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Portion Size Selection in Relation to Hemoglobin A1Cs

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By

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Abstract

Obesity has been recognized as an increasing issue within our country. Obesity contributes to many health related issues, including type 2 diabetes mellitus. Portion size is a factor that has generated clinical research interest. The aim of this study was to determine if there was a relationship between management of diabetes measured by hemoglobin A1c and portion size selection for type 2 diabetics. In this study, subjects selected portion sizes of four different foods. Data were compared to recent A1c levels. Due to the small sample size, nonparametric statistical analysis was used. The relationship of grain portion weight selection and A1c was significant (Spearman $R = .900$, $p = .037$). This finding has potential for future investigation and patient education.

Introduction

Nurses have an obligation to care for individuals, not only with their current illness, but also in preventing disease. According to Shepard (2009), "Having good health is the most important prerequisite for people to enjoy life in their older years" (p. 337). Health promotion is something that should be encouraged throughout life and not only in old age. Obesity is an important aspect of good health and can be attributed to nutritional intake. Akil and Ahmad (2012) stated that 70% of adults, in the United States, are classified as overweight or obese. Obesity increases the risk for heart conditions, and has an effect on quality of life; these issues need to be addressed by nurses and health care workers. Furthermore, obesity was found to be a major risk factor for the development of type 2 diabetes, asthma, hypertension, stroke, and coronary artery disease (Ahmad and Akil, 2012).

Obesity is a variable that can be adjusted when it comes to its contribution to heart conditions and other chronic diseases. Type 2 diabetes is rising quickly in the United States and has become prevalent in both adults and children. The development type 2 diabetes is associated with continual and excessive consumption of sugar and fat. Warber, Schaller and James (2000/2005, pg.538) go so far as to claim that, "Nutrition is regarded as the most controllable risk factor affecting long-term health." There have recently been new approaches when it comes to assessing nutritional intake. Portion sizing is one of the latest aspects of nutrition that has come under close government scrutiny due to the increasing epidemic of obesity in both adults and children (Shepard, 2009). Therefore, investigation of portion size among people who have diabetes could provide valuable information and future interventions on tackling this epidemic.

The terms *portion size* and *serving size* are often used interchangeably; however, they both have distinct definitions. Faulkner et al. (2012) define these terms as *portion size* being the amount of food consumed at a single eating occasion, and *serving size* being the amount that is recommended. Therefore, one portion size can represent multiple serving sizes. When persons are confronted with an open container and no guidance about the proper serving size, portion size becomes an issue and potentially results in excessive food intake (Wansink, Ittersum, Painter, 2006). With diabetic patients, this over consumption is an even greater concern. Over consumption of foods high in carbohydrate can cause a spike in blood glucose, worsening an already chronic disease due to the insulin resistance (Huether & McCance, 2012).

Fasting blood glucose levels are used to manage diabetes within a narrow time frame. For long-term diabetes management, glycosylated hemoglobin A1c (HbA1c) provides a measure of the percentage of hemoglobin A1c that has been glycosylated, or exposed to glucose in the blood over the life of erythrocytes, approximately 2-3 months (Banks & Corbett, 2013). According to the American Diabetes Association, a diabetic who is eating properly and watching his/her carbohydrate intake and glycemic index and glycemic load of those carbohydrate sources will have a HbA1c less than 7% according to the American Diabetes Association (as cited by Unger, 2008). These A1c levels are affected by a multitude of things; including the patient's perception of proper portion sizes. Overeating would cause an increase in HbA1c levels beyond 7%, whereas adequate intake or reduced intake of high glycemic index/ high glycemic index foods would potentially lower HbA1c to below 7%.

Overeating and portion size are areas of research in diabetes management where data are lacking. Specifically, research is lacking on whether people monitor portion sizes and consistently chose to eat recommended serving sizes (CDC, 2006). A search of PubMed and

Cumulative Index of Nursing and Allied Health Literature databases using the terms *portion size* and *diabetes* found no citations. In order to get an accurate assessment of a patient's portion size intake, one would need to visualize and measure the portion sizes being consumed by the patient. Portion sizes could then be compared to the recommended serving sizes. Kral (2006) recognized that a research tool was needed to compare a person's view of portion size related to the average portion size selected; assessing portion size perception is a controllable factor that requires more research and could be beneficial in preventing future complications.

