EVALUATION OF THE EFFECTIVENESS OF AN EDUCATIONAL PROGRAM DESIGNED TO TRAIN UNDEREDUCATED DIABETES MELLITUS PATIENTS TO FOLLOW THE DIABETIC DIET

by

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Chapter I

INTRODUCTION

Diabetes mellitus, an incurable disease, is a leading health problem in the United States. Approximately five percent of the national population is afflicted with the problem. Treatment components are diet, oral agents, and/or insulin. Nutritional management is essential to disease control. Diet therapy in the care of patients with diabetes has been called a failure (1). Ineffective education has been cited (1) as a major reason for failure. Researchers also have indicated a need for attention to the provision of individualized diet prescriptions, understandable educational materials, and emphasis on an individual's culture or lifestyle.

The purpose of the study was to design an educational program in diabetes diet control and to field test the program in a realistic setting. The program components, consisting of a diabetic diet guide and an audiovisual presentation demonstrating how to use the guide, were developed with special emphasis on understanding by patients of low literacy levels and attention to cultural relevancy.

The field test evaluation in an outpatient clinic setting encompasses areas of dietary knowledge, clinical indices, and dietary behavior. The program effectiveness was evaluated on the basis of whether there was an increase in patient dietary knowledge, a decrease in weight and blood glucose values, and fewer acute disease complications for the experimental than the control subjects,

and a qualitatively observable trend insofar as dietary behavior was concerned.

Chapter II

LITERATURE REVIEW

It is generally recognized that educational programs should place greater emphasis on the consideration of literacy level and cultural relevancy both of which are of critical importance in dealing with undereducated subjects. The following review covers studies and reports of programs designed to improve subject knowledge, clinical indices, and dietary behavior of persons with diabetes as well as testing instructional effectiveness of program intervention with undereducated patients.

Literacy Level

Literacy level refers to both the reading and comprehension level of patients. The definition of the term literacy level is related to the meaning of several other words. Webster's dictionary (2) states that literacy is the quality of being literate which indicates the ability to read and write. Level is a position on a scale of achievement. Comprehension is the act of or capacity to understand a concept. Understanding may be demonstrated by the application of a concept in a real-life situation. Literacy level varies on a continuum from low to high. Therefore, a patient's ability to read and write may be qualitatively measured. The term illiterate refers to an inability to read and write. If the patient's literate abilities are low, then the literacy level of dietary instructional materials

and programs may be critical to patient's ability to learn and apply knowledge to be learned in day-to-day living.

Documentation of the need for the development of dietary educational materials at low literacy levels has been provided by several researchers (3-7). For example, Power (6) and Williams (7) recommended the development of materials for populations who experience difficulty in the reading and comprehension and educational materials containing therapeutic concepts. Power (6) and Williams (7) stress the need for materials designed to meet the needs of patients with a low literacy level.

Readability

Readability (2) refers to the ease with which material can be read or comprehended. Readability has been determined through the use of wordlists (8-10), reading formulae (15-17), and checklists (18).

Wordlists

Wordlists have been standardized by grade level derived by educators who tested for student vocabulary, reading, and comprehension skills. Barbe (8), Wide Range Achievement Test (WRAT) (9), and Cloze (10) are examples of wordlists using established standards.

Barbe's (8) wordlists have been compiled by using extensive reading skill level checklists. The checklists consider vocabulary, perceptive skills, comprehension, and oral expression. The acquisition of vocabulary requires word recognition skills and the knowledge of word meanings. The beginning reader learns the meaning of place, quantitative, and descriptive words. The perceptive listening and visualization skills also support learning. Comprehension integrates

an interest in printed words with numerous other abilities which include attention span, remembering, sequencing, following directions, and progressions such as reading from front to back, left to right, and left hand page to right hand page. Oral expression is measured by spontaneous, complete thoughts; remembering ; the production of a five-word sentence; and the paraphrasing of a story in a person's own words.

