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Developing Diabetes Educational Materials for Gambian Clinic Staff and Type 2 Diabetics

Rachel Golin
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DEVELOPING DIABETES EDUCATIONAL MATERIALS
FOR Gambian clinic staff and type 2 diabetics

By

Rachel Golin

MASTER OF SCIENCE THESIS

Submitted to the Biomedical and Health Sciences Department
at Grand Valley State University
Allendale, Michigan
in partial fulfillment of the requirements
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MASTER OF SCIENCE IN HEALTH SCIENCES

2004
ABSTRACT

The Gambia is a small, developing country on the west coast of Africa. As with much of the world, there has been an increase in Type 2 Diabetes in the Gambia. According to the World Health Organization, the total population of the Gambia is 1.3 million (1). In 2000, there were 22,000 diabetics in the Gambia (estimated prevalence of 2%) and it is projected that the number will reach 61,000 by the year 2030 (2).

One way to help combat the increase of Type 2 Diabetes and its complications is by educating clinic staff workers and diabetics using educational materials that are scientifically accurate and culturally appropriate. Finding such materials is often a challenge in lesser developed countries such as the Gambia. The goal of this nine-week project was to develop educational materials which met these criteria and could be used to teach the target populations (Gambian clinic staff and Type 2 diabetics).
ACKNOWLEDGEMENTS

This project would not have been possible had it not been for my committee members. Thank you for your support, encouragement, and help as I started, worked through, and completed this project.

I would also like to thank Ruth Wood, Dr. Stan Haegert, and Deb Newsome for investing so much of their time in helping me complete this project. Thank you to the Gambians in Ndungu Kebbeh who so warmly welcomed me and provided much insight into life in the Gambia. A special thank you to each of the 23 diabetics who let me be a part of their lives and health care.
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CHAPTER 1
INTRODUCTION

Diabetes mellitus is a metabolic disorder in which blood glucose is poorly regulated or utilized (3). There are two types of Diabetes mellitus, designated Type 1 and Type 2. Type 1 Diabetes mellitus is often referred to as “juvenile diabetes” since it is usually diagnosed early in life (4). Type 1 Diabetes results from a lack of insulin secretion whereas Type 2 Diabetes is the result of insulin resistance (5). Insulin is vital for cells to be able to absorb glucose. Without insulin, glucose from carbohydrates remains in the blood and therefore the cells are unable to obtain the energy they need (3). Surprisingly, Diabetes mellitus is the sixth leading cause of death (4), usually due to diabetes-related complications such as heart and kidney disease, nerve damage, eye, mouth, skin and foot care related problems (3, 4, 6). Adult diabetics are two to four times more likely to experience fatal heart disease or strokes (7). Diabetes is also the leading cause of acquired blindness in adults 20 to 74 years old (7). With complications such as these, it is important for diabetics to be educated about what they can do to improve their health and to help prevent complications. It is also important for the general public to be educated about diabetes since the prevalence of Type 2 Diabetes is one of the most important health problems of this century (8), is increasing quickly around the globe (6, 7, 9-16) and is expected to double over the next twenty years (17). The goal of this project was to investigate the health needs of diabetics in the Gambia, create materials to further educate the clinic staff and the diabetics, and offer practical management of the disease on a daily basis. It was imperative for this to be done in a manner consistent with
the Gambian culture and appropriate for the educational level of both the staff and diabetics.

Type 2 Diabetes, Noninsulin-Dependent Diabetes Mellitus (NIDDM), is the most prevalent type of Diabetes mellitus in the interior Gambian town of Ndungu Kebbeh. Type 2 Diabetes occurs in approximately 90-95% of the diabetic population (4) and most frequently is in adults over 40 years of age (3). Symptoms of Type 2 Diabetes may include frequent urination, excessive thirst and hunger, irritability, weakness and fatigue, dramatic weight gain, nausea, vomiting, hard-to-heal skin, gum, and/or bladder wounds and infections, blurred vision, tingling or numbness in extremities, and itchy skin (4). These symptoms, with the exception of weight gain, may also be present in Type 1 Diabetes. In Type 1 Diabetes, there is typically weight loss rather than weight gain (4, 5). These symptoms can increase gradually over an extended period of time (months or even years) or may be so discrete that they go unnoticed (4). Clinical characteristics of Type 2 Diabetes include normal to high plasma insulin, plasma glucagon that is high and resistant to suppression, increased plasma glucose, and reduced insulin sensitivity (5). Less than 12 percent of those diagnosed with diabetes have acceptable levels of blood glucose, blood pressure, and cholesterol (7). Therapy for Type 2 Diabetes may include weight loss, thiazolidinediones, metformin, sulfonylureas, and various types of insulin (5, 7, 18, 19).

Western cultures are acutely aware of the correlation between obesity and disease. This awareness is the result of many educational booklets available to the public, information gained from doctor appointments, and television advertisements. However, in many developing countries being overweight is often associated with prosperity. The
larger the person, the more desirable he or she may be. Therefore one of the challenges in health education within these cultures is combating the cultural emphasis placed on being overweight.

Most Type 2 diabetics can control their diabetes with exercise and an individual meal plan; however, it should be noted that some Type 2 diabetic patients may need to resort to supplemental medicine, such as thiazolidinediones, sulfonylureas, metformin, or insulin to help assist the body's blood glucose regulation. In a country such as the Gambia, diet and exercise are especially important since supplemental medicine and insulin are often difficult to find, afford, and properly store.

Since meal planning is such an important part of diabetic health maintenance, it is vital for diabetics to be knowledgeable about which foods to consume and which foods to control. However, the majority of food plans available to diabetics are based on a Western diet, which is neither appropriate nor adequate for non-Western cultures. For example, an American diabetic breakfast may be a bowl of cereal, a piece of fruit, and a glass of water. There may be a morning snack of cheese and crackers, followed by a lunch of a meat sandwich, another piece of fruit, and a glass of milk. Once again, there may be a snack in the afternoon. Dinner could be a salad, a baked potato, and a three-ounce steak. There may be an evening snack of popcorn. This contrasts greatly with a typical Gambian diet. For breakfast, many Gambians eat chere, which is steamed millet. The purchased millet must be pounded, sifted, and then pounded again before being steamed. Lunch is typically rice and an oil-based sauce with a few vegetables (cassava, tomatoes, eggplant) and some fish. The dinner meal is either chere or rice served with a
similar oil-based sauce. Oil, whether it is vegetable or palm, is eaten in excessive quantities. Gambians believe the more oil, the better the taste.

Carbohydrates make up a large portion of the foods readily available in the Gambia and therefore are a large part of a typical Gambian diet; examples of such carbohydrates include rice, millet, and bread. Rice is preferred more than millet; however, the cost of rice has made it prohibitive to some families. Although carbohydrates are such a large part of the Gambian diet, it is necessary to develop educational materials that emphasize the importance of controlled carbohydrate consumption. It is important for diabetics to eat consistent amounts of carbohydrates at regular intervals during the day. Another vital part of diabetes self-management is exercise. Both of these factors, carbohydrate consumption and exercise, need to be addressed in a manner consistent with the cultural and educational needs of the people.
CHAPTER 2
BACKGROUND

Type 2 Diabetes

The human diet consists of three major carbohydrate sources: sucrose, lactose, and starch (5). Sucrose is usually known as cane sugar, lactose is the disaccharide in milk, and starches are polysaccharides that are in almost all nonanimal foods, especially grains (5). Starch digestion is initiated by ptyalin, an enzyme in saliva, and thirty to forty percent of starch is broken down before this enzyme is inactivated by the secretions from the stomach (5). Starch digestion is then completed in the small intestine (5). At each stage of digestion, starches are hydrolyzed to maltose (5). Maltose is then converted to glucose which is utilized by cells for metabolism. Both digestion and glucose uptake require a functioning pancreas (5).

The pancreas is comprised of two major tissue types: the acini and the islets of Langerhans (5). The acini are responsible for secreting digestive juices into the duodenum, whereas the islets of Langerhans are responsible for secreting insulin and glucagon into the bloodstream (5). While insulin and glucagon are just two of the hormones secreted by the pancreas, their functions are the most critical in diabetes (5). Insulin is a small protein that affects glucose uptake by cells in the body as a source of energy (5). When glucose is absorbed into the blood stream after a high-carbohydrate meal (Figure 1), insulin is secreted to allow a rapid uptake, storage, and utilization of glucose by body tissues (5). After insulin has been secreted by the pancreas, it binds to receptors on cells which regulate glucose transporters (GLUTs) (20). GLUTs are found...
throughout the body; for example, they are found in erythrocytes and brain, muscle, adipose, intestinal and liver tissue (20). One particular insulin-sensitive glucose transporter is GLUT4 which is found only in muscle cells and adipocytes (20). Insulin binding to its receptor on these target cells results in signal transduction via a second messenger system (20, 21). This signal transduction causes GLUT4 to be transported in cytoplasmic vesicles toward the outer membrane (20), where the GLUT4-containing vesicles then fuse with the plasma membrane (20). This allows GLUT4s to transport blood glucose into the cell (20) to generate ATP for energy. As glucose is taken up by the cells, blood glucose concentrations decrease and the need for insulin also decreases. When insulin no longer occupies its receptors, the GLUT4 channels are returned to the intracellular vesicles via endocytosis (20).

Like insulin, glucagon is also secreted by the pancreas (5). However, glucagon is produced by the alpha cells of the islets of Langerhans and is secreted when blood glucose concentrations are low (5) (Figure 1). Glucagon helps increase blood glucose concentrations by signaling the liver to convert glycogen to glucose (5).

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**Figure 1:** Relationship between blood glucose, insulin, and glucagon concentrations
Fasting blood glucose is a measure of blood glucose concentrations prior to eating (e.g., first thing in the morning). The normal fasting blood glucose concentration is between 80 and 90 mg per 100 ml of blood (5). During the first hour after a meal the level rises to between 120 and 140 mg per 100 ml of blood. However, due to insulin secretion, the level returns to between 80 and 90 mg per 100 ml of blood usually within two hours after the last carbohydrates have been absorbed (5). As mentioned, glucagon is secreted when there are low levels of blood glucose, and insulin is secreted in response to elevated levels of blood glucose. A consistent level of blood glucose is necessary because glucose is the only nutrient that is usually used in sufficient quantity by the brain, retina, and the germinal epithelium of the gonads to ensure optimal energy requirements (5). If glucose levels are too low or too high, cells are not able to function properly. For example, in hypoglycemic conditions, cells become starved because there is not enough glucose to meet their functioning needs.