Research Question:

Is portion size selection of patients with type 2 diabetes mellitus correlated with glycosylated hemoglobin?

Research Methodology

Following approval of the East Tennessee State University (ETSU) Institutional Review Board, two different locations were used for recruiting subjects for this study, The Johnson City Community Health Center and East Tennessee State University Family Medicine Associates Clinic. Both of these facilities are associated with ETSU. Permission was obtained from leaders at both of these facilities to conduct research at there and the principle investigator went to clinic directors to review the study and clinic operation. The providers would agree to review their schedule for type 2 diabetic patients and inform the principle investigator of when patients with type 2 diabetes were scheduled. Patients were approached before or after their appointments. Excluded from participation in the study were people under 18 and type 1 diabetics.

Informed consent was obtained by asking the patient if they were willing to participate in the study and having them sign a consent form. After informed consent was obtained, a clinic provider collected each participant's body mass index (BMI) and provide the PI with the most

recent hemoglobin A1C from the participant's medical record. The participant was also given a self-survey that consisted of demographic information and multiple choice questions relative to factors having an influence on diabetes. Each participant was then given verbal instructions to select what he/she considered to be an adequate portion of four different foods.

Figure 1. Food groups presented for subject portion selection

These foods included grapes, corn, cereal, and popcorn. Grapes were selected as a fruit, canned kernel corn as a vegetable, cornflakes as a grain, and microwave popcorn as a snack (see Table 1). Each food was chosen to represent a different food group, glycemic index and glycemic load. Glycemic index was compared to glucose = 100 (Foster-Powell, Holt, S., & Brand-Miller, J, 2002).

Table 1.

Study Foods and Glycemic Indices and Loads

Group	Example	Glycemic Index	Glycemic Load	Serving Size
Fruit	Grapes	59	11	120 g
Grain	Cornflakes	93	23	30 g
Vegetable	Canned corn	46	13	80 g
Snack	Microwave Popcorn	55	6	20 g

(Adapted from: Atkinson, Foster-Powell, & Brand-Miller, 2008 and Foster-Powell, K., Holt, S., & Brand-Miller, J., 2002).

Glycemic index reports the response to a food 2 hours after eating compared to a standard of

amount of glucose or white bread to provide a comparison of carbohydrate quality (Foster-Powell et al., 2002). Glycemic load provides a standard for a serving of a specific food incorporating a specific quantity with quality, or glycemic index. (Foster-Powell et al., 2002). The expectation is that sustained intake of high glycemic load foods promotes larger increases blood glucose and greater demands for insulin.

Each selection was measured in cups and weighed in ounces. The data were recorded on a flow sheet. A household measuring cup and digital scale were used to record the selected portion sizes. The data plan was to include correlation analysis using Pearson product moment correlations (*r*).

Results

Overall, five subjects were recruited. Of these five subjects, 60% were males and 40% were females (see figure 2).

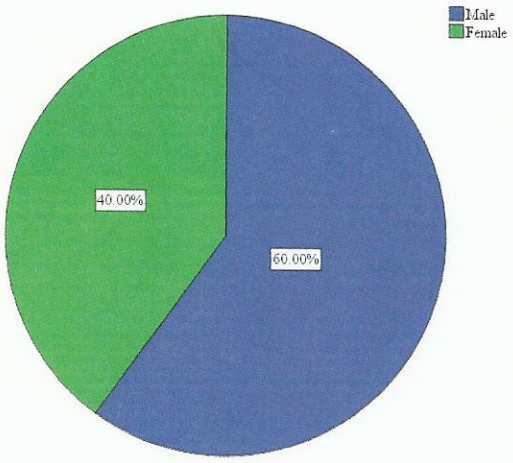


Figure 2. Sample gender

Forty percent of subjects were white, 40% were Hispanic or Latino, and 20% were listed as other. When asked if they had previous diabetes education, 80% of them had and 20% had not. Subjects were asked if they were insulin dependent. 40% responded with yes, 40% said no, and

20% did not know. The age of the subjects ranged from 30-73 with an average age of 52.6 years. The BMI of the subjects ranged from 29.8-36.4; with an average of 32.6. Participant's most recent A1C ranged from 6.5-14; with an average of 9.8. Data are reported in Table 2.

