Knowledge of Low Carbohydrate Diet in Type 2 Diabetic Patients

Chelsea Anne Alvarado

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Knowledge of Low Carbohydrate Diet in Type 2 Diabetic Patients

by

Chelsea Anne Alvarado

An Honors Capstone
submitted in partial fulfillment of the requirements
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of
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April 6, 2018

Honors Capstone Director: Louise C. O'Keefe, PhD, CRNP, CNE, FAANP, Director of the Faculty/Staff Clinic, Assistant Professor

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Chelsea Anne Alvarado
Student Name (printed)

[Signature]
Student Signature

4/10/2018
Date
Acknowledgement

I would like to acknowledge Dr. Louise O’Keefe for taking the time to be my faculty advisor for this Honors Capstone project. I also would like to acknowledge my family’s and friends’ support and encouragement from to continue to press forward to finish the project. I could not have accomplished this project without them and the guidance from my faculty advisor. I would like to also recognize Dr. Ann Bianchi for organizing and guiding the honors sections of the nursing classes.
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Abstract

Background

Type 2 diabetes requires lifelong management through diet and exercise. The American Diabetes Association (ADA) recommends that individuals with type 2 diabetes receive self-care education, which includes medication management, medical nutrition therapy, physical activity, and smoking cessation. Medical nutrition therapy is the use of an individualized diet, recommended by a medical provider or nutritionist, to treat medical conditions.

Methods

The project used a descriptive research design. This project used the survey generator, Qualtrics, to obtain data from participants. The participants completed a ten question survey to assess knowledge on low carbohydrate diet in type 2 diabetic clients.

Results

The survey asked participants for their own definition of a low carbohydrate diet: “whole grains, unprocessed, less than a third of your plate. Rest should be protein & vegetables.” The survey also asked participants to rate their familiarity of and how they learned about low carbohydrate diet. The participants answered that they are willing or very willing to change their dietary habits based on CDC and ADA recommendations.

Discussion

With a sample size of four, the survey study does not fully assess the knowledge of low carbohydrate diet of diabetics in the university’s faculty and staff population. Although this survey study does occur in the university setting, knowledge may not be applicable across disciplines outside of the sciences.
Introduction

In type 2 diabetes mellitus (T2DM) the pancreas produces insulin but the body cells are resistant to using it; unlike type 1 diabetes mellitus, in which the pancreas does not produce insulin. Type 2 diabetes is a chronic disease that accounts for 90% of diabetic cases (Bagnasco et al., 2014). It requires a lifelong treatment of diet and medication administration. The American Diabetes Association (ADA) recommends that individuals with type 2 diabetes receive self-care education, which includes medication management, medical nutrition therapy, physical activity, and smoking cessation (“Standards,” 2016). Medical nutrition therapy is the use of an individualized diet, recommended by medical providers or nutritionists, to treat medical conditions. In addition, Tierney (2012) describes medication management that includes insulin administration and/or metformin as the first line therapy for newly-diagnosed T2DM. She describes a glycemic “target” hemoglobin A1C (HgA1C) level of <7% with metformin therapy according to the ADA recommendation. HgA1c measurement is important compared to frequent blood sugar (BS) monitoring because of its comprehensive review of a patient’s long-term glucose management and disease progress (Tierney, 2012). Tierney (2012) discusses that when metformin as the sole treatment in the management of T2DM is inadequate, clients are prescribed additional therapeutic medications, which lead to increased costs of care.

The ADA recommends the implementation of whole grains, legumes, vegetables, and fruit in place of refined carbohydrates and added sugars in their medical nutrition therapy. The ADA also recommends a weight loss of 5% of initial body weight in overweight and obese individuals in order to improve glycemic control (“Standards,” 2016). In their comparison study between a low carbohydrate diet and high carbohydrate diet and the effect on T2DM management, Tay and colleagues (2015) define “low carbohydrate diet” as containing 14% of
total energy from carbohydrates, 28% from proteins, and 58% from total fats (35% monounsaturated fat and 13% polyunsaturated fat). Their study showed a positive relationship between low carbohydrate diet and decreased cardiovascular risk compared to high carbohydrate diet. However, a limitation of their study is the limited number of participants.

The purpose of this project is to survey the Type 2 diabetic university employee population’s knowledge of a low carbohydrate diet as management of T2DM. This paper will present a brief review of literature on studies of medical nutrition therapies and low carbohydrate diet as possible medical nutrition therapy for individuals with T2DM.