Type 2 Diabetes is a result of decreased sensitivity of the target tissues to insulin (5). This is known as insulin resistance (5). In Type 2 Diabetes, there is an increase in plasma insulin secretion due to the pancreatic beta cells responding to the increase in blood glucose (5). The increase of blood glucose results from the decrease in carbohydrate utilization and storage rather than from carbohydrate intake. However, due to the decreased insulin sensitivity of the body tissues, the increased amounts of insulin are not capable of maintaining normal blood glucose regulation (5). During the later stages of Type 2 Diabetes, the pancreatic beta cells become destroyed and therefore are unable to produce enough insulin (5). The initial decrease in insulin sensitivity leads to mild hyperglycemia (high blood glucose concentrations) after eating carbohydrates;
however, during the later stages, when the pancreatic beta cells become destroyed, the result is severe hyperglycemia (5).

While Type 2 Diabetes is characterized by both insulin resistance and beta-cell failure, the latter of which leads to insulin deficiency, there has been a long debate over which occurs first (22). It has been established that both environmental and genetic factors lead to Type 2 Diabetes (22, 23) (Figure 2). In the same way, both insulin resistance and beta-cell failure define Type 2 Diabetes (22).

While the etiology of Type 2 Diabetes is not completely understood (25), researchers have found that Type 2 Diabetes can be triggered by obesity (5, 17, 22, 23). Although other risk factors include sedentary lifestyle, hypertension, dyslipidemia, history of polycystic ovary syndrome, age, family history, and ethnicity (9, 11-13, 19, 22, 23).
24-27), obesity is the most studied risk factor. New research is finding that intra-abdominal obesity (greater amount of adiposity in the abdominal region (28)) may have a stronger correlation with Type 2 Diabetes compared to general, overall obesity (10). That is, waist circumference has a correlation with Type 2 Diabetes independent of obesity measured by body mass index (29). Obesity leads to enlarged adipose cells (3). These cells have the same number of insulin receptors as normal-sized fat cells; therefore, this reduction in relative number (and/or function) of insulin receptors, in relation to cell size, can lead to insulin resistance (3). Insulin resistance is when a normal amount of insulin has a subnormal effect and is the result of the pancreas initially producing too much insulin which in turn causes the cell to become hyposensitive to insulin (3). Since the cells are less responsive to insulin, they require more insulin in order to be stimulated (an increased threshold for insulin). Due to the lack of insulin, the cells are not capable of absorbing enough glucose. The demand for more glucose increases the individual's appetite (more food, more starch, more glucose, more fat) (3). While insulin resistance helps define Type 2 Diabetes, the complete mechanism of insulin resistance is not entirely understood. Insulin resistance results in an increased appetite and overeating which contributes to obesity (3). A sedentary lifestyle by itself can also lead to decreased insulin stimulation in muscle (22). It is thought that either obese people have fewer insulin receptors or that there are abnormalities of the signaling pathway (5). Another possibility is that the genetic determinant which can lead to obesity may also lead to insulin resistance (22). Again, there is still much research to be completed before we can completely understand the link between obesity and Type 2 Diabetes. It should be noted that not all Type 2 Diabetics are obese (10).
Type 2 Diabetes usually is effectively treated by caloric restriction and weight reduction in conjunction with exercise (5, 17, 23, 27, 30-32). These lifestyle interventions of nutrition and physical activity not only help treat Type 2 Diabetes (15, 16, 33), but they also help prevent Type 2 Diabetes (27). The goal of treatment is to increase insulin sensitivity and blood sugar control by reducing insulin resistance (5, 31-33). Usually no exogenous insulin is required (5). However, drugs that increase insulin sensitivity (e.g., metformin) or ones that stimulate the pancreas to secrete extra insulin (e.g., sulfonylureas) may be prescribed (5). Some of the Type 2 diabetics seen at the Ndungu Kebbeh Health Centre are taking either metformin or Glibenclamide, a sulfonylurea. However, some studies conducted outside of the Gambia have shown that diet and lifestyle change are more effective at reducing the development of diabetes compared to prophylactic drugs such as metformin (17, 24). Such lifestyle changes can prevent or delay the onset of diabetes (24).

Medical Nutrition Therapy/Exercise

Medical Nutrition Therapy (MNT), a term introduced by the American Dietetic Association in 1994, is defined as “the use of specific nutrition services to treat an illness, injury, or condition” and involves two phases: 1) assessment of the nutritional status of the client and 2) treatment, which includes nutrition therapy, counseling, and the use of specialized nutrition supplements” (30, 34). MNT protocols are developed by experts and practitioners and are based on professional knowledge and available research (35). MNT is an important component of treating many chronic illnesses; examples of such illnesses include coronary heart disease, hypertension, obesity and obesity-related
complications, and diabetes and diabetes-related complications (36). The role of MNT in diabetes involves assessment of the patient’s knowledge of nutrition and diabetes self-management, identification and negotiation of individual nutrition goals, nutrition intervention involving meal-planning and educational materials which meet the patient’s needs, and evaluation of outcomes and ongoing monitoring (34). Specific goals of MNT for treating diabetes include 1) achieving optimal metabolic outcomes (i.e., blood glucose levels in a safe, normal range, lipid and lipoprotein levels that reduce risk for macrovascular disease, and blood pressure levels that decrease the risk for vascular disease) 2) preventing and treating chronic diabetic complications 3) improvement of health via physical activity and healthy food choices and 4) assessing individual nutrition needs based on personal and cultural preferences, lifestyle, and the individual’s wishes and willingness to change (12, 30, 37, 38). One study found that patients’ motivation to change to accommodate their medical needs increases the possibility for improved glycemic control in the future (38).

MNT is important in preventing, delaying and treating both types of diabetes (36). There is much evidence-based research that points to the clinical effectiveness of MNT in treating diabetes (34). Examples of the effectiveness of MNT in diabetics include decreased HbA1c levels, which are indicative of long term blood glucose levels and control (34), and possible reduction in eye complications (39). While there appears to be strong evidence favoring MNT, it should be noted that it is not clear whether it is solely responsible for the improvements, or whether the results are due to MNT in conjunction with other treatment components (40).
MNT is an essential component of Type 2 Diabetes care because it contributes to glycemic control (41). Factors influencing glycemic responses include type of sugar, nature of the starch, cooking and food processing, food form, and the presence of other components that may slow down digestion (30). One way that Type 2 diabetics can help improve their glycemic control is by spacing their meals (41). Smaller, more frequent, meals and snacks allow optimal glucose control and help prevent large swings in blood glucose levels (41). By eating frequently and regularly, there is a decreased chance of glycemic overload at any particular time of day (41).

Glycemic index refers to the measure of change in blood glucose following consumption of carbohydrate-containing foods (42). Although the glycemic effect of carbohydrate food varies (30, 41), the total amount of consumed carbohydrate is more important than the carbohydrate source (30, 41). Unlike the amount of carbohydrate, the specific type of carbohydrate is not a predictor for the resulting glycemic effect (42). It is unclear as to why this is the case (42). Since the glycemic effect is determined by the amount of carbohydrate ingested, carbohydrate counting is very important (41). Recommended sources of carbohydrates include grains, vegetables and fruit (41).

By its nature, MNT must be followed for a long duration and therefore it may take some time before one sees the effects of MNT in treating diabetes (36). However, even if the patient needs to resort to pharmacotherapy, MNT should still be continued as it may reduce the amount of medication necessary for disease control (36).

While diabetics must reduce their energy intake to lower blood glucose levels, they must also increase their energy expenditure, such as through exercise (15, 30, 43). Exercise increases the demand for blood glucose (9) and helps improve insulin
It is believed that diet and exercise achieves the greatest improvement in insulin sensitivity compared to either diet or exercise alone (31). Exercise should be in tandem with calorie restriction (31, 43) as both components help achieve and maintain weight loss (31, 41). Such weight loss and control are vital since there is such a strong correlation between obesity and Type 2 Diabetes.

**Implementing Diabetes Programs**

Although diabetes was once considered a “disease of affluence”, it is now becoming a major problem in the third world (10, 44). Diabetes is a disease that impacts the patient’s physical, psychological, and social well-being (45). While everyone agrees there is a great need for diabetes programs, implementing diabetes programs can be difficult due to lack of government support (for public health programs that control chronic disease) and inadequate health care systems/infrastructures. (44, 46, 47). Public health programs for control of chronic or noncommunicable disease are often given low funding priority. Although the majority of health care systems have focused on acute problems such as infectious diseases (47), the implementation of diabetes educational programs is essential (10) due to the growing threat of diabetes to the world’s public health and the dramatic increase of diabetes in less developed countries (46). Currently, the highest incidence of diabetes is in developing countries, and in the ethnic minority and disadvantaged populations of developed countries (44, 46-48). Therefore, it is essential for the diabetes educational programs to meet the needs of these populations by
advocating a healthy lifestyle; lifestyle changes are only possible when the means to provide such educational programs are available (44).

Diabetes intervention occurs at three levels: primary, secondary, and tertiary (44, 46). The primary level of intervention is to reduce the incidence of the disease (46). This can be accomplished by modifying the behavior and/or lifestyle of high-risk individuals in order to prevent development of the disease (46). Emphasis on primary prevention has increased due to the fact that many of the risk factors for Type 2 Diabetes are lifestyle choices that are controllable (e.g., being overweight or obese, sedentary lifestyle, and inadequate nutrition) (44, 46). The secondary level of intervention is aimed at reversing or halting the disease (46). The goal of tertiary intervention is to prevent or delay the development of diabetes complications (46). All three levels are needed, especially the tertiary level, since diabetics have the right to enjoy the highest quality of life possible and because the high cost of care for chronic health problems often makes adequate treatment prohibitive (44, 46). It is important for those providing primary, secondary, and tertiary care to consider the medical, educational, and emotional needs of the target population (10, 46). Medical needs include self-monitoring equipment (e.g., glucometers) and access to appropriate and adequate health care facilities. Educational needs include teaching the importance of diet, exercise, medication and self-monitoring, and enabling the patients to be a part of their own healthcare plan. Emotional needs include being able to meet with other diabetics and receive guidance in how to lead as normal a life as possible (44).

There are barriers to each of these needs (44, 49). Examples of medical barriers include not having access to glucometers and being unable to travel to adequate health
centers (44). One frequent educational barrier is lack of funding for necessary education (44). A common emotional barrier is the patients' misconception about their role in their healthcare; it is often thought that decision-making about their wellbeing and healthcare should be determined solely by healthcare providers (44).