The WRAT wordlist (9) is a graded list of words which yields a word recognition grade level score. The test taker reads the words aloud until three or more words are mispronounced. The number of words pronounced correctly are equated with a grade level. The test takes about two to three minutes. If the patient scores below the sixth grade level, a listening test is administered.

The Cloze wordlist (10) assesses the degree of comprehension between a reader and any given material. Cloze measures the "fit" of material by grade level. The reader supplies exact replacements for deleted words which requires sensitivity to grammatical, syntactical, and semantic clues. If the reading test is too difficult for the test taker, a listening test is administered. A score is derived by determining the percentage of replacements achieved. A score of 60 percent or above on the total test indicates the person can handle a given grade level with ease. The test takes about 10 to 15 minutes.

In the WRAT (9) and Cloze (10) wordlists, listening tests are used. Listening has been found to be as effective as reading for men of average or low literacy levels. However, if the material is too

difficult, comprehension and word recognition learning do not occur. In a study by Sticht (11) of 300 men, 25 percent preferred listening to reading. Sticht listed several hints for designing aids, manuals, diagrams, etc., to assist learning in patients with low literacy levels.

Disease oriented language is another area of consideration in material development. Mohammed (12) found that of 220 participants, 42 percent could not comprehend fourth grade level disease oriented words (12). Samora, et al. (13) reported that hospital inpatients are often unable to understand medically related terms. One hundred twenty-five patients were given 50 disease related words generally assumed to be familiar. Individuals declaring higher educational levels generally understood more words than persons declaring lower educational levels. One-fourth of the high school graduates lacked knowledge of the terms. Podell (14) suggests that the shorter the list of instructions, the larger the proportion of information retained.

Reading Formulae

Reading formulae also may be used to ascertain readability or comprehensibility and are specifically designed to establish the grade level of educational materials. The Fry readability graph (15), the SMOG readability graph (16), and "How Easy" (17) are examples of reading formulae. The Fry method (15) requires the counting of three randomly selected 100-word passages, counting the number of sentences per 100 words, and the number of syllables. The SMOG formula (16), developed by McLaughlin, requires the counting of 10 consecutive sentences near the beginning, middle, and end of a piece

of material. "How Easy" (17) estimates reading ease by testing 100-word samples selected by a prescribed numerical scheme, figuring the average sentence length for each 100-word sample, or, for a combination of the total samples, dividing 100 words by the number of sentences, figuring word length, and counting syllables the way words or symbols are pronounced. The scheme was developed by Flesch in 1949.

Checklists

Anderson, Olson, and Rhodes (18) have developed a checklist for content, format, stereotyping, and readability for evaluating printed materials. Readability recommendations encompassed the avoidance of technical language, circular definitions, or hyphens. Other suggestions were to use a positive writing style, active voice, and suitable reading levels.

Other Considerations

Researchers have further suggested literacy level considerations such as oral emphasis, visualization, repetitive application, self-pacing, and audience and material evaluation strategies.

Oral Emphasis

Oral interaction is a strategy used in several studies (19-21). Chandalia and Bargrodia (19) in a study in India conducted an entire dietary instructional program orally. Hassell and Medved (20) and Goldsmith and Davidson (21) solicited patient information using interview schedules. Discussion was reported as an effective learning tool in research projects (22-23).

Visualization

Visualization as an effective aid to learning has been supported by educators. Based on tests conducted with children, Dwyer (24) noted that the type of artwork used affects the literary level of materials. Also, realistic, detailed artwork fits in with current educational emphases on visual literacy. Slowie (23) has indicated that ikonic learning styles of individuals center upon the use of visually oriented instructional aids which coincides with Power's (6) suggestions on visual emphasis. Power (6), Davidson (25), the North Carolina Select-A-Meal (26), Olson and Pringle (27), and Suren (28) have all used visualization processes in diabetes mellitus patient education. None of the visualization processes were evaluated. Health educators (6,24-28) have utilized realistic artwork in visual portrayal in dietary guides. Diverse audiovisual presentations such as audiotapes, slides, films, illustrated letters, and laminated posters have been used (6,19,20,28,29). Numerous nonprint materials (30) are available in the form of audiotapes, videotapes, slides, and films for low literacy skill patients. No documentation of evaluation was noted for the materials.