**Review of Literature**

The review of evidence consisted of a search in CINAHL and MEDLINE databases and reputable articles from the CDC website and the *Clinical Endocrinology News* journal for studies and systematic reviews that addressed low-carbohydrate diet, its effect on cognition, and factors affecting self-management. The key words searched were low-carbohydrate diet, type 2 diabetes, effects on cognition, evidence-based protocols, and nutritional therapy. The search criteria included full-text articles written in the English language, published less than 5 years ago (January 2012-January 2018), and in peer-reviewed journals.

Bagnasco and colleagues (2013) aim to answer the question “Do personal characteristics influence the effectiveness of self-management education?” The methodology attempted to describe a protocol for a qualitative systematic review and to identify which personal characteristics impact the effectiveness of self-management education in patients with T2DM. The systematic review also appraised the quality of each study for the review using the criteria of McMaster University by two researchers. The sample size in each study reviewed contains a convenience sample of patients with T2DM, aged 18 years or more, and in 132 listed study
references. The review finds a commonality of personal factors that influence self-management in the appraised studies. The patient’s self-efficacy presents as the most mentioned quality followed by diabetes knowledge and social support. The review contains strengths in the inclusion of randomized controlled trials (RCTs), controlled trials, and cohort studies. The review also appraises the quality of each study using the criteria of McMaster University and uses the PRISMA criteria to form the review and meta-analysis for the quantitative data between the studies. The review’s weaknesses and limitations include using only two researchers to abstract the data and failing to present the numerical evidence of the stated quantitative systematic review and state the sample size of studies reviewed.

Khazrai and colleagues’ (2014) review compares different types of diets and their effect on T2DM. The review article analyzes eight studies involving overweight adults with T2DM. Their research findings demonstrate that the four types of diets reviewed provide benefits of weight reduction and long-term management of T2DM. The review states that the individual’s preference and cultural needs drive the type of diet the individual decides to implement in their plan of care. The review’s strengths include its ability to compare studies and four types of diets, including ADA guidelines, to present a statistical significance in the Mediterranean diet, to provide a review of evidence table for the eight studies referenced, and to not generalize the nutrition therapy but to individualize the therapy based on the client’s needs. The review also had limitations. The review contained only a few studies on ketogenic diets (low-carbohydrate/high-protein diet) and reviewed only eight studies.

Tay and colleague’s (2015) study aims to compare low-carbohydrate and high-carbohydrate diet’s glycemic control and cardiovascular risk factors through randomized controlled trials. The sample size consisted of 115 obese patients with T2DM. The study’s
research findings demonstrated significant reduction in weight and HgA1c improvement with both diets. Low carbohydrate diet provided a more favorable effect on cardiovascular risk factors such as on the lipid panel (a decreased low density lipids) and glycemic control, and reduced antiglycemic medications. The study’s strengths includes performing a randomized controlled trail for over 52 weeks, forming individualized diet plans based on the participant’s caloric needs, and assessing participants’ HgA1c at the start of the study, 24 weeks, and 52 weeks. The study also includes limitations such as a withdrawal rate of n=16, a limited generalization to the whole population of T2DM with the study’s mean age of 58 ± 7 years, and an incomplete control of day-to-day dietary intake beyond the randomized dietary assessment at their designated study center.

Zajac and colleagues (2016) used the same cohort in the Tay and colleagues (2015) study to compare a low-carbohydrate to high-carbohydrate diet’s effect on cognitive performance over 52 weeks. The research findings show that both diets achieved reductions in weight and HgA1c and showed no significant difference on cognitive function. The strengths of the study include using a cognitive test battery, measuring weight, height, and HgA1c regularly, and assessing with more cognitive domains compared to previous dietary studies. Some of the study’s limitations include the absence of non-intervention control group, the difficulty in determining the observed effects on cognition were from the repeated testing or the lifestyle intervention, limited assessment on all possible cognitive domains, and the testing of a relatively modest sample size with participant withdrawals. The sample size limits the representation of individuals over 65 years old. However, previous studies assessed a smaller sample size than the present study but proved to be sufficient sampling to show differences between low carbohydrate and high carbohydrate diets.
Tierney and colleagues’ (2012) study aims to compare new and updated list of alternative medications to treat T2DM. The systematic review of about 38 referenced studies describes the new and updated list of medications, which serve as an alternative and/or additive to lifestyle change and metformin therapy alone. The review discussed the efficacy, contraindications and side effects, and purpose in therapy for each medication categories. It also uses published guidelines, review articles, primary manuscripts and Food and Drug Association (FDA) prescribing information documents and compares older regimens to the new medications list of benefits and obstacles as strengths of the review article. The review also displays weaknesses or limitations such as referencing some primary research manuscripts more than five years older from date of publication, failing to consider the affordability costs of multiple new medications for long-term treatment, and limiting generalization to the general population of T2DM.