Another major problem is the low literacy skills of many diabetics (50). Patients with poor literacy skills are not only limited in their reading ability, but may also have difficulty with oral communication and understanding the risks associated with the disease (51). Poor health literacy is most prevalent among immigrants, elderly patients, racial and ethnic minorities, and those with low educational achievements, (51). It has been suggested that literacy level may be an important predictor of who benefits from diabetes management intervention (50, 51). In a study done by Rothman et al. (2004), it was found that programs that take into consideration patients' low literacy levels can help reduce the disparity of improvement between patients with high and low literacy (50). Schillinger et al. (2002) found that inadequate health literacy is independently associated with worse glycemic control and higher rates of retinopathy (51). Therefore, it is important to have educational programs that support the specific needs of those with low literacy (51).

A key component to educating diabetics is that it should not be done in isolation. It must be in tandem with appropriate primary clinical care. Unfortunately, health care and self-care facilities are often inadequate. Therefore, when developing a diabetic educational program, it is essential to take into consideration the varying levels of health care available (e.g., at the national, district, and local levels), and to make education an integral part of the health care system (46).
Ideally, the educators should be a multidisciplinary team. An ideal team would consist of a diabetologist/pediatrician, a specialist (e.g., obstetrician), a dietitian, a pharmacist, a primary care physician, a primary care worker, and a person with diabetes (46). Each of the healthcare workers provides unique expertise so that together an effective program is available. Since such a group is rarely available, a strong emphasis must be placed on increasing the knowledge and skills of the existing primary health care workers (45, 46). In order to promote the knowledge and skills of the primary health care workers, it is important to assess the needs of the population and local geography since these needs will be the basis for the knowledge and skills promoted. It is also important to identify current health care workers, lay people who are locally known and accepted (e.g., teachers), and diabetic patients who could be trained to be effective diabetes educators (46). It is essential for the educators to be people whom the patients respect. Patients are much more likely to follow the advice of educators they respect.

The materials and information which will be used are just as important as the educators. In order to determine the most useful materials, one must consider the needs of those who will be the educators. Educational materials should be correct, up-to-date, consistent in terms of language, style and content, concise, simple, appropriate, friendly, specific and structured, and readable (45, 46). Simple diagrams and pictures are recommended in lieu of large areas of text, especially when the target population may not be literate. The content of the educational materials should include an explanation (What is diabetes?), a rationale (Why self-care is important), a process (How to choose healthy meals) and practical hints (How to estimate a serving size). It is important that educational materials are not used in place of discussions with medical personnel. They
should never be used in lieu of a detailed explanation of the disease and appropriate self-management techniques. Rather, they should be used as reinforcement to the educational discussion between the health care worker and the diabetic individual(s) (46). The discussion is the primary method for educating the patients, while the materials serve as a reinforcement and reminder of what was discussed.

While educating diabetic individuals, it is important to provide correct, consistent, and up-to-date information. It is also important to find the balance between giving enough information without overloading the individual(s) with too much information. Consideration should also be given to providing information at the appropriate time, such as when the patient is able to spend time learning what is being taught. Many of these goals can be accomplished by discussing the information with the individual, listening to the individual, identifying hidden worries and/or difficulties with understanding the material, providing small pieces of information at a given time, obtaining feedback on information given, summarizing information given, demonstrating practical skills, and by being positive, encouraging and supportive (46).

One cornerstone to diabetic patient education is teaching diabetics how to take responsibility for their care (52, 53). Self-management programs have been reported to help patients manage their symptoms (54) and are critical to the care of diabetics (55). Diabetic patients need to strive for the best possible control of their glucose levels (14), and self-management is one of the ways they can achieve successful glucose control outcomes.
The Gambia

The Gambia is a very small country on the west coast of Africa and is approximately 240 miles long and 16 miles wide (56) (Figure 3). The Gambia River runs east-west, creating a division between the north and south banks. The Gambia is bordered on the North, South and East by Senegal; on the West it is bordered by the Atlantic Ocean (56)(Figure 4). The Gambia’s tropical semi-arid climate endures a five month rainy season (June – mid October) and a seven month dry season (56). June and July are farming months, and the greatest rainfall occurs in August (56). The Gambian economy relies heavily on agriculture and the primary export is peanuts (56).

While the population of the Gambia is 1.3 million (1), it is experiencing rapid population growth due to the high birth rate (41.6 per 1000) and high immigration rates from politically unstable West African countries (56), such as Cameroon, Côte d’Ivoire, Guinea-Bissau, Nigeria, Liberia and southern Senegal (Casamance region). This causes the Gambia to have one of the fastest growing population rates in the world (56). Due to the growing population and the small size of the country, the Gambia has the fourth highest population density in the entire continent of Africa (56). This high population density proves problematic in a country that is already underdeveloped. One of the greatest needs facing the Gambia is the ability to provide necessary medical and social services for its citizens and residents (56).

The literacy rate in the Gambia is 40% (56). It is estimated that 55% of males and 27% of females in the Gambia can read (56). This low literacy rate poses many problems for educating Gambians, particularly when it comes to health education (56).
The interior village of Ndungu Kebbeh is located on the north bank and has a population of 5,000 people. The primary language spoken in Ndungu Kebbeh is Wolof. There is only one health center in Ndungu Kebbeh and it serves many surrounding villages, mainly on the north bank. The Ndungu Kebbeh Health Center is currently staffed by an American physician, two American nurse practitioners, and one American medical technologist. In addition to the American staff, there are five Gambian midwives and nine Gambian junior assistants (equivalent to a LPN in the United States). One of these junior assistants is the chief lab assistant. Patients who have unstable blood glucose levels are seen at the clinic biweekly. Stable patients are seen on a monthly or bimonthly basis depending on how far away they live. While at the clinic, the patient undergoes a fasting blood glucose test and is usually seen by one of the American staff. The patient’s blood pressure is taken and his or her feet are checked for sores. Any additional problems or concerns the patient has are also addressed at that time.

In the Gambia there is a large focus on infectious diseases such as malaria and HIV/AIDS. However, there is little to no emphasis on chronic, noncommunicable diseases such as diabetes. The American clinic staff at the Ndungu Kebbeh Health Center realized the need for educational materials for the growing number of diabetics and for the clinic staff who treat these patients. The goal of this project was to create materials that will further educate the clinic staff and diabetic patients about the disease and practical management of Type 2 Diabetes. It was imperative for this to be done in a manner consistent with the Gambian culture and appropriate for the educational needs of both the staff and the diabetics.
Figure 3: Location of the Gambia (57)

Figure 4: Map of the Gambia (58)
CHAPTER 3
METHODOLOGY

Calculations

For meal planning, individual differences needed to be considered. Such individual differences include gender, height, weight, and activity level. It was necessary to make calculations and compile a chart for the clinic staff to use with each diabetic that would indicate the total daily carbohydrate consumption recommended for each height and weight group based on gender (Appendix C, pgs 69-70).

The range of height increments were chosen based on the average Gambian height. Since heights are not recorded at the clinic, I asked the staff members for an estimated range of male and female Gambian heights. The staff members provided the range of heights. Weight range estimations were also provided by the clinic staff. Weight categories (ideal, overweight, obese) were based on Body Mass Index. A Body Mass Index (BMI) of greater than 30 indicates obesity. A BMI between 25 and 30 signifies being overweight, and a BMI between 20 and 25 represents healthy weight. The equation used to calculate each weight range was derived from the following calculation:

\[ \text{BMI} = \frac{\text{wt in kg}}{(\text{ht in cm})^2} \times 10,000. \]

Therefore, \( \text{wt in kg} = \frac{((\text{ht in cm})^2 \times \text{BMI})}{10,000} \). For each height increment on the chart, weight was calculated for a BMI of 20, 25, and 30 (Appendix C, pgs 60-70).

Caloric intake was based on the following equations (59):

For females, \( (10 \times \text{wt in kg}) + (6.25 \times \text{ht in cm}) - (5 \times \text{age in years}) - 161 \).
For males, \((10 \times \text{wt in kg}) + (6.25 \times \text{ht in cm}) - (5 \times \text{age in years}) + 5\).

This equation was used because it is based on resting metabolism. Since many of the diabetics lead sedentary lifestyles, the equation for resting metabolism was appropriate to use.

Once the daily amount of calories was calculated, it was then calculated what portion of the diet should be derived from carbohydrates. These calculations were based on the Food and Drug Administration’s recommendation that 60% of one’s diet should be from carbohydrates. Each daily caloric intake was multiplied by 0.60. Four carbohydrate calories are equivalent to one gram of carbohydrates, and fifteen grams of carbohydrates are equivalent to one carbohydrate unit. Carbohydrate units are a measurement method used to help diabetics eat a consistent amount of carbohydrates each day (60). The number of carbohydrate units is dependent on the number of grams of carbohydrate in the food item. The number of carbohydrate units each person should consume is based on caloric intake needs. Therefore, daily carbohydrate units per day was calculated for each height and weight group (Calories \(\times 0.60 \times \frac{1}{4} \times \frac{1}{15}\)).

Carbohydrate Units/Meal Plans

After observing each of the typical sauces being prepared, the “recipe” (based on observing how much of each ingredient was added) was used to calculate how many carbohydrate units were in each dish. Surprisingly, the oil-based sauces served with rice or millet contained very few carbohydrates. Each portion size contained approximately 1 carbohydrate unit. Therefore, the majority of a Gambian diabetic’s carbohydrate intake comes from rice and millet. Using Bowes and Church’s Food Values of Portions.
Commonly Used (61), I was able to calculate how many carbohydrate units were in the cooked rice and steamed millet. One-quarter cup of the rice available in the Gambia is equivalent to one carbohydrate unit (15 grams of carbohydrates). The same is true for one-quarter cup of steamed millet.

Since it is important for diabetics to eat consistent amounts of carbohydrates at the same times each day, it was then calculated how many carbohydrate units should be consumed early in the morning (7:00am), at breakfast (10:00am), lunch (1:00pm), afternoon snack (4:30pm), and dinner (8:00pm). An afternoon snack is not common in the Gambia; however, the time between lunch and dinner is too long, and therefore a snack was added.

The different choices for each time were shown pictorially using boxes for each choice. For each time period, the diabetics could choose from one of the options shown in the boxes (Appendix E). For example, in the morning and for an afternoon snack they could eat either a small piece of fruit or a small piece of bread. (Serving size depends on total daily carbohydrate allowance.) For breakfast, lunch, and dinner, the amount of rice or millet depended on whether or not they were eating it plain or with sauce. If they were eating it without sauce, they could have more rice.

These meal plans were shown in a very simplistic way. Extra copies were given to the clinic to have available for future diabetics and in case the current diabetics needed another copy or had a change in dietary needs due to weight change.
Teaching The Clinic Staff

I had the privilege of speaking with many of the staff members regarding their knowledge of diabetes and what they wanted to learn. This helped shape my workshop with them.