Repetition

Educational strategists believe repetitive application in the form of simulation and/or practice in the application of knowledge is beneficial to learning by low literacy level patients. Olson and Pringle (27) recommend repetitive role playing of desired behaviors

whereas Shortridge (31) and Gaw (32) advocate practice by participation or experiences to exacerbate the acquisition and reenforcement of desirable skills. Olmstead (33) stated that mature adults particularly need active participation to aid in the integration of new skills into an existing lifestyle.

Self-Pacing

A strategy that incorporates the previously described learning methods and which affords considerable flexibility in learning styles and materials is self-pacing. Several studies have evaluated the effectiveness of programs that use diverse types of educational materials. Successful educational tools that provide flexibility include audiotapes (23), audiotapes with flipcharts or slides (29), films (29), and teaching machines or programming (29,34,35). The flexibility is in terms of permitting the selection of different forms of education for learners with specific abilities.

Cultural Relevancy

Another parameter which is currently receiving emphasis in dietary education is cultural relevancy. Culture (2) means the customary beliefs, social forms, and material traits of a racial, religious, or social group. Relevance (2) means practical and social applicability. Cultural relevancy then means the factors that relate to individuals from a special culture. Nutritionally, this means that food examples are meaningful to the cultural group in the educational program.

Cultural factors which define the types of foods consumed are geographical location, ethnic origin, religion, and finances. Goldsmith and Davidson (21) surveyed the Southeast United States for the foods that are frequently eaten and incorporated them into the dietary guide given each patient (25). Weinsier, et al. (5), Garber (36), and Davidson (39) have emphasized commonly eaten foods by ethnic origin whereas Garber (36) indicated that foods allowed or disallowed by religious preference should be considered. Suren (28), Stone (37), Stucky (38), and Tunbridge and Wetherhill (40) considered patient financial status in meeting individualized dietary prescriptions. Food likes and dislikes affect dietary compliance with restricted therapeutic prescriptions. The food likes and dislikes of sample populations have been studied (5,6,21,23,28,37). In other dietary studies (5,6,19,23,37,39,41-43), individual lifestyle adaptations were considered. Another dietary study by Hamburger, et al. (44), emphasized the need to consider the individual's work schedule and the family lifestyle in the formulation of and compliance with diet prescription.

Knowledge

Several specific essential knowledge areas that can be identified are nutritional information basic to the disease, foods within food exchange groups, food serving sizes, and restricted and unrestricted foods. The latter three topics specifically pertain to the Food Exchange Lists for Meal Planning (45).

The relationship of the quantity of food consumed, the kind and intensity of physical activity, and the interaction of food and activity on body weight has been cited as important as basic nutritional knowledge areas pertinent to the dietary care of patients (5,25,27,37,39,41,44,46,47,48). Specific concepts and values about caloric restriction were believed essential (23,37,39,41,48) (See Clinical Indices, weight, page 12). Slowie (23) recommended presenting patients with the knowledge required for a balanced diet thereby lessening risk factors which may accompany and complicate disease manifestations (See Clinical Indices, acute complications, page 14).

The Exchange Lists for Meal Planning (45) is widely used for developing and following diet prescriptions for diabetes mellitus patients. The insufficient knowledge of patients has been seen as a problem affecting dietary compliance (2,5,6,19,22,23,27,28,29,36,37, 39-41). The measurement of the serving size of food as a prerequisite for following the exchange system has been emphasized (19,23,25,26). Weinsier, et al. (5) and Etzwiler (49) found that diabetes patients are unaware of correct serving sizes or standard measurement techniques. The Grady Memorial Hospital (25) utilizes a system of providing patients with standard measurement tools which is effective. Bohdan and Jans (42) found that incorporating individualized teaching of tray portions, food models, and simulated menu planning into the education provided patients was an effective teaching method.