The Community Preventive Services Task Force (CPSTF) (“Announcement,” 2017) recommends an intensive lifestyle intervention to improve glycemic index and reduce cardiovascular risk factors. The CPSTF bases their recommendation on a systematic review performed by Huang and colleagues in 2016. Their recommendation was published on the Center of Disease Control and Prevention (CDC) website but the CDC states that the recommendation has not been reviewed and approved (“Diabetes M,” 2018).

Michele Sullivan (2018) wrote a Clinical Endocrinology News journal article titled “Low-calorie diet alone reversed type 2 diabetes.” Sullivan obtained her information from a study published on the Lancet website that the primary investigator could not access through the university database. The aim of the reviewed study was to test the effects of a strict calorie-controlled diet on type 2 diabetics’ weight loss and disease remission (of diabetes and medication). The study was called the DiRECT (the Diabetes Remission Clinical Trial), which is
a diet intervention without an exercise regimen. DiRECT consisted of a very strict calorie control with three diet phases: total diet (3-5 months of about 850 calories per day), food reintroduction (over 2-8 weeks), and weight loss maintenance phase (the rest of the study duration). Dr. Michael E.J. Lean and colleagues removed antidiabetic and antihypertensive medications at the beginning of the study and only used antihypertensive drugs at times of high systolic blood pressure. The study obtained a sample size of 298 adults from different primary care practices in Scotland and England with a mean age of 54 years old and mean diabetes duration of about 3 years. The twelve month study showed significant weight loss in the intervention group compared to the control group of at least 15 kg in 24% of the intervention group. Although the participants initially decreased in weight at the early stages of the study, there was an increase in weight during the food reintroduction and maintenance phase by 1-2 kg. The study showed that 46% of participants experienced diabetes remission without medication (antidiabetic and antihypertensive drugs) (Sullivan, 2018). This study’s strengths include a control group for comparison, focusing on the diet without the exercise component, and measuring weight during each diet phase to assess the effects. Four of the 298 participants regained weight within 60 days of the study’s end. Though the study did not report how much weight they regained, the investigators provided a “short rescue plan” to reduce weight and maintain diabetes remission. Another weakness is that the study was conducted in the Europe instead of the United States (US). There is a difference in the regional and cultural eating habits that could have an impact in the effectiveness of this study in the US.

Methods

Design
The study was a descriptive research design. The study included both quantitative and qualitative data. A survey was distributed electronically. The survey consisted of a variety of question forms such as multiple choice, Likert scale, dichotomous scale, and fill in the blank (in a discussion format).

Sample

The convenience sample was obtained from the University of Alabama in Huntsville Faculty and Staff with an inclusion diagnosis of T2DM and age over 19 years old.

Setting

The study was conducted online by sending out an email with a website link to a ten question survey through the Qualtrics survey software. Although the choice was given of filling in the survey in person at the Faculty and Staff Clinic, no participant took advantage of this. The setting of the research was of the participants’ own choosing as the questionnaire was online.

Procedure

The university institutional review board study approval was obtained (Appendix A). The Research Advisor emailed an invitation to all the Deans in the different colleges of the University with a request to have the respective faculty and staff complete a questionnaire about low carbohydrate diets with an attached consent form as part of their participation in the survey. The setting of the research were of the participants’ own choosing as the questionnaire was online. If participants didn’t have the resource to answer the questions online, the participants received the opportunity to fill out the questionnaire in person at the university clinic to answer the same survey. The responses were documented and accessed anonymously.

Instrument

The participants answered a ten item questionnaire through the Qualtrics survey software or in person, by appointment, at the Faculty and Staff clinic. The survey questions were in the
form of multiple choice, Likert scale, dichotomous scale, and fill in the blank (in discussion format).