Each staff member was given an English version of the booklet. The workshop entailed explanations of digestion, the role of insulin, the relationship between blood glucose, insulin, and glucagon and explanations of hereditary and environmental factors affecting Type 2 Diabetes. A detailed explanation of insulin resistance was also given. Finally, I explained the posters I would be using with the diabetics and how the carbohydrate unit chart in the booklet should be used.

Teaching The Diabetics

Each diabetic was given a Wolof version of the booklet (Appendix D) and a small plastic eight-ounce cup for measuring rice and chere. The height, weight, and fasting blood glucose were measured and recorded for each diabetic. Following this, the diabetics were taught about Type 2 Diabetes and practical self-management of the disease (e.g., meal planning). The workshop concluded with an appropriate lunch being served to the diabetics and their guests.
CHAPTER 4
RESULTS

Outline of Stay

Table 1: Outline of Stay

<table>
<thead>
<tr>
<th>Week</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Became acquainted with the health care workers. Observed three cooks preparing typical dishes.</td>
</tr>
<tr>
<td>2</td>
<td>Calculated carbohydrate units and daily caloric intake.</td>
</tr>
<tr>
<td>3</td>
<td>Worked on English version of the booklet and meal plans. Spent time discussing with the Gambians their perception of diabetes.</td>
</tr>
<tr>
<td>4</td>
<td>Met with illustrator.</td>
</tr>
<tr>
<td>5</td>
<td>Waited for illustrator. Used this time to help simplify other health educational materials. Met with a Gambian translator.</td>
</tr>
<tr>
<td>6</td>
<td>Inserted illustrations into booklet. Had an American proofread translation.</td>
</tr>
<tr>
<td>7</td>
<td>Printed and prepared booklets. Prepared posters.</td>
</tr>
<tr>
<td>8</td>
<td>Visited each of the 23 diabetics. Taught the staff. Taught the diabetics.</td>
</tr>
<tr>
<td>9</td>
<td>Met with NaNA representative and Gambian physician.</td>
</tr>
</tbody>
</table>
Week 1

I arrived in Banjul, the Gambia on the evening of April 25th along with a registered dietitian who accompanied me for the first ten days. We arrived in Ndungu Kebbeh on April 27th. During our first evening in Ndungu Kebbeh, we were introduced to a lady who graciously allowed us to watch her prepare typical Gambian meals for her family. Before meeting this lady, we had been informed that the family's income was higher than the average Gambian family's income. During the first week in Ndungu Kebbeh, we went with this lady in the morning as she bought the daily groceries for her family's meals. Every morning Gambian women in Ndungu Kebbeh go to a small market place to purchase their daily groceries. Their daily meals depend on what is available. Different villages have their large market ("luma") day on different days of the week. In Ndungu Kebbeh, there is luma on Saturday where many grocery and non-grocery items are available. Grocery items include potatoes, different kinds of tomatoes, egg plant, onions, sugar, bouillon cubes, a variety of spices, garlic, bananas, bean-and-oil sandwiches, rice, millet, bread, fried pancakes, fish, beef, goat meat, live chickens, and various kinds of cooking oil. The better quality vegetables are more expensive and are sold quickly. The market on Sunday through Friday is very small. Typically, one can buy fish, bitter or regular tomatoes, tomato paste, bouillon cubes, some spices, and vegetable or palm oil. The variety of vegetables is unlike Saturday's luma and most of the time the vegetables have started to spoil. It is not uncommon for a lady to go to another village's luma to buy a large quantity of a vegetable to sell the following mornings in Ndungu Kebbeh. It should be noted that grocery availability depends on the season. What is
available during dry season is different than what is available during rainy season. Also, prices vary according to the season.

Due to her family’s income, the first cook was able to purchase several small tomatoes, onions, garlic, five fresh fish, eggplant, and approximately one and one-half cup of palm oil. Palm oil is more expensive and desirable than vegetable oil. The biggest meal of the day is eaten at lunch time. While rice is the choice starch, its cost makes it prohibitive to some families. In families where this is the situation, steamed millet is eaten. The first cook prepared rice for each of the three lunch meals we observed. It was obvious that Gambians like oil. She used all of the oil she had purchased for their lunch meal. Although she continued to use large amounts of oil for each dish she prepared, it is questionable whether or not that is her daily practice. She intended to share the meal with us, and therefore may have added extra oil for our sake. She also prepared lunch for two other Americans. Each American received one fish, leaving one fish for her family of two adults and three children.

Since this family had more money than the average Gambian family, we also watched two low-income women prepare meals for their families. Although the day we observed these two ladies was a Saturday, and therefore there was luma, due to a lower income, they had significantly fewer ingredients than the first cook we observed. The first noticeable difference was in the fish and oil. One of these ladies was unable to afford oil, and made her oil from palm nuts. We helped her pound palm nuts to get the oil. Both ladies were preparing meals for large families and used dried, not fresh, fish. There was not enough fish for each family member to get their own. To help compensate
for the lack of fish, bouillon cubes were used to add flavor. Due to cost, dried ground okra was used as a substitute for flour to thicken the sauce.

We were able to watch the first cook prepare three meals and each of the second and third cooks prepare one meal each. While there was variation in the amount of vegetable and fish used, each meal had the same amount of carbohydrates for each serving size. This is because the vegetables that were used are comprised of very little carbohydrates.

Week 2

The second week was spent calculating the carbohydrate units in each of the typical dishes. Daily calorie allowance for various heights and weights were also calculated. The height and weight range for the average Gambian was provided by the clinic staff members. While the clinic does record patient weight, patient height is not recorded. The clinic staff members were able to identify the approximate range for average Gambian height.

Week 3

During the third week, I started working on the English booklet and meal plans. I also spent time with both the clinic staff and lay people discussing their perceptions of diabetes. It was important to find out what they knew. It was interesting to hear some of the myths. For example, one Gambian mentioned that a diagnostic tool of diabetes is whether or not a person is followed by a trail of ants. Another Gambian elaborated by explaining that the sugar which diabetics “leak” attracts many ants and therefore if one is
followed by a trail of ants, he or she must be diabetic. It was also interesting to hear their rudimentary understanding of genetics. Some of the more educated Gambians realized that if a parent had diabetes, their child could also become diabetic. However, they believed this was due to parents passing blood from themselves to their children; as expected, they had no understanding of genes. It was surprising to hear the educated Gambians' knowledge of the relationship between exercise and diabetes care. They believed that exercise was good for diabetics because this allowed the diabetics to sweat out their extra sugar. Despite their misunderstandings, it was impressive to see their keen interest in diabetes. Everyone I spoke with knew a diabetic. Unfortunately, many of the diabetics they spoke of had died.

Week 4

By the beginning of the fourth week, the writing of the English booklet had been completed. One of my main goals for this project was to have culturally sensitive material. One way I wanted to achieve this was by having illustrations that Gambians could relate to. I met with a Gambian illustrator during week 4. This particular illustrator was a staff member of the literacy center in Ndungu Kebbeh. I was able to look through his and others' previous drawings to get some idea of what kinds of illustrations would be feasible.

Looking through *Where There Is No Doctor: A Village Health Care Handbook* (62) and booklets the literacy center had previously published provided ideas of the illustrations that should be included. Another source of ideas came from the Novo Nordisk™ booklet *Diabetes & You: Your Guide to Living with Diabetes* (63). For
illustrations that I was uncertain of (e.g., illustrating sexual problems), I asked for the illustrator’s and the American staff’s opinion. The illustrator told me he would have the pictures completed in one week’s worth of time.

Week 5

I was expecting to have the completed illustrations by the beginning of week 5. However, the illustrator was unable to complete the illustrations by then. I used this time to help the American staff simplify HIV/AIDS education material. This provided excellent practice with simplifying complicated scientific information into a practical format appropriate for those with no science education. During this week I also met with a Gambian translator. She was able to translate the booklet in less than two hours. The illustrator completed the pictures by the end of this week.

Week 6

Week 6 began with inserting the illustrations into the booklet. I also asked the literacy center American staff member to proofread the Wolof translation. This particular American is fluent in Wolof and has a greater understanding of the proper grammar and syntax than the average Gambian. She was able to work with an educated Gambian at the literacy center to accomplish this task. They finished the final translation work by the end of week 6.
**Week 7**

The clinic staff and diabetics were taught using posters. Poster board was purchased in the capital city, Banjul. It was important for the posters to contain the same illustrations as the booklet since the booklet was intended to serve as a reminder and reinforcement of what was taught during the workshop. Using a computer, the booklet illustrations were scanned, enlarged and printed out. They were then colored by hand, cut out, and pasted onto the poster board. At the end of week 7, the booklets were printed. However, due to some risograph machine problems, this process took longer than expected. Nonetheless, by the end of week 7, the booklets had been printed, stapled, and folded.

**Week 8**

The project came to an end during week 8. Sunday was spent traveling to 14 villages to personally invite the diabetics to the workshop on that Wednesday. The following day was spent teaching the staff. That Wednesday was spent teaching the diabetics.

That Sunday we traveled to the villages of each of the diabetics who are seen at the clinic; an invitation letter with two admission tickets (Appendix F, pgs 106-108) was given to each diabetic. Also, each diabetic was told that we would be holding a meeting that Wednesday at the Ndungu Kebbeh Health Centre. This was not a surprise to them as they had heard of my coming for several months. It was also explained that a fasting blood test would be taken and therefore it was imperative for them to not eat that Wednesday morning. In the Gambia, it is not uncommon for men to have more than one
wife. It is culturally appropriate for a man to have one, two, three, or four wives. If a family compound has more than one wife, the wives take turns cooking. However, usually the first wife is the main cook. Each male diabetic was asked to bring the main cook for his compound. Each female diabetic was also asked to bring the main cook for her compound; however, if she was the main cook, she was invited to bring a guest of her choice. The reason the cooks were requested to come is because they are responsible for the diabetics' meals and since most of diabetic care is dependent on proper eating, it was appropriate for the cooks to come. This also allowed the diabetics to bring one travel companion.

Week 9

During week nine, I was able to meet with the person in charge of diabetes education at the National Nutrition Agency (NaNA). He was very excited about the booklet and the response I received from the diabetics. What pleased him most was how culturally sensitive the booklet was. I also met with an internal medicine doctor at the national hospital; he is known as the “diabetes specialist” of the country. He had created a pamphlet for Gambian diabetics. However, it was geared toward educated Gambians who could read English. The pamphlet was in English and contained no pictures. It was obvious he was not happy with my work. It was later discovered that his unhappiness was more than likely due to not consulting him before beginning this project.
Booklet

For the cover of the booklet, I wanted a picture that showed how diabetes can affect both men and women, both young and old. I decided to use a picture that the literacy center had used for a previous publication (Appendix C, pg 66).