Clinical Indices

Investigators recognize that standard body weight, normal blood glucose values, and a minimum number of acute complications are indicators of disease control.

Weight

Numerous researchers (5,23,27,37,39,41,43,44,46,47,50,51,52,53) have emphasized the need for weight control with diabetes mellitus patients. Two separate studies were conducted which used behavior modification to induce weight loss in patients. Goldner, et al. (53) found that a patient population that was 133 percent of standard body weight (SBW) lost weight at the rate of one to three percent in the first six months following a three-month weight reduction regimen but that weight was often regained after four or five years if constant monitoring was not maintained. Greene (47) conducted a pilot study using behavior therapy techniques to influence weight loss among obese adult onset diabetes patients for a five month period. Twenty-four experimental study participants showed a mean weight loss of 2.15 pounds whereas the five control participants increased weight by a mean of 1.3 pounds during the same period. In the study by Weinsier, et al. (5), the ending percent of SBW was 129 indicating only a negligible change. Davidson (39), using the controlled short term starvation method, reported the average weight loss maintenance of diabetes patients from 1971-1977 varied by patient populations from 50 to 90 percent success rates. According to Rifkin

and Sussman (52), when patients are obese, a 10 to 15 percent weight reduction may be sufficient to stabilize the course of the disease. Thus, the inference is that though actual standard body weights are desirable, good control may be established at slightly higher weights than standard.

Blood Glucose

Generally, researchers have indicated that a relationship exists between weight and blood glucose values. Most researchers believe that normal blood glucose values within the range of 80 to 140 mg/100 ml are beneficial to the control of diabetes mellitus and subsequently to the health and longevity of patients. Tucker (54) categorized factors serving as impediments to blood sugar control. Tucker listed variations in food intake and in exercise, stress, insulin, and excess weight as factors affecting blood glucose control in the insulin-dependent patient. According to Flood (46), the factors apply similarly to patients who have the maturity onset diabetes.

Studies have been undertaken using educational intervention techniques with the goal of monitoring and stabilizing blood glucose levels in patient populations. The Grady Memorial Hospital (25) modifies educational instruction plans continually in an effort to stabilize blood glucose levels. Davidson and co-workers (39,41) report that with diet therapy instruction on a one-to-one basis with a dietitian has been successful in reducing the patient's weight which concomitantly lowers blood glucose levels. However, the

success Rate was not defined.

Chandalia and Bagrodia (10) found that a one hour nutritional counseling session was effective in reducing blood glucose levels significantly in experimental over control patients in a one month period. Greene (47) conducted a five-month study in which findings for blood glucose values showed significant reduction for experimental over control subjects. The control group averaged a gain of 57.75 mg per 100 ml while the experimental group's mean values declined 16 mg per 100 ml. Patients who attended a maximum of four counseling sessions showed a greater blood glucose decline than did patients who attended fewer sessions.

Acute Complications

The necessity of minimizing complications of diabetes mellitus has been reiterated by numerous researchers who indicated that repercussions occurred when weight and blood glucose values were not reduced and stabilized (3,4,5,19,27,39,41,46-49,52,53). In documenting the establishment of control, studies indicated the need for attention to reducing the number of visits by patient clientele over time. The reports, however, place greater emphasis on the overall implications of chronic complications categorized as micro and macroneuropathy (52). No literature reports were found that categorized or enumerated occurrences of complications during scientific study periods.

Dietary Behavior

Dietary behavior has been cited as the basic influence on clinical indices which reflect disease control. In research studies, patient knowledge is reported as dietary behavior (1,3,37,49). In discussing dietary compliance or dietary behavior, following an individualized dietary prescription is the expected standard. Parameters of dietary behavior include meal regularity (1,3,5,7,37,48,49,56,57), consuming foods as prescribed from food groups (3,5,6,7,20,21,23,25,26,36,37, 39-41,45,48,49,55), using standard methods of measuring serving sizes (19,23,25,26,37,48,49,55), consuming unrestricted foods (23,25,26,37, 45,48,55), and avoiding restricted foods (23,25,26,37,45,48,55).