**Results**

Four individuals participated in the study. The study included both quantitative and qualitative data. Data and comments were obtained from the responses to the online survey. No participants scheduled an in-person interview in the university clinic. See Appendix B and C for graphs and tables of exact wording of survey questions and participants’ answers.

The participants were ages 40 through 59 years old, with a diagnosis of T2DM of a range of three to ten years. Twenty-five percent (1) of participants rated 4 out of 10 (very well) in self-assessment in how well they are managing their diabetes through diet, while seventy-five (3) rated 9 and above out of 10. All participants (4) answered “no” to familiarity to the *Choose MyPlate* app. Participants were also asked on *Choose MyPlate*’s recommended percentage of non-starchy items on the plate. There were answers spread across 1/3, 1/4, and 2/3 of the plate and one participant left the question unanswered. The participants also provided their own definition of low carbohydrate diet: “whole grains, unprocessed, less than a third of your plate. Rest should be protein & vegetables;” “protein & veggies;” “eat more meat, salads;” and “diet that has low amount of simple carbs” (Appendix C).

The survey asked participants about their familiarity of low carbohydrate diets. The participants rated familiar to very familiar. They also provided answers to how they learned about low carbohydrate diet: “I’m a nurse,” “Diabetic Nutrition class and websites,” “[G]oogle,” and “Dietician.” When asked on the survey, participants answered that they are willing or very willing to change their dietary habits based on CDC and ADA recommendations. Of the participants, seventy-five percent (3) said they already eat healthy to manage their diabetes.
Twenty-five percent (1) say there is something hindering him/her: “limited food choices that [I] like that are filling and satisfying.”

**Discussion**

With a sample size of four, the survey study does not fully assess the knowledge of low carbohydrate diet of diabetics in the university’s faculty and staff population. In part of the answer of a simple Google search, the general population may not have access to reputable research sources. Although this survey study does occur in the university setting, knowledge may not be applicable across disciplines outside of the sciences.

According to the data collected, the participants are familiar with low carbohydrate diets and are likely to change their dietary habits based on recommendations from the CDC and ADA. A hindrance reported was healthy foods that are appetizing and filling. With the availability of the internet, one could search for healthy recipes online. However, healthier choices of food tend to be more expensive in contrast to fast food which is more cost effective for the amount of food and the feeling of satiety.

**Limitations**

There were limitations to the study. The study consisted of convenience sampling with an unknown $n$ at the beginning. After the study ended, there was not a significant amount of participants as expected. To correct this in the future, the investigator needs to leave the survey open longer and send reminder emails. A limitation noticed during the review of the results is that not all questions were answered by the participants. The survey should also be set to require all questions to be answered before submitting. Another limitation is restricting the convenience sampling and sending the recruitment email only to the university’s faculty and staff. In the future, the survey should also be open to university students, aged above 19, in order to possibly obtain more participants.
Conclusion

Self-care management is one of the important factors in managing type 2 diabetes. The review of literature shows that there is a need to increase efforts in weight loss and disease management and prevention of a negative progression of diabetes. It is important to focus on preventive intervention in order to reduce the cost of care. This includes a healthy dietary regimen with consideration to low carbohydrate and low calorie diets. Clients can ask their primary providers for possible diabetes remission through strict provider-led regimen. The strict low calorie diet study, that Sullivan reviewed, took place in Europe (2018). Clients and providers may advocate for a similar study in the US to compare the regional and cultural eating habits and promote efforts in disease remission and lifelong prevention in place of lifelong treatment with medications.

The reviewed studies show improvement in glycemic control and weight loss. Therefore, implementing a low carbohydrate diet for long-term management in T2DM provides a treatment option. Based on the review of literature, a low-carbohydrate diet shows effective weight loss and in long-term management of blood glucose in adults with T2DM. A low carbohydrate diet could also be used to prevent comorbidities related to uncontrolled lifestyle management.

As clients’ knowledge is reinforced for different dietary recommendations, the healthcare team should consider the individual needs and backgrounds of clients. The ADA continues to use the Choose MyPlate guidelines. In order to implement this at the university setting, posters of the MyPlate image as a visual could be placed around the university eating areas as a reminder for both T2DM and non-diabetics.