The first page of the booklet explains what diabetes is (Appendix C, pg 67). This proved to be the most challenging page. It was hard to balance simplicity with accuracy. Many of the lay people do not understand such things as glucose and intestines. Therefore, the terms had to remain simple. It was too complicated to explain how there are different food types (proteins, starches, etc.) and that the starches are broken down into glucose in the intestines. Therefore, the booklet was kept at a simplistic, elementary level. “Sugar” was used in placed of “glucose” and “stomach” replaced “small intestine.”

The second page detailed various signs and symptoms (Appendix C, pg 68). Each of the pictures is based on Gambian culture. The listed signs and symptoms include always hungry, always thirsty, frequent urination, always tired, weight loss, blurry vision, long-lasting wounds and infections, numb or tingling hands or feet, sexual problems, and vaginal infections (63).

Signs and symptoms was followed by a chart for the staff members to use when calculating the amount of carbohydrates each diabetic should consume on a daily basis (Appendix C, pgs 69-70). The following pages include a written form of each meal plan (Appendix C, pgs 71-75). This is separated by total daily carbohydrate allowance. It is important for diabetics to eat consistently in terms of amounts and times of day.
Therefore, the carbohydrate units are spread over the course of the day, with the greatest amounts being consumed at lunch time and dinner time.

Both the charts of weights, heights, and daily carbohydrate units, and the lists of times and amount of carbohydrate units were not included in the Wolof booklet. These pages were solely for the staff members. It would be too confusing for the general diabetic population. Instead, each diabetic was given a colored meal plan sheet with their corresponding daily carbohydrate allowance and what should be eaten when (Appendix E).

Attaya is a very strong, sugar tea that is consumed by many Gambians. The “ritual” of making attaya is very time consuming but it serves as a format for socializing. The ratio of tea to water to sugar of this drink varies by round. For the first round, one-third cup tea leaves, one cup water, one-half cup sugar is used. In the second round the same tea leaves are used and an additional one cup water and one-third cup sugar are added. The third round again uses the original tea leaves and adds another cup of water and one-quarter cup sugar. Each person usually drinks one to two ounces per round. Usually no one exceeds four ounces per setting. Since attaya is such a large part of the Gambia culture, I felt it was necessary for diabetics to still be allowed to partake every once in a while. In the booklet (Appendix C, pg 75), it is stressed that attaya is to be consumed only on holidays. As mentioned, three rounds of attaya are served. The first round has the most caffeine. The third round has the most sugar since not all the sugar is dissolved from the preceding rounds. Since caffeine is harmful, especially with a compromised circulatory system, the first round should be avoided. The immense sugar in the third round should also be avoided. Therefore, diabetics should only consume the
second round. They also need to eat a small amount of bread when drinking attaya. This slows down the absorption of the sugar by the body.

Since many of the diabetics are older and have daughters and sons who do much of the household work, their sedentary lifestyle needs to be offset by exercise. Therefore, the importance of exercise was mentioned (Appendix C, pg 76). It would be beneficial if the diabetics were able to walk around their compounds four to five times a day.

Due to elevated blood sugar, a diabetic’s circulatory system becomes compromised and this leads to difficulties in healing. Therefore, it is imperative for diabetics to stay away from things that cause harm to their bodies. Common examples include fires (mainly for cooking), nails, and broken sticks. It is also important for them to daily check their hands and feet to ensure all existing wounds are healing properly.

Many Gambians wait until they can no longer conceal their pregnancy before visiting the clinic. Since pregnancy can add stress to a diabetic’s body, it is important for a diabetic woman to visit the clinic as soon as she knows she is pregnant. Each of these issues was mentioned on the Tips page of the booklet (Appendix C, pg 76).

Since diabetics are capable of getting sick like anyone else, it was important to include information on what to do when one becomes sick. I believe this is even more important in a country like the Gambia where sickness is abundant and where medical care is not always available. It is important for the diabetics to continue eating at their regular times and for them to drink large quantities of water (64) (Appendix C, pg 77).

It is often costly for diabetics to visit the health center. While their treatment is provided at minimal costs, transportation to and from their village can be expensive. In order to encourage appropriate visits, it was stressed that they should return to the clinic...
when they have been asked to return for a follow-up check up, if they are sick and not getting better, if they are pregnant, and if they have any questions (Appendix C, pg 77).

The booklet then explains the different times of day and the corresponding clocks that were used as illustrations (Appendix C, pg 78). Morning snack should be eaten at 7:00am. Breakfast is commonly eaten at 10:00am. Then lunch at 1:00pm and an afternoon snack at 4:30pm. The day ends with dinner at 8:00pm. It is not common for Gambians to eat right away in the morning or to eat an afternoon snack. However, due to the diabetics’ needs for eating consistently and frequently, these times were added. The various measurements (one-quarter cup, one-half cup, three-quarter cup, one cup, and one and one-quarter cup) are also shown (Appendix C, pg 78). This is to help them understand how much they can eat. The last page shows the various food pictures and what each picture represents (Appendix C, pg 79). Although a banana is pictured, any small piece of fruit can be eaten. The differences between rice (or millet) with or without sauce is because the amount of rice (or millet) that can be eaten depends on whether or not it is being eaten plain or with sauce.

**Teaching The Clinic Staff**

Each staff member understands English and therefore they were given English versions of the booklet (Appendix C). Since the staff members have some scientific understanding, I was able to go more in depth about diabetes. We started by talking about what diabetes is and how food, namely starch, is broken down into glucose. I explained the relationship between the concentrations of blood glucose, glucagon, and insulin (Figure A.1): if someone has not eaten, they have a low blood glucose
concentration, an elevated glucagon concentration, and a decreased insulin level. However, after eating, their blood glucose levels rise, as well as their insulin levels; but their glucagon levels decrease. I explained how insulin is needed by cells to take up the blood glucose. Since many of the staff members had not had science for some time, I briefly explained how one’s body is made up of cells and how cells need glucose for energy.

From previous conversations, I knew there would be much confusion regarding environment factors and genetic factors in diabetes. I explained how both are important, and how a person can be affected by both (Figure A.2). I explained that one example of genetic problems is faulty insulin receptors. I then mentioned that environmental factors include lifestyle and obesity. Some staff members had many questions at this point. It was encouraging to see them so interested in this topic. One of the nurses even commented that he wanted to learn as much as possible in order to help all of the diabetics who come to the clinic.

We then discussed how obesity can lead to insulin resistance, which leads to Type 2 Diabetes, which leads to overeating. This led into a discussion about insulin resistance and how obesity can lead to it (Figures A.3-4). After this, I explained and showed the posters I would be using with to the diabetics (Appendix B). This was not only good experience for me, but it was good for the staff members to know what diabetics would be hearing. At the very end, I explained how to use the carbohydrate unit/day chart in the book (Figure A.5). I made sure they understood what to do when a diabetic came to the clinic. I also reviewed the various meal plans for the carbohydrate units/day allotments (Appendix E).
Teaching The Diabetics

The invitation letter requested that each diabetic and guest arrive at the Ndungu Kebbeh Health Centre by 10am. Knowing that punctuality is not always a priority, it was hoped that the diabetics would arrive by 10:45am and that the workshop could begin at 11:00am. It was very surprising to see most of the diabetics waiting outside the clinic at 7:15am. By 10am, every diabetic had arrived.

The teaching took place via a translator. This was the same translator who accompanied me while visiting the diabetics’ villages. It was beneficial that he is a nurse.

We began by introducing ourselves. Every diabetic then received a booklet in Wolof and a plastic cup to help measure their cooked rice and millet. After this, heights, weights, and fasting blood glucose were measured. Since the clinic would be closing for approximately five weeks, we made sure they had enough medicine. Since the majority of the diabetics had been fasting, there was a small piece of fruit and a small piece of bread with butter available for them and their guests.

While they were outside eating, I calculated, based on height and weight, how many carbohydrate units per day each diabetic should consume. Each diabetic was then called into the room based on that number and given a sheet with specific amounts pictured. They were grouped according to how many carbohydrate units per day they could consume. For example, everyone who could consume 10 carbohydrate units per day sat together, those who could consume 11 carbohydrate units per day sat together, etc.
I then started the teaching. Again, it was very important for the poster pictures to match the illustrations in the book. I wanted the diabetics to be able to look through the book and know what was being shown, even if they could not read Wolof. The posters were the main teaching tool. The pictures in the booklet were to remind them of what they learned at the workshop. However, unlike the booklets, the posters did not contain any writing.

The first poster was used to show that diabetes affects young and old, male and female (Figure B.1). The second poster was used to explain what diabetes is (Figure B.2). I explained that when they eat food, it is broken down into sugar. Bodies need sugar for energy; however, diabetics are not able to take the sugar out of their blood and therefore their bodies are not capable of getting the sugar, and therefore the energy they need.

Next we talked about the signs and symptoms of diabetes (Figures B.3-5). Many of the diabetics had questions about various signs and symptoms, such as tingling in the neck and impotence at night. Again, it was very beneficial to have a Gambian nurse as a translator. We then discussed their very sweet tea, attaya, and how it needs to be limited (Figure B.6). I explained that it should be only consumed on holidays, and only about once a month. When attaya is consumed, it should only be the second round and with some bread. After this, we talked about exercise and how simply walking around one's compound on a daily basis is beneficial (Figure B.6). The importance of staying away from things that could harm them, such as fire, nails, and sticks, was stressed (Figure B.7). One of the diabetics asked if they needed to wear shoes and what they should do if they did not have money for shoes. I explained that they should wear shoes as much as possible outside. If they did not have shoes, they should be even more careful about what
they might step on. It was also important to ask the diabetics to check their hands and feet 
on a regular basis for wounds that are not healing (Figure B.7). While many of the 
diabetics were older patients, there were a few women who were of child-bearing age. 
The importance of coming to the health center early in a pregnancy was mentioned 
(Figure B.8).

Since diabetics are able to get sick just like anyone else, we then talked about 
what to do in the event of getting sick: to eat at the regular time intervals and to drink 
large quantities of water (Figure B.9). They were told to return to the clinic for routine 
follow-up visits if they were sick and not getting better, if they were pregnant, and if they 
had any questions (Figure B.10).