West (1) and Stone (37) both suggested that adherence or compliance with a diet prescription was a rare occurrence. Stone found that less than 22 percent of the diabetes mellitus population followed recommended diets (37). However, Holland (56) reported that 53 percent of the patients in the 1964-65 National Health Survey stated adherence to a diet prescription. Williams and colleagues (57) observed inaccurate adherence to prescribed diets by qualitative analysis of reported food intakes. Knowles, et al. (58) reported 22 to 89 percent adherence to prescribed diets in seven juvenile insulin independent patient studies. A 1970 Great Britain study by Tunbridge and Wetherhill (40) found that 30 percent of the participants consumed approximately 10 percent of the prescribed kilocalories in a seven-day food intake study. Williams, et al. (57) in an early North Carolina study stated that seven of 60 patients (12 percent) reported total

dietary compliance with the diet prescription. Because of the confusing results of the 24-hour recall data, a seven-day home visit study was conducted. Of the 17 patients, 12 showed at least one discrepancy with the diet prescribed food exchanges each day.

Specific reports in the literature relative to patient food habits in the consumption of unrestricted and restricted foods are very limited. However, researchers have indicated that patients need knowledge of such foods (23,25,26,37,45,48,55).

Evaluation of Selected Programs

Numerous reported patient educational programs are diverse in setting, emphases, and scope. The following programs have been selected for detailed description of the general program, emphases, and strategies as well as results.

The Grady Memorial Hospital plan (25), Atlanta, reported by Davidson and coworkers (39,41), is implemented in a teaching hospital of the Emory School of Medicine. The hospital serves more than 5,000 diabetes mellitus patients. Contemporary strategies include having the patient, and frequently a family member, spend an entire day in the Diabetes Day Care Center where health care team members instruct patients in total health care. Over a one year period, a patient receives about 25 hours of individual and group instruction on diet. Each patient is given a personal copy of a color-coded, illustrated diet manual (25) which is used at home. Standard measurement equipment is given the patient to measure food serving

sizes. Follow-up care is continually available and observation of patients who are hypoglycemic or hyperglycemic takes place on a special observation ward. Davidson and coworkers (39,41) state that special attention is given to the literacy level of patients when providing dietary education. Methods used to attain such a level were not documented. The color-coded take home manual would require considerable explanation for the illiterate or semiliterate patient. The development of the foods used in the guide has been cited earlier in the literature review (21) and indicates cultural relevancy is of prime concern in the design of educational materials in the patient education program. Success in dietary behavioral changes has been measured by changes in weight, blood glucose values, and the number of disease complications. Caloric restriction therapy is intense, and one week fasting periods are used frequently with obese inpatients and outpatients. For the years 1970 to 1974, weight loss success rates of patient population varied from 50 to 90 percent with success rates increasing as follow-up monitoring intensified. Two-thirds of the patients on intensive diet therapy lost weight ($\bar{X}$ = 17 pounds) in a two year period, thereby lowering blood glucose levels more significantly than drug therapy. The glucose tolerance tests of many obese individuals had reverted to normal with reduction to ideal body weight. Another documentation of program success is shown by a decrease of hospital admissions for acute complications by 30 to 36 percent per year when comparing 1970 and 1972-74 statistics. Dietary behavior was not evaluated separately

since improved clinical indices were considered to indicate dietary compliance.