Table 2.

Sample Demographics

Subject	Age	Gender	Ethnicity
1	65	Male	White
2	57	Male	White
3	73	Female	Other
4	38	Female	Hispanic
5	30	Male	Hispanic

Each subject was asked how long they had been a diabetic and the average numbers of years were 6.3; with a range of 0 -16 years.

Eighty percent of subjects reported taking oral medications for controlling diabetes, while 20% did not. The subjects were also asked if they prepared their own meals, with 40% indicating they did prepare their own meals; 20% stating they did not prepare their own meals, and 40% stating that they sometimes prepared their own meals. Each participant was asked if they exercised at least 3 times each week for one hour on each of the three days for a total of three hours per week. Sixty percent said they did not exercise at least three times a week, and 40% indicated that they sometimes did exercise. None of the subjects stated that they exercised at least one hour on three days each week. Diabetes education, of some sort, was previously

provided with 80% of the sample as seen in Figure.3. Eighty percent of subjects were currently taking oral medications (Figure 4).

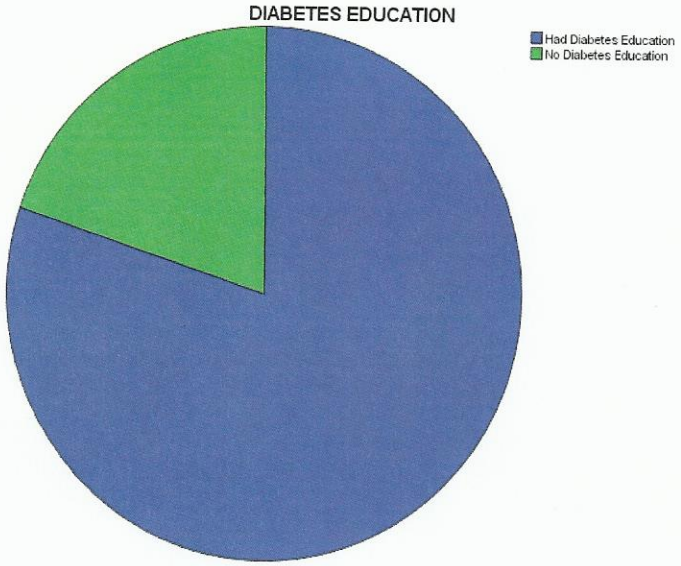


Figure 3. Sample with previous diabetes education

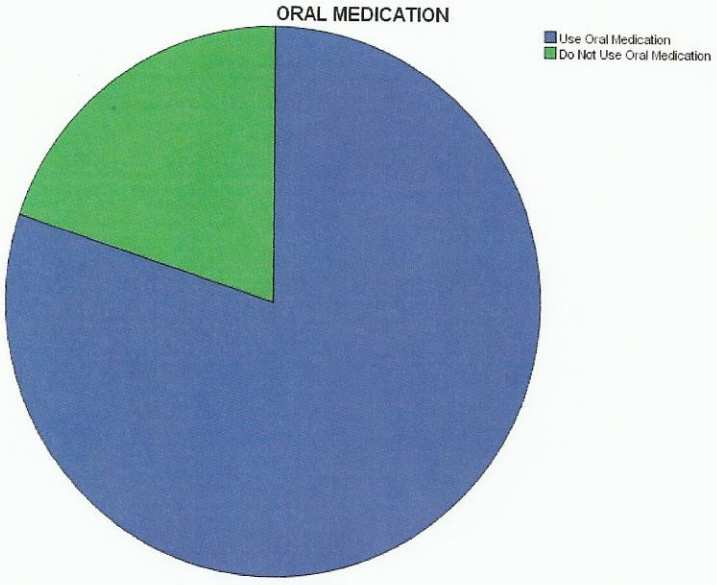


Figure 4. Sample taking oral anti-diabetic medication

Sixty percent of subjects reported taking insulin while 40% were not currently on insulin as seen in Figure 5.