To ensure they understood what the clock pictures in the booklet and on the meal 
plan sheets indicated, we went through each illustration (Figures B.11-12). The clock 
with 7:00am is for when they first wake up, then 10:00am for when they eat breakfast, 
and then 1:00pm for lunch. 4:30pm is for a snack after work and 8:00pm is for dinner. I 
got through what each food picture represented (Figures B.13-14). I had real bread and 
fruit with me, as well as cooked rice and millet. It was stressed that even though a banana 
was shown, they could eat any small piece of fruit, such as a small mango. I brought 
alternate food items (e.g., a small mango) with me to show them what I meant. Lastly, I 
got through the various cup measurements showing them with a plastic cup identical to 
the ones I had given them (Figure B.15). Each one of the diabetics had received the same 
kind of plastic cup.

After the poster session, I had each group of diabetics and their cooks, based on 
how many carbohydrate units they could consume per day, to come to the front. Using
real food, I showed each group how much they could eat at each time. Many of the cooks laughed at the small amount. They laughed even more when they learned the measurements were for cooked, not uncooked, rice and millet. Nonetheless, it was obvious they cared about their health and would at least try to adhere to the meal plans. My advisor explained to the diabetics that people all over the world feel the same way they do (i.e., displeasure for having a limited diet).

The day was concluded by eating lunch. I had asked for a special lunch to be prepared: one with not much oil, but with more spices and meat than usual. Each of the diabetics was then given money for their traveling expenses and a toothbrush to help promote better oral care.

**Data**

The diabetics were asked to return to the clinic for a regular visit and check-up. It was at this time that follow-up measurements of weight and fasting blood glucose levels were taken. The goal of the statistical analysis was to determine whether or not those who were following the diet had a statistically significant difference in their mean fasting blood glucose levels. Ideally, a decrease in weight for those who were overweight or obese would occur. Both the decrease in fasting blood glucose and weight would help signify improved blood glucose management and disease care. Although there appeared to be some decrease in weight in most of the patients, a statistical analysis of this weight loss was not possible since the follow-up weights were taken on a different scale (Table 2).
Patients 5, 6, 7, 11, 12, and 20 were not included in the statistical analysis because they had not completed a follow-up appointment. Patients 4, 10, 15, 18, 19, and 23 were also excluded from the statistical analysis due either to not fasting before the morning of their appointment or not having taken their medicine appropriately. Patients 1, 10, and 21 were not included in the statistical analysis because they had not been trying to follow the diet.

Using SPSS, the paired T-test was performed on data from patients 2, 3, 8, 9, 13, 14, 16, 17, and 22. The test statistic (t) is -0.088 and the p-value is 0.932. Due to the large p-value (>0.05), there is no statistically significant evidence for a difference in the mean fasting blood glucose before and after the workshop.
### Table 2: Patient Data

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<th>Patient Number</th>
<th>Sex</th>
<th>Height (cm)</th>
<th>Weight (Kg)</th>
<th>FBG* (mg/dL)</th>
<th>Carb Units</th>
<th>Follow-Up Date</th>
<th>Follow-Up Weight (Kg)</th>
<th>Follow-Up FBG (mg/dL)</th>
<th>Following Diet? (Yes/No)</th>
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<td>70</td>
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*FBG: Fasting Blood Glucose

#Data in bold indicates patients included in the statistical analysis
CHAPTER 5
DISCUSSION

This project was aimed at creating scientifically accurate and culturally sensitive Type 2 Diabetes educational materials for clinic staff and Type 2 diabetics at a small health center in the Gambia, West Africa. This project accomplished its goal of creating materials which explained the disease, complications resulting from the disease, and appropriate self-management techniques.

This project was also aimed at the secondary and tertiary levels of intervention, which is to halt the disease and delay the onset of complications. What helped ensure the success of this project was the team approach for education and health care. Specifically, a registered dietitian, a physician, a nurse practitioner, and Gambian nurses helped gain the trust of the diabetics as well as disseminate information. It was important that the diabetics trusted and respected those who taught them in order to achieve compliance with the regimen.

Another endeavor that led to the success of this project was the focus on accurate explanations in a culturally appropriate manner. It was often a challenge to teach accurately, yet simplistically to meet the needs of the less educated population. One example is the explanation of what diabetes is. Since many Gambians do not understand the human gastrointestinal tract, it was not practical to explain in detail the process of carbohydrate digestion by the small intestine. Rather, the information was simplified to digestion occurring in the stomach. While some people would argue that this is not scientifically accurate and therefore should not be taught, it was important for the
diabetics to gain some knowledge of how digestion occurs. It was imperative to work with the terminology they use and understand. The goal of this project was to be simplistic enough for the less educated Gambians to be able to understand what was being taught. Had more detail been explained, it is arguable that not as much would have been learned.

One important way of being culturally appropriate and sensitive is to immerse one's self in the culture. From the beginning, much emphasis was placed on understanding the life of an average Gambian and ensuring that the materials were based on this lifestyle. Examples of immersion in the culture included shopping at the local markets, helping prepare meals, eating typical dishes, and spending time talking with both diabetic and non-diabetic Gambians.

Another factor that helped was being flexible. When doing cross-cultural projects, it is important to remember that not everything will happen as planned. In fact, it is rare for things to happen as planned. There were many periods of waiting. For example, waiting an extra week for the illustrations and then having to wait almost a week to print the booklets. At times, being in another culture can be frustrating. Nonetheless, being flexible can help combat the frustration.

While in many respects this project was very simple, it was a good starting point for both the clinic and the diabetics. Not very often do patients in the Gambia get the opportunity to learn about their disease and ways in which they can help improve their health. This is usually a privilege only for those who are able to afford to travel to a larger health center. Future endeavors include extending this project to a primary level of prevention. Another suggestion is for additional workshops where diabetics are able to
learn more about the disease and how it can impact their lives without them realizing it. The diabetics were very excited to have a special day just for them where they could learn how to improve their health. It would be beneficial for them to be able to attend more workshops to not only help solidify the information they previously learned, but to also teach them new, detailed information.

From a statistical standpoint, there should be more diabetics in the study and each should return for a follow-up visit. It would also be ideal for the same scale to be used for before and after weights. However, this was not the situation. Although the p-value obtained from the data was not statistically significant, much was still gained from this project. For example, at least two of the diabetic patients have been able to either reduce or completely stop taking their supplemental medicine (Metformin or Glibenclamide). It was also encouraging to see so many diabetics at least trying to follow the new meal plan. Since carbohydrates make up such a large portion of their diet, it is not surprising that they struggle with limiting the amount they consume. It is hoped that they will feel better and experience less complications and greater quality of life when they follow the meal plan and therefore be encouraged to continue following it.

The booklet which was created is still being used by the clinic. When diabetics return for follow-up visits, a clinic staff member reviews the booklet with them. A booklet is also given to and reviewed with new diabetic patients that are seen at the clinic.

During my visit I met with a representative from the National Nutrition Agency (NaNA) two times. It was evident that NaNA has a desire to help Gambian diabetics. During each visit and phone call I was told that they were about to create educational
materials. However, at the end of my visit, they were not currently working on any educational programs or materials. This may be due to not having enough financial or staffing resources. The representative with whom I met was very excited about the materials I developed. If nothing else, hopefully NaNA will be able to use the materials that were produced as a result of this project. They may also contact the Ndungu Kebbeh Health Centre for ideas on diabetes workshops. It would be beneficial to the diabetics in the city if NaNA, which is located in the capital city of Banjul, was able to develop materials that were still culturally appropriate, yet sensitive to the needs of those in the city. While some similarities exist, there are quite a few differences between living in Ndungu Kebbeh and Banjul. Some examples include the availability of health care facilities and medicine and the variability of grocieries.

This project has many similarities to the PUMCH (Peking Union Medical College) Diabetes Education Centre in China (65). Both this project and the PUMCH approach focus on teaching about prevention of complications, practical care, and self-management (65). One difference between the PUMCH approach and this project is that the PUMCH project also educates Chinese diabetics about the highly sophisticated scientific theory underlying Diabetes mellitus and current diabetes treatment options (65). These factors would not be practical to teach in the Gambia as the educational level of the general population is not advanced enough to grasp a sophisticated scientific theory and diabetic treatment options in the Gambia are very limited.

This project is also similar to the diabetes education occurring in Bali (66). Like the Gambia, diabetes education and awareness in Bali is a challenge (66). The Bali diabetic educators represent many specialties (e.g., endocrinologists, diabetologists,
cardiologists, dietitians), healthcare providers (e.g., doctors, nurses, nutritionists), and non-healthcare professions (e.g., diabetics) (66). Each education session is limited to 20 people; this limited number enables teaching activities to be carried out effectively and intensively (66). This mirrors the same approach to the diabetic workshop in the Gambia; only 23 diabetic patients were present, and at times, even smaller groups were used to help lead to more effective comprehension (e.g., breaking the large group into smaller groups based on daily carbohydrate intake). In Bali, the education course has both a basic and intermediate curriculum (66). The basic curriculum is to teach diabetics nursing and communications skills in addition to an elementary knowledge of diabetes (66). The purpose of this curriculum is for the diabetic participants to be able to serve as future educators (66). The intermediate curriculum teaches how to prevent and treat diabetes-related complications. In future projects in the Gambia, it would be ideal for Gambian diabetics to be able to help educate newly diagnosed diabetics. In Bali, the diabetics’ understanding of the knowledge and skills presented was evaluated via a test (66). However, due to the low literacy level among the nationals, this would not be feasible in the Gambia.

This project also mirrors the approach to diabetes education in Denmark. The Danish Diabetes Education Centre, which is part of the Odense University Hospital, provides courses for diabetics to learn about diabetes, practical tips, and theory to help them make healthy lifestyle choices (67). The simple, yet effective, concept underlying the education at the Danish Diabetes Education Centre is the belief that the best way of coping with diabetes is to master the understanding of the disease (67). It is believed that those who have a greater level of practical and theoretical level of knowledge will
maintain a higher quality of life (67). Similar to the education program in Bali, the Danish Diabetes Education Centre limits its class size; there are only 10 – 12 participants, of similar age, in each class (67). Each diabetic student is allowed to have a friend, parent, or spouse accompany them (67). This is similar to the Gambian diabetics bringing one guest with them. The Danish program focuses on an explanation of the disease and self-management (67). Some specifics of the self-management education include appropriate grocery shopping, healthy cooking, and exercise (67). Due to the low variety of groceries available in the north bank of the Gambia and Gambians' limited income, shopping was not directly covered in the educational materials. However, if future diabetes education projects were to be completed in the Gambia, it would be useful to mention how to make healthy choices at the market, especially for diabetics who live in Banjul. The educators in the Danish program included nurses, dietitians, physicians, and podiatrists (67). Again, a multi-specialty team is emphasized.

Some countries, such as Thailand, use a survey to aide diabetes education (9). Diabetics' responses to questions regarding lifestyle and understanding of diabetes are then used to help educate the diabetics. Unfortunately, due to the low literacy level, such an approach would not be feasible in the Gambia. However, the clinic staff has assumed the responsibility of assessing the diabetics' general understanding of their self-management and providing reminders as necessary.