The evidence-based nutritional guideline from the National Clearinghouse of Guidelines (2015) recommends educating patients with T2DM on carbohydrate counting as a key strategy in
glycemic control. Whether portion control or healthful food choices promote glycemic control, individuals with T2DM need further education for those who have low health literacy and/or multiple comorbidities. The implications for best practice are as stated above and based on the provider’s judgement on the individual’s needs and treatment, and client’s autonomy in self-management. The studies were broadly applicable to the target population, generally consistent findings, and blood glucose management through lifestyle change of carbohydrate counting.

A low carbohydrate diet could be considered under the recommendation of carbohydrate counting as treatment option for individuals with T2DM for blood glucose management. Based on the review of literature, medical nutrition therapy of carbohydrate counting has the potential to be cost effective versus the potential comorbidities and its costs of intervention. Possible barriers to implementing the evidence based guideline are personal factors of the individual, such as age, socio-economic status, cultural issues, psychosocial and mental health status, health history and other health conditions, and the persistent belief that low carbohydrate, or “ketogenic,” diets lead to hypoglycemia. Possible solutions to overcome the barriers include education initiatives and practical tools such as clinical algorithms, training, and toolkits to educate on the importance of nutritional intervention. Providing resources to support individuals physically and mentally throughout the medical nutrition treatment plan presents a possible solution to improve self-management in reducing the progression of or possibly the remission of T2DM.
References


http://dx.doi.org/10.15585/mmwr.mm6635a5


Appendix A

March 5th 2018

Chelsea Alvarado
Department of Nursing
University of Alabama in Huntsville

Dear Ms. Alvarado,

The UAH Institutional Review Board of Human Subjects Committee has reviewed your proposal, *Knowledge Regarding Low Carbohydrate Diets in University Employees with Type 2 Diabetes*, and found it meets the necessary criteria for approval. Your proposal seems to be in compliance with this institution's Federal Wide Assurance (FWA) 00019998 and the DHHS Regulations for the Protection of Human Subjects (45 CFR 46).

Please note that this approval is good for one year from the date on this letter. If data collection continues past this period, you are responsible for processing a renewal application a minimum of 60 days prior to the expiration date.

No changes are to be made to the approved protocol without prior review and approval from the UAH IRB. All changes (e.g. a change in procedure, number of subjects, personnel, study locations, new recruitment materials, study instruments, etc) must be prospectively reviewed and approved by the IRB before they are implemented. You should report any unanticipated problems involving risks to the participants or others to the IRB Chair.

If you have any questions regarding the IRB’s decision, please contact me.

Sincerely,

Bruce Stallsmith
IRB Chair
Professor, Biological Sciences
Expedited:

☐ Clinical studies of drugs and medical devices only when condition (a) or (b) is met. (a) Research on drugs for which an investigational new drug application (21 CFR Part 312) is not required. (Note: Research on marketed drugs that significantly increases the risks or decreases the acceptability of the risks associated with the use of the product is not eligible for expedited review. (b) Research on medical devices for which (i) an investigational device exemption application (21 CFR Part 812) is not required; or (ii) the medical device is cleared/approved for marketing and the medical device is being used in accordance with its cleared/approved labeling.

☐ Collection of blood samples by finger stick, heel stick, ear stick, or venipuncture as follows: (a) from healthy, nonpregnant adults who weigh at least 110 pounds. For these subjects, the amounts drawn may not exceed 550 ml in an 8 week period and collection may not occur more frequently than 2 times per week; or (b) from other adults and children, considering the age, weight, and health of the subjects, the collection procedure, the amount of blood to be collected, and the frequency with which it will be collected. For these subjects, the amount drawn may not exceed the lesser of 50 ml or 3 ml per kg in an 8 week period and collection may not occur more frequently than 2 times per week.

☐ Prospective collection of biological specimens for research purposes by noninvasive means. Examples: (a) hair and nail clippings in a nondisfiguring manner; (b) deciduous teeth at time of exfoliation or if routine patient care indicates a need for extraction; (c) permanent teeth if routine patient care indicates a need for extraction; (d) excreta and external secretions (including sweat); (e) uncannulated saliva collected either in an unstimulated fashion or stimulated by chewing gumbase or wax or by applying a dilute citric solution to the tongue; (f) placenta removed at delivery; (g) amniotic fluid obtained at the time of rupture of the membrane prior to or during labor; (h) supra- and subgingival dental plaque and calculus, provided the collection procedure is not more invasive than routine prophylactic scaling of the teeth and the process is accomplished in accordance with accepted prophylactic techniques; (i) mucosal and skin cells collected by buccal scraping or swab, skin swab, or mouth washings; (j) sputum collected after saline mist nebulization.