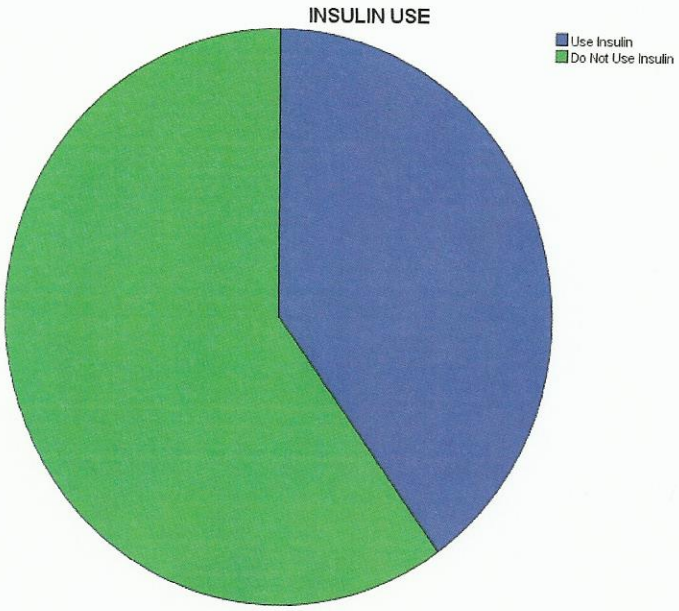


Figure 5. Sample using insulin

Two subjects or 40% of the sample, both females, reported preparing their own meals while 40% reported fixing meals sometimes and 20% reported not fixing his meals and diagramed in Figure 6.

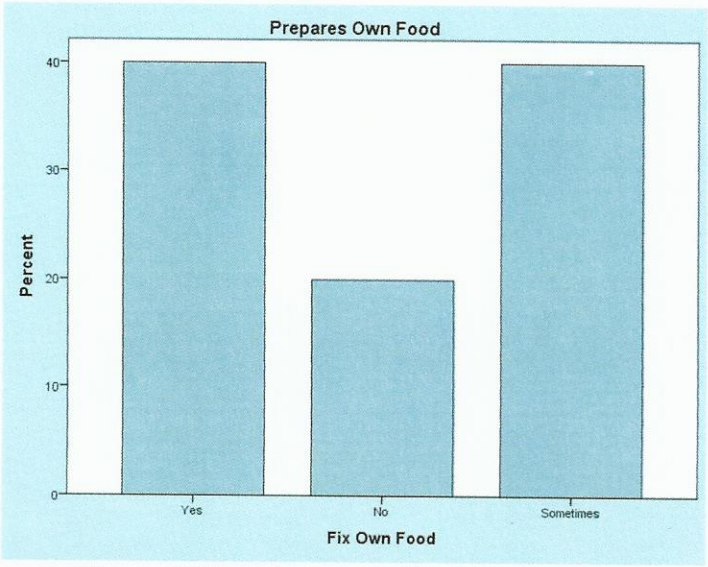


Figure 6. Sample preparation of own meals.

In summary the sample is described in Table 3.

Table 3.

Sample Description

Variable	n	Percent
Ethnicity		
White	2	40
Hispanic/Latino	2	40
Other	1	20
Diabetes education	4	80
Insulin dependent	2	40
Oral anti-diabetic agent	4	80
Prepare own meals	2	40

Pearson product-moment correlation statistic, *r*, was planned to evaluate the data. However using this statistic would not produce credible results with this study's data because assumptions of using Pearson *r* require data must be interval or ratio level and have a normal distribution (Polit & Beck, 2012). Normal distribution of a sample is often assumed to be normal based on a large sample of 100 or more and impossible with a very small sample (StatSoft,

Inc.,2013). While some of the variables, such as: age, BMI, A1c, and portion weights provided interval level data, other variables, such as: insulin use, oral anti-diabetic agents, diabetic education and gender were ordinal or nominal level. Because there was a mix of ordinal and continuous data, the nonparametric correlation statistic, Spearman *R* was used using SPSS software for analysis (IBM Corporation, 2012).