As Type 2 Diabetes is becoming more prevalent, there is an increase in awareness of the need for educational materials. While each country's programs and materials will vary slightly to meet the needs of the target population (e.g., cultural and educational needs), each should share the following similarities: an explanation of the disease,
prevention and treatment of complications, and self-management. Such education is necessary to help combat the rising prevalence of Type 2 Diabetes and its complications.
REFERENCES


4. www.diabetes.org


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64. *Sick Day Guidelines*. Foote Hospital Diabetes Center: Jackson, Michigan.


APPENDIX A

Posters Used For Teaching Staff
Figure A.1: Relationship between blood glucose, glucagon, and insulin. Left side represents relationship when one has not eaten. Right side represents relationship after eating.

Figure A.2: Genetic vs. environmental factors affecting Type 2 Diabetes

Figure A.3: How obesity can lead to insulin resistance
Figure A.4: Cycle between obesity, insulin resistance, Type 2 Diabetes, and eating too much

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<th>Obese</th>
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<td>64 - 77 kg 14 CU/Day</td>
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<td>66 - 79 kg 14 CU/Day</td>
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<td>67 - 81 kg 15 CU/Day</td>
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<td>168 cm</td>
<td>56 - 71 kg 14 CU/Day</td>
<td>71 - 84 kg 15 CU/Day</td>
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</tbody>
</table>

Figure A.5: How to use chart in English booklet
APPENDIX B

Posters Used For Teaching Staff and Diabetics
Figure B.1: Anyone can become affected by Type 2 Diabetes

Figure B.2: What is diabetes

Figure B.3: Signs and Symptoms: Always hungry, always thirsty, frequent urinating

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Figure B.4: Signs and Symptoms: Always tired, weight loss, blurry vision

Figure B.5: Signs and Symptoms: Sexual problems, vaginal infections

Figure B.6: Attaya and Exercise
Figure B.7: Tips: Stay away from things that can harm you, check your hands and feet daily for wounds that are not healing

Figure B.8: Tips: Visit the clinic early in your pregnancy.

Figure B.9: When sick, eat at regular times and drink a lot of water (1 glass/hour)
Figure B.10: Visit the clinic for follow-up appoints, if sick and not getting better, if pregnant

Figure B.11: Meal Plan

Figure B.12: Meal Plan, continued
Figure B.13: Different early morning and late afternoon snack options

Figure B.14: Different meal options – Millet with and without sauce, Rice with and without sauce

Figure B.15: Measurements: ¼ cup, ½ cup, ¾ cup, 1 cup, 1 ¼ cup
APPENDIX C

Booklet In English
DIABETES
WHAT IS DIABETES?

When you eat food, it is broken down by your stomach into sugar. This sugar enters your blood. Your body needs this sugar. However, when you have diabetes, the sugar is not able to go from your blood to your body. This is why it is important to eat carefully and regularly and to take care of your body.
SIGNS & SYMPTOMS

Always Hungry  Always Thirsty  Frequent Urinating

Always Tired  Weight Loss

Blurry Vision  Long-lasting Wounds & Infections

Numb or Tingling Hands or Feet

Sexual Problems  Vaginal Infections
<table>
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<tr>
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<td>------------------------</td>
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<td>45 - 56 kg 10 Carb Units/Day</td>
<td>56 - 68 kg 11 Carb Units/Day</td>
<td>&gt; 68 kg</td>
</tr>
<tr>
<td>152 cm</td>
<td>46 - 58 kg 10 Carb Units/Day</td>
<td>58 - 69 kg 11 Carb Units/Day</td>
<td>&gt; 69 kg</td>
</tr>
<tr>
<td>154 cm</td>
<td>47 - 59 kg 10 Carb Units/Day</td>
<td>59 - 71 kg 11 Carb Units/Day</td>
<td>&gt; 71 kg</td>
</tr>
<tr>
<td>156 cm</td>
<td>49 - 61 kg 11 Carb Units/Day</td>
<td>61 - 73 kg 12 Carb Units/Day</td>
<td>&gt; 73 kg</td>
</tr>
<tr>
<td>158 cm</td>
<td>50 - 62 kg 11 Carb Units/Day</td>
<td>62 - 75 kg 12 Carb Units/Day</td>
<td>&gt; 75 kg</td>
</tr>
<tr>
<td>160 cm</td>
<td>51 - 64 kg 11 Carb Units/Day</td>
<td>64 - 77 kg 12 Carb Units/Day</td>
<td>&gt; 77 kg</td>
</tr>
<tr>
<td>162 cm</td>
<td>52 - 66 kg 11 Carb Units/Day</td>
<td>66 - 79 kg 13 Carb Units/Day</td>
<td>&gt; 79 kg</td>
</tr>
<tr>
<td>164 cm</td>
<td>54 - 67 kg 12 Carb Units/Day</td>
<td>67 - 81 kg 13 Carb Units/Day</td>
<td>&gt; 81 kg</td>
</tr>
<tr>
<td>166 cm</td>
<td>55 - 69 kg 12 Carb Units/Day</td>
<td>69 - 83 kg 13 Carb Units/Day</td>
<td>&gt; 83 kg</td>
</tr>
<tr>
<td>168 cm</td>
<td>56 - 71 kg 12 Carb Units/Day</td>
<td>71 - 85 kg 13 Carb Units/Day</td>
<td>&gt; 85 kg</td>
</tr>
<tr>
<td>170 cm</td>
<td>58 - 72 kg 12 Carb Units/Day</td>
<td>72 - 87 kg 14 Carb Units/Day</td>
<td>&gt; 87 kg</td>
</tr>
<tr>
<td>172 cm</td>
<td>59 - 74 kg 13 Carb Units/Day</td>
<td>74 - 89 kg 14 Carb Units/Day</td>
<td>&gt; 89 kg</td>
</tr>
<tr>
<td>174 cm</td>
<td>61 - 76 kg 13 Carb Units/Day</td>
<td>76 - 91 kg 14 Carb Units/Day</td>
<td>&gt; 91 kg</td>
</tr>
<tr>
<td>176 cm</td>
<td>62 - 77 kg 13 Carb Units/Day</td>
<td>77 - 93 kg 15 Carb Units/Day</td>
<td>&gt; 93 kg</td>
</tr>
<tr>
<td>178 cm</td>
<td>63 - 79 kg 13 Carb Units/Day</td>
<td>79 - 95 kg 15 Carb Units/Day</td>
<td>&gt; 95 kg</td>
</tr>
<tr>
<td>180 cm</td>
<td>65 - 81 kg 14 Carb Units/Day</td>
<td>81 - 97 kg 15 Carb Units/Day</td>
<td>&gt; 97 kg</td>
</tr>
<tr>
<td>182 cm</td>
<td>66 - 83 kg 14 Carb Units/Day</td>
<td>83 - 99 kg 16 Carb Units/Day</td>
<td>&gt; 99 kg</td>
</tr>
<tr>
<td>184 cm</td>
<td>68 - 85 kg 14 Carb Units/Day</td>
<td>85 - 102 kg 16 Carb Units/Day</td>
<td>&gt; 102 kg</td>
</tr>
<tr>
<td>186 cm</td>
<td>69 - 86 kg 14 Carb Units/Day</td>
<td>86 - 104 kg 16 Carb Units/Day</td>
<td>&gt; 104 kg</td>
</tr>
</tbody>
</table>
### 10 Carbohydrate Units Per Day

<table>
<thead>
<tr>
<th>Time</th>
<th>Option 1</th>
<th>Option 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 am</td>
<td>1 small piece of fruit OR 1/4 village bread</td>
<td></td>
</tr>
<tr>
<td>10:00 am</td>
<td>1/2 cup millet with no sauce OR 1/4 cup millet with sauce</td>
<td></td>
</tr>
<tr>
<td>1:00 pm</td>
<td>3/4 cup rice with no sauce OR 1/2 cup rice with sauce</td>
<td></td>
</tr>
<tr>
<td>4:30 pm</td>
<td>1 small piece of fruit OR 1/4 village bread</td>
<td></td>
</tr>
<tr>
<td>8:00 pm</td>
<td>3/4 cup millet with no sauce OR 1/2 cup millet with sauce</td>
<td></td>
</tr>
</tbody>
</table>

### 11 Carbohydrate Units Per Day

<table>
<thead>
<tr>
<th>Time</th>
<th>Option 1</th>
<th>Option 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 am</td>
<td>1 small piece of fruit OR 1/4 village bread</td>
<td></td>
</tr>
<tr>
<td>10:00 am</td>
<td>3/4 cup millet with no sauce OR 1/2 cup millet with sauce</td>
<td></td>
</tr>
<tr>
<td>1:00 pm</td>
<td>3/4 cup rice with no sauce OR 1/2 cup rice with sauce</td>
<td></td>
</tr>
<tr>
<td>4:30 pm</td>
<td>1 small piece of fruit OR 1/4 village bread</td>
<td></td>
</tr>
<tr>
<td>8:00 pm</td>
<td>3/4 cup millet with no sauce OR 1/2 cup millet with sauce</td>
<td></td>
</tr>
</tbody>
</table>
12 Carbohydrate Units Per Day

7:00 am 1 small piece of fruit
OR
1/4 village bread

10:00 am 3/4 cup millet with no sauce
OR
1/2 cup millet with sauce

1:00 pm 1 cup rice with no sauce
OR
3/4 cup rice with sauce

4:30 pm 1 small piece of fruit
OR
1/4 village bread

8:00 pm 3/4 cup millet with no sauce
OR
1/2 cup millet with sauce

13 Carbohydrate Units Per Day

7:00 am 1 small piece of fruit
OR
1/4 village bread

10:00 am 3/4 cup millet with no sauce
OR
1/2 cup millet with sauce

1:00 pm 1 cup rice with no sauce
OR
3/4 cup rice with sauce

4:30 pm 1 small piece of fruit
OR
1/4 village bread

8:00 pm 1 cup millet with no sauce
OR
3/4 cup millet with sauce
### 14 Carbohydrate Units Per Day

