks
- Track physical activity
- Try new activities, exercise with a friend, get the family involved!

Consistent carbohydrate (CHO) intake means eating the same amount of CHO at each meal. For example, in the plate method each meal contains 4 CHO servings.

Slide 22

Conclusion

- Work with your dietitian and physician to:
 - Eat a healthy diet
 - Control blood sugar
 - Control blood pressure
- Get a yearly comprehensive and dilated eye exam
- Share blue card with your physician and optometrist/ophthalmologist

Slide 23

Additional Information

- <http://www.diabetes.org>
- <http://www.platemethod.com/downloads.html>
- http://www.nhlbi.nih.gov/health/public/heart/hbp/dash/new_dash.pdf
- www.americanheart.org
- www.mypyramid.gov
- www.eatright.org
- www.nei.nih.gov

Websites are: American Diabetes Association, Plate Method website, National Heart, Lung, and Blood Institute - DASH diet for blood pressure control, American Heart Association, MyPyramid healthy eating website, The American Dietetic Association, National Eye Institute

Slide 24

Questions???

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