☐ Collection of data through noninvasive procedures (not involving general anesthesia or sedation) routinely employed in clinical practice, excluding procedures involving x-rays or microwaves. Where medical devices are employed, they must be cleared/approved for marketing. (Studies intended to evaluate the safety and effectiveness of the medical device are not generally eligible for expedited review, including studies of cleared medical devices for new indications).

☐ Research involving materials (data, documents, records, or specimens) that have been collected, or will be collected solely for nonresearch purposes (such as medical treatment or diagnosis).

☐ Collection of data from voice, video, digital, or image recordings made for research purposes.

☐ Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.
Exempt

□ Research conducted in established or commonly accepted educational settings, involving normal educational practices, such as (a) research on regular and special education instructional strategies, or (b) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods. The research is not FDA regulated and does not involve prisoners as participants.

☒ Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interviews, or observation of public behavior in which information is obtained in a manner that human subjects cannot be identified directly or through identifiers linked to the subjects and any disclosure of the human subject’s responses outside the research would NOT place the subjects at risk of criminal or civil liability or be damaging to the subject’s financial standing, employability, or reputation. The research is not FDA regulated and does not involve prisoners as participants.

□ Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement) survey procedures, interview procedures, or observation of public behavior if (a) the human subjects are elected or appointed public officials or candidates for public office, or (b) Federal statute(s) require(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter. The research is not FDA regulated and does not involve prisoners as participants.

□ Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects. The research is not FDA regulated and does not involve prisoners as participants.

□ Research and demonstration projects which are conducted by or subject to the approval of department or agency heads, and which are designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs. The protocol will be conducted pursuant to specific federal statutory authority; has no statutory requirement for IRB review; does not involve significant physical invasions or intrusions upon the privacy interests of the participant; has authorization or concurrent by the funding agency and does not involve prisoners as participants.

□ Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the Food and Drug Administration or approved by the Environmental Protection Agency or the Food Safety and Inspection Service of the U.S. Department of Agriculture. The research does not involve prisoners as participants.

¹ Surveys, interviews, or observation of public behavior involving children cannot be exempt.
Appendix B

INSTRUMENT with informed consent attached to the recruitment email.

You are invited to participate in a research study about low carbohydrate diet. This study is designed to help us to better understand knowledge associated with managing type 2 diabetes with a low carbohydrate diet in addition to medication.

PROCEDURE TO BE FOLLOWED IN THE STUDY: Participation in this study is completely voluntary. After reading the email invitation, you will be asked to participate in a ten-question online survey about low carbohydrate diet. The survey can be completed at the participant’s time discretion within the time frame given in the email invitation. The survey will have a variety of question forms such as multiple choice, Likert scale, dichotomous scale, and fill in the blank. The survey may take five to ten minutes of your time.

DISCOMFORTS AND RISKS FROM PARTICIPATING IN THIS STUDY: There are no expected risks associated with your participation in this study as we are simply asking you to share information about your knowledge of low carbohydrate diet.

EXPECTED BENEFITS: Results from this study can benefit society by understanding the general understanding of the type 2 diabetes population on low carbohydrate diet. You may develop an interest in exploring more information related to low carbohydrate diet after participating in this study.

INCENTIVES AND COMPENSATION FOR PARTICIPATION: If the participant is interested, informational sheets about low carbohydrate diet are available to pick up at the UAH clinic.

CONFIDENTIALITY OF RESULTS: Participant numbers will be used to record your data, and these numbers will be made available only to those researchers directly involved with this study in a password protected computer, thereby ensuring strict confidentiality. This consent form will be kept in a locked box and destroyed three years after study completion. The data from your session will only be released to those individuals who are directly involved in the research and only using your participant number. Data will be presented in a summary format so your individual responses will not be able to be linked to you at any time.

FREEDOM TO WITHDRAW: You are free to withdraw from the study at any time. You will not be penalized because of withdrawal. Investigators reserve the right to remove any participant from the session without regard to the participant’s consent.

CONTACT INFORMATION: If any questions should arise about this study or your rights as a participant, you may contact the Principal Investigator at any point in the research process. You may contact Dr. Louise O’Keefe (Louise.Okeefe@uah.edu) or Chelsea Alvarado (caa0014@uah.edu). If you have questions about your rights as a research participant, or concerns or complaints about the research, you may contact the Office of the IRB (IRB) at 256.824.6000 or email the IRB chair at irb@uah.edu.