<table>
<thead>
<tr>
<th>Time</th>
<th>Option 1</th>
<th>Option 2</th>
<th>Option 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 am</td>
<td>1 small piece of fruit and 1/4 village bread</td>
<td>OR</td>
<td>2 small pieces of fruit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OR</td>
<td>1/3 village bread</td>
</tr>
<tr>
<td>10:00 am</td>
<td>3/4 cup millet with no sauce</td>
<td>OR</td>
<td>1/2 cup millet with sauce</td>
</tr>
<tr>
<td>1:00 pm</td>
<td>1 cup rice with no sauce</td>
<td>OR</td>
<td>3/4 cup rice with sauce</td>
</tr>
<tr>
<td>4:30 pm</td>
<td>1 small piece of fruit</td>
<td>OR</td>
<td>1/4 village bread</td>
</tr>
<tr>
<td>8:00 pm</td>
<td>1 cup millet with no sauce</td>
<td>OR</td>
<td>3/4 cup millet with sauce</td>
</tr>
</tbody>
</table>

### 15 Carbohydrate Units Per Day

<table>
<thead>
<tr>
<th>Time</th>
<th>Option 1</th>
<th>Option 2</th>
<th>Option 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 am</td>
<td>1 small piece of fruit and 1/4 village bread</td>
<td>OR</td>
<td>2 small pieces of fruit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OR</td>
<td>1/3 village bread</td>
</tr>
<tr>
<td>10:00 am</td>
<td>1 cup millet with no sauce</td>
<td>OR</td>
<td>3/4 cup millet with sauce</td>
</tr>
<tr>
<td>1:00 pm</td>
<td>1 cup rice with no sauce</td>
<td>OR</td>
<td>3/4 cup rice with sauce</td>
</tr>
<tr>
<td>4:30 pm</td>
<td>1 small piece of fruit</td>
<td>OR</td>
<td>1/4 village bread</td>
</tr>
<tr>
<td>8:00 pm</td>
<td>1 cup millet with no sauce</td>
<td>OR</td>
<td>3/4 cup millet with sauce</td>
</tr>
</tbody>
</table>
### 16 Carbohydrate Units Per Day

<table>
<thead>
<tr>
<th>Time</th>
<th>Meal</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 am</td>
<td>1 small piece of fruit and 1/4 village bread OR 2 small pieces of fruit OR 1/3 village bread</td>
<td></td>
</tr>
<tr>
<td>10:00 am</td>
<td>1 cup millet with no sauce OR 3/4 cup millet with sauce</td>
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<td>1 cup rice with no sauce OR 3/4 cup rice with sauce</td>
<td></td>
</tr>
<tr>
<td>4:30 pm</td>
<td>1 small piece of fruit and 1/4 village bread OR 2 small pieces of fruit OR 1/3 village bread</td>
<td></td>
</tr>
<tr>
<td>8:00 pm</td>
<td>1 cup millet with no sauce OR 3/4 cup millet with sauce</td>
<td></td>
</tr>
</tbody>
</table>

### 17 Carbohydrate Units Per Day

<table>
<thead>
<tr>
<th>Time</th>
<th>Meal</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 am</td>
<td>1 small piece of fruit and 1/4 village bread OR 2 small pieces of fruit OR 1/3 village bread</td>
<td></td>
</tr>
<tr>
<td>10:00 am</td>
<td>1 cup millet with no sauce OR 3/4 cup millet with sauce</td>
<td></td>
</tr>
<tr>
<td>1:00 pm</td>
<td>1 1/4 cup rice with no sauce OR 1 cup rice with sauce</td>
<td></td>
</tr>
<tr>
<td>4:30 pm</td>
<td>1 small piece of fruit and 1/4 village bread OR 2 small pieces of fruit OR 1/3 village bread</td>
<td></td>
</tr>
<tr>
<td>8:00 pm</td>
<td>1 cup millet with no sauce OR 3/4 cup millet with sauce</td>
<td></td>
</tr>
</tbody>
</table>
18 Carbohydrate Units Per Day

7:00 am  
1 small piece of fruit and 1/4 village bread  
OR  
2 small pieces of fruit  
OR  
1/3 village bread  

10:00 am  
1 cup millet with no sauce  
OR  
3/4 cup millet with sauce  

1:00 pm  
1 1/4 cup rice with no sauce  
OR  
1 cup rice with sauce  

4:30 pm  
1 small piece of fruit and 1/4 village bread  
OR  
2 small pieces of fruit  
OR  
1/3 village bread  

8:00 pm  
1 1/4 cup millet with no sauce  
OR  
1 cup millet with sauce  

ATTAYA

☆ Only on Holidays  
☆ Only 2nd Round  
☆ Only with a little bit of village bread
EXERCISE

Walk Around Your Compound 4-5 Times A Day

TIPS

★ Stay away from anything that may cause damage to your body.

★ Check your hands and feet carefully for wounds.

★ If pregnant, visit a health center early in pregnancy.
WHEN YOU ARE SICK...

⋆...If able, eat your regular meals and snacks at the appropriate times of the day.

[Clocks showing different times]

⋆...Drink! Drink! Drink! Drink at least 1 cup of water every hour.

VISIT THE HEALTH CENTER...

⋆...when you are told to come back for a visit.

⋆...when you are sick and not getting better.

⋆...if you are pregnant.

⋆...if you have any questions.
TIME

7:00 am  
Morning Snack

10:00 am  
Breakfast

1:00 pm  
Lunch

4:30 pm  
Afternoon Snack

8:00 pm  
Dinner

MEASUREMENTS

\(\frac{1}{4}\text{ Cup}\)  \(\frac{1}{2}\text{ Cup}\)  \(\frac{3}{4}\text{ Cup}\)

\(1\text{ Cup}\)  \(1\frac{1}{4}\text{ Cup}\)

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FOOD

One Small Piece of Fruit
Two Small Pieces of Fruit
One Small Piece of Fruit and 1/4 Village Bread
1/4 Village Bread
1/3 Village Bread
Cous Without Sauce
Cous With Sauce
Rice Without Sauce
Rice With Sauce

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REFERENCES


*Sick Day Guidelines.* Foote Hospital Diabetes Center: Jackson, Michigan.

A special thank you to Amadou Manneh, Ancha Drammeh, and Gibril Touray for all of their help.
APPENDIX D

Booklet in Wolof
FEEBARI SUKUR
LUY
FEEBARI SUKUR?

Soo lekke ŋam, sa biir dina liggéey ŋam wi, soppali ko sukur. Sukur sii mooy dugga ci sa deret. Sa yaram wi sukur sii la bugga. Su fekkee danga ame feebari sukur, sukur si du man a dugga ci deret ji ak sa yaram wi. Lii moo tax dina am solo lool ngir nga bayyi xel ci ni ngaa lekke ak toppatoo sa yaram.
MANDARA &
LI NGAA YÉG

Xiff saa yu nekka  Mar saa yu nekka  Seben mu bari

Sonna saa yu nekka  Peese bu waañneeku

Bët yu lëndëm  Boo amee gaañu-gaañu walla góom,  dina dee yagga balaa mu wër

Tanka yu sadar ak loxo yu sadar

Jafe-jafey sëy  Feebari kanam

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ATTAYA

☆ Ci feet rekk

☆ Ńaareel bi rekk

☆ Mook mburu bu tuuti rekk
TAAGAT YARAM

Doxantu ci lu wór sa kër ṅenenti yoon be juróomi yoon ci bés bi.
XALAAT

* Sorril léppa luy indil sa yaram fitna.

* Seetal sa loxo yi ak sa tanka yi ndax amuñu góom.

* Soo biiree, nga teel a dem lopitaan ngir ŋu seet sa biir.
BOO
FEEBAREE...

* ...So manee, lekka aî, reer, ndéewo, ak lekkantu ak di naan saa yu nekka ci bès bi.

* ...Naan! Naan! Naan! Naanal appi benna kaasi ndox wuxtú wu nekka.
DEMAL
LOPIITAAN...

* ...su ŋu la waxee nga dellusi.

* ...boo feebaree walla tanewulo.

* ...soo biiree.

* ...soo amee laajte.
WAXTU

7:00 ci subba  
Na nga lekka dara  
suba balaa ngaa ndéewo

10:00 ci subba  
Ndéewo

1:00 ci bëccëg  
Añ

4:30 ci bëccëg  
Njoganal

8:00 ci ngoon  
Reer

NATA

$\frac{1}{4}$ Kaas  
$\frac{1}{2}$ Kaas  
$\frac{3}{4}$ Kaas

1 Kaas  
$1\frac{1}{4}$ Kaas
ÑAM

Jurōom-ñaari waxtu ci suba

Naari doomi garab

Jurōom-ñaari waxtu ci suba ak ¼ mburu

¼ Mburu

¼ Mburu

Cere bu amul soos

Cere bu am soos

Malo bu amul soos

Malo bu am soos
REFERENCES


Sick Day Guidelines. Foote Hospital Diabetes Center: Jackson, Michigan.

Ny ngge gërëm
Aamadu Maane,
Añca Daraame,
ak
Jibril Tuuré
ci seen ndimbal.
APPENDIX E

Meal Plans
10 Carb Units/Day
11 Carb Units/Day

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12 Carb Units/Day
13 Carb Units/Day
14 Carb Units/Day
15 Carb Units/Day
16 Carb Units/Day
17 Carb Units/Day
18 Carb Units/Day
APPENDIX F

Invitation Letter To Diabetics & Admission Ticket
11 June 2004

Dear Sir:

My name is Rachel Golin (Roxi Géy) and I am a student from the United States of America. I have been working at the Ndungu Kebbeh Health Centre for the past seven weeks developing diabetes educational materials.

I would like to invite you to a meeting at the Ndungu Kebbeh Health Centre on Wednesday, 16 June 2004 at 10:00 am. It would be most beneficial if you could bring your first wife with you. This meeting is for diabetics. My goal is to help you better understand diabetes and what you can do to help improve your health.

Enclosed are two tickets; one is for you and the other is for your first wife. Please bring these tickets to the meeting.

I look forward to our meeting on 16 June 2004.

Sincerely,

Rachel Golin (Roxi Géy)

Ruth Wood, NP-C (Kumba Bah)
11 June 2004

Dear Madam:

My name is Rachel Golin (Roxi Géy) and I am a student from the United States of America. I have been working at the Ndungu Kebbeh Health Centre for the past seven weeks developing diabetes educational materials.

I would like to invite you to a meeting at the Ndungu Kebbeh Health Centre on Wednesday, 16 June 2004 at 10:00 am. It would be most beneficial if you could bring the main cook of your compound with you. If you are the main cook, please feel free to bring another guest. This meeting is for diabetics. My goal is to help you better understand diabetes and what you can do to help improve your health.

Enclosed are two tickets; one is for you and the other is for your guest. Please bring these tickets to the meeting.

I look forward to our meeting on 16 June 2004.

Sincerely,

Rachel Golin (Roxi Géy)

Ruth Wood, NP-C (Kumba Bah)
Diabetes Education
Ndungu Kebbeh Health Centre
Wednesday, 16th June 2004
10:00 am