Spearman *R*, a nonparametric statistic, requires ordinal level data and provides information similar to information from Pearson *r* except data are ordered in ranks (Statsoft, 2013). Two-tailed tests were performed. Although use of the Spearman *R* provides less sensitive information than the Pearson *r*, the data are in keeping with the requirements of Spearman *R* and correlations above 0.8 were considered "high" (Polit & Beck, 2012). In this study, portion weight of grain and A1c demonstrated a correlation of 0.9 (p=.037 at the .05 level).

Other variables demonstrated correlations greater than 0.8 but were not found to be significant. BMI demonstrated correlation of R = -.821 (p = 0.089) and years of having diabetes. Years of diabetes and grain portion weight demonstrated a correlation of R = -.821 (p = 0.089). The correlations are listed in Table 4.

Table 4.

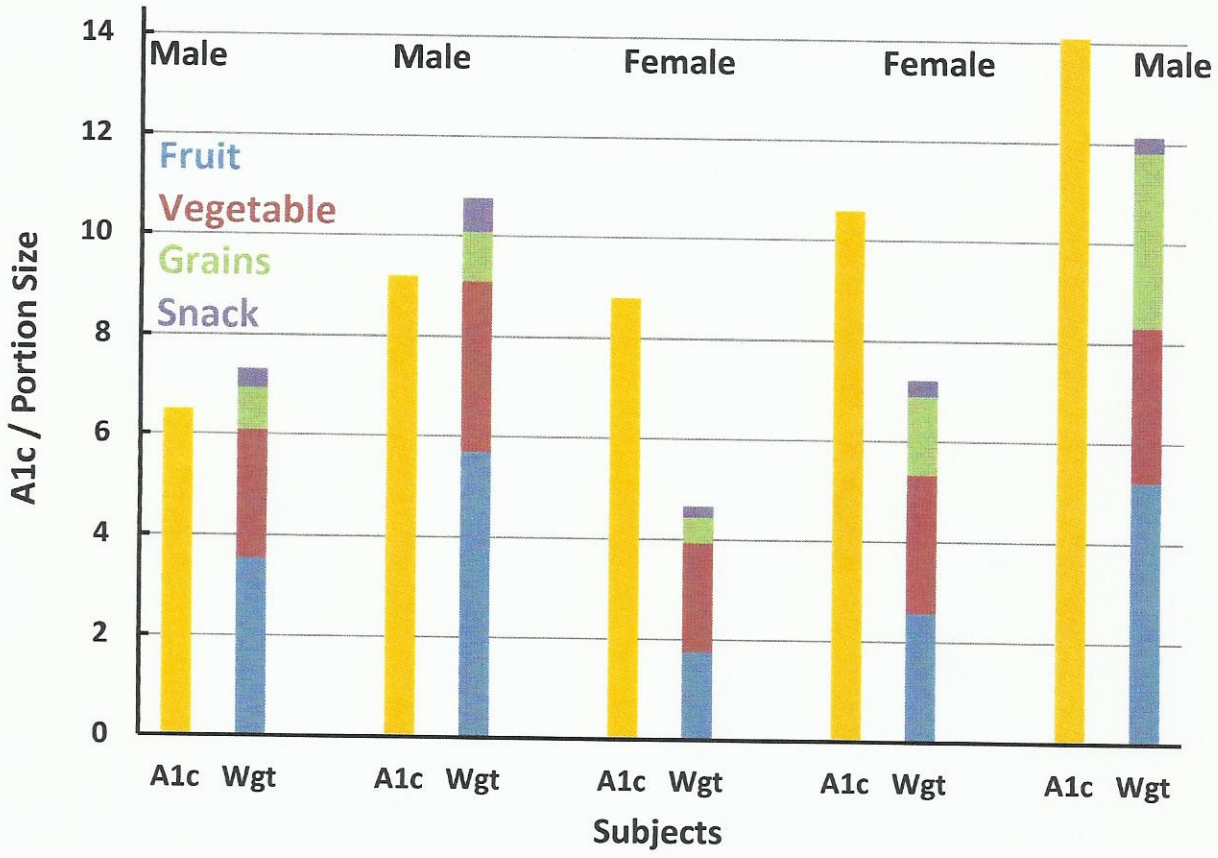
Variable Correlations Greater than Spearman R = 0.8