If you agree to participate in our research and you are 19 years or older, please continue to the survey. Your voluntary completion of this survey serves as your consent to participate.

This study was approved by the Institutional Review Board at UAH and will expire in one year from March 5, 2018.
Survey Questions

1. What is your age group?
   1) 19-29 years
   2) 30-39 years
   3) 40-49 years
   4) 50-59 years
   5) 60-69 years
   6) 70 years and above

2. When were you (year) diagnosed with type 2 diabetes? Please specify. ________

3. How well do you think you are managing your diabetes through diet in addition to medications? Scale from 1 to 10, with 1 - not well managed to 10 – well managed. Please circle: 1 2 3 4 5 6 7 8 9 10

4. Are you familiar with the “app” My Plate recommended portions for healthy eating? Y or N.

5. What portion of the plate does the My Plate recommend for non-starchy or low carbohydrates each meal?
   1) 1/3
   2) ¼
   3) 1/2
   4) 2/3

6. What is your definition of a low-carbohydrate diet? ______________________________

7. How familiar are you with a low carbohydrate diet?
   1) Very familiar
   2) Familiar
   3) Neutral
   4) Not familiar
   5) Never heard of it before today

8. How did you learn about low carbohydrate diet? ______________________________

9. How willing are you to change your dietary habits based on recommendations from the Center of Disease Control and Prevention (CDC) and the American Diabetes Association (ADA) in order to lose weight and manage your diabetes?
   1) Very willing
   2) Willing
   3) Neutral
   4) Not willing
   5) Never willing

10. What are some things that are hindering you from eating a healthy diet to manage your type 2 diabetes?
    1) I already eat healthy to manage my diabetes.
    2) Something/some things that is/are hindering me are: _______________________
Appendix C

Survey Response Report

(All graphs are in response percentages)

Q1 - What is your age group?

Q2 - When were you (year) diagnosed with type 2 diabetes? Please specify.

<table>
<thead>
<tr>
<th>Participant</th>
<th>When were you (year) diagnosed with type 2 diabetes? Please specify.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2008</td>
</tr>
<tr>
<td>2</td>
<td>2017</td>
</tr>
<tr>
<td>3</td>
<td>2017</td>
</tr>
<tr>
<td>4</td>
<td>May 2015</td>
</tr>
</tbody>
</table>
Q3 - How well do you think you are managing your diabetes through diet in addition to medications? Scale from 1 to 10, with 1 - not well managed to 10 – well managed. Please check:

Q4 - Are you familiar with the “app” My Plate recommended portions for healthy eating?
Q5 - What portion of the plate does the My Plate recommend for non-starchy or low carbohydrates each meal?

Q6 - What is your definition of a low-carbohydrate diet?

<table>
<thead>
<tr>
<th>Participant</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>whole grains, unprocessed, less than a third of your plate. Rest should be protein and vegetables.</td>
</tr>
<tr>
<td>2</td>
<td>protein and veggies</td>
</tr>
<tr>
<td>3</td>
<td>Eat more meat, salads</td>
</tr>
<tr>
<td>4</td>
<td>Diet that has low amount of simple carbs</td>
</tr>
</tbody>
</table>
Q7 – How familiar are you with a low carbohydrate diet?

Q8 - How did you learn about low carbohydrate diet?

<table>
<thead>
<tr>
<th>Participant</th>
<th>How did you learn about low carbohydrate diet?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I'm a nurse</td>
</tr>
<tr>
<td>2</td>
<td>Diabetic Nutrition class and websites.</td>
</tr>
<tr>
<td>3</td>
<td>google</td>
</tr>
<tr>
<td>4</td>
<td>Dietician</td>
</tr>
</tbody>
</table>
Q9 - How willing are you to change your dietary habits based on recommendations from the Center of Disease Control and Prevention (CDC) and the American Diabetes Association (ADA) in order to lose weight and manage your diabetes?
Q10 - What are some things that are hindering you from eating a healthy diet to manage your type 2 diabetes?

Q10_2_TEXT - Something/some things that is/are hindering

<table>
<thead>
<tr>
<th>Response</th>
<th>Something/some things that is/are hindering - Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>limited food choices that i like that are filling and satisfying</td>
</tr>
</tbody>
</table>