Variables	Spearman *R*	Significance at 0.05 level
Grain portion weight x A1c	.900	.037
BMI x Years with diabetes	-.821	.089
Years with diabetes and Grain portion weight	-.821	.089

The relationship of portion size and type of food selected with A1c can be seen in Table 5. The gender difference can also be observed.

Table 5.

Relationship of Portion Size and Type of Food Selected with Hemoglobin A1c



Possibly one of the most significant trends in the data was A1c in comparison to length of time since the subject had been diagnosed with diabetes. Figure 7 clearly shows the A1c level decreasing as the age of subjects increased. The longer a subject had diabetes, the more controlled the A1c level seemed to be.

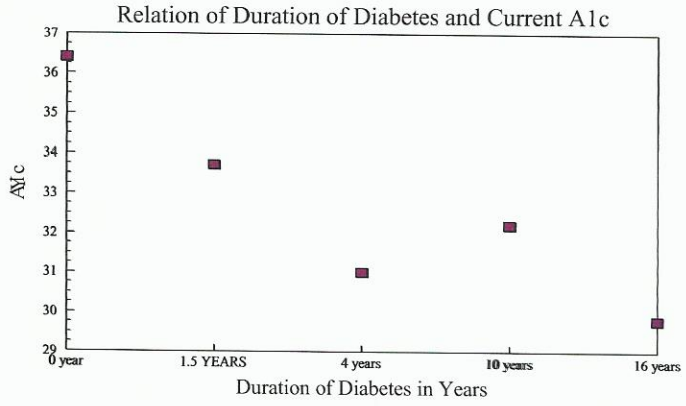


Figure 7. Duration of diabetes and A1c

Discussion

Although many of the correlations were not statistically significant, some trends in the data are worth mentioning. One of the most interesting data trends was that of subject #5. This subject was newly diagnosed and his A1c was over 14%. Not only did he have the highest and most poorly controlled A1c, but he also picked the largest portion sizes of all the subjects. Because he was in the process of being diagnosed, he had not received previous diabetes education. These findings could suggest future research on the effectiveness of portion size evaluation as part of diabetes education for newly diagnosed diabetics.

Another relationship was the correlation of education on portion size selection. Diabetes education includes education on which foods affect blood sugar along with amounts that should be eaten seemed to have relationship to portion size and even A1c. While education's relationship to A1c could not be calculated, a scatterplot of the data indicated a relationship. This finding would indicate the need to identify the level of diabetes knowledge to determine essential information needed to control A1c.

Another question from the self-survey that showed some interesting results was the question that asked subjects if they prepared their own foods. The subjects that responded yes were women and those that said no or sometimes were men. In addition, male subjects tended to choose larger portions of certain foods or larger portion sizes altogether. If the men do not have control over the foods they consume and are served large portions; this could influence management of their diabetes and A1c levels. Meal preparation and portion size should be considered when discussing education. There could be implications for the importance of spousal/family education as well. Again, data did not demonstrate significance due to the small sample size.

This correlation of duration of diabetes and A1c could be due to a variety of things, such as exercise, education, and increased knowledge on food choices. In future studies, relationship of duration between disease and A1c is worthy of investigation.

Overall, this study taught many lessons about research. The most important lesson had to do with features of human research. Human research takes a lot of time, and time that is hard to come by during the final semester of nursing school. Potential subjects are people who have their own lives and do not willingly sacrifice their time very often when there is no direct benefit to them. So, the research process takes a lot of time and the hope that someone will participate at each data collection time at the clinic. Also, I realized that face to face requests facilitate gaining participation. When the provider tried to explain the study and asked patients to participate, they tended to decline much more frequently.

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