Chandalia and Bagrodia (19) conducted a highly simplified dietary education program emphasizing only a few important aspects of the diabetic diet. Nutritional counseling instructions were given for one hour in groups of three to five and patients did not receive any written instructions. The nutritional counseling discussion centered upon general nutritional knowledge basic to the disease, meal regularity and food division, common food exchangeability, and measurement of food serving sizes. The program was designed to compensate for low literacy levels by the use of oral interaction and the lack of written instruction. Cultural relevancy was considered by taking into account commonly eaten foods. Evaluation of the program was accomplished by testing the change in knowledge and blood glucose values. Weight was handled by asking patients with normal and stable body weights to continue normal food intake. Overweight patients were advised to reduce fat intake considerably and to reduce cereal intake at main meals by one-fourth. Twenty-one of 43 patients were overweight (20 percent above ideal body weight). The nutritional knowledge of patients was assessed by recording responses to three oral questionnaires each consisting of 10 questions. Question areas covered the relationship of calories, body weight, and physical activity, treatment of hypoglycemia, precautions taken when eating out, alcoholic and carbonated beverages, distribution of meals, and concentrated carbohydrates and artificial sweetening agents.

Achievement on the knowledge test was poor at initial testing. Questions had to be explained to patients. At the first and fourth week after nutritional counseling, achievement was improved. The effect of counseling on knowledge attainment was statistically significant ($p \leq 0.001$). The patients were divided into groups on the basis of blood glucose values at the end of the control period. Patients who had normal blood glucose levels were placed in group I and patients with abnormal levels were assigned to group II. The blood glucose levels for group II did not change significantly during the control period but were significantly reduced ($p \leq 0.001$) at the first and fourth weeks. No change occurred in blood glucose levels in group I.

Greene (47) described a behavior modification program for adult onset diabetes. The study was proposed to explore the use of behavior therapy techniques in the improvement of diabetic control by accomplishing a decrease in weight and blood glucose levels. Thirty-one experimental and eight control subjects participated in the program for a five-month period. Although attention to literacy level was not specifically addressed, oral interviews were used and education was provided on an individual basis utilizing a simple series of do's and don'ts directed toward specific changes in the environment to facilitate weight and diabetic control. Specific mention of cultural relevancy consideration was not made but the session on shopping integrated commonly eaten foods into the food shopping pattern. Sessions were divided into the theory of behavior modification,

stimulus control - act of eating, stimulus control - cue elimination, shopping, and maintenance. Recommendations were to eat from all four food groups, substitute lower calorie foods, and to increase fiber and polyunsaturated fat, consume only moderate amounts of saturated fat and cholesterol, and to eat sufficient protein. The basic emphasis was on internal control relative to the act of eating, environment situations, and general change in food habits instead of teaching fundamentals of the diabetic diet. Although results were not statistically significant, a trend toward weight loss was observed in that experimental subjects experienced a mean loss of 2.15 pounds between the initial and final visit. At the same time, the control group gained an average of 1.3 pounds. Patient session attendance varied. Patients missing sessions were less successful in weight reduction than those attending all sessions. Blood glucose values were significantly improved for the experimental over the control group ($p \leq 0.5$). The control group gained an average of 57.75 mg per 100 ml between the beginning and the end of the study whereas the experimental group mean values declined by 16.6 mg per 100 ml. Again, the trend was greater for participants who attended all sessions.

Chapter III

MATERIALS AND METHODS

A diabetic diet guide and an audiotape-slide presentation entitled, "How to Follow the Diabetic Diet Guide," were developed to train undereducated diabetes mellitus patients at the High Point Memorial Hospital in High Point, North Carolina. The purpose of the study was to evaluate the newly designed program. The objectives of the program were to improve patients' knowledge of diet and disease control as reflected by the improvement of clinical indices of weight, blood glucose levels, and minimal acute complications. The improvement in clinical indices was predicted to occur through patient dietary compliance.

Study Design

The staff of the High Point Memorial Hospital Outpatient clinic volunteered to assist in the study. Fifty-one diabetes mellitus patients of 100 potential participants consented to participate. Subjects were randomly assigned by sex and race by a ratio of about two (experimental) to one (control). Experimental subjects numbered 17 black females, 11 caucasian females, four black males, and one caucasian male for a total of 33 participants. However, the accidental death of one caucasian male reduced the experimental group to 32 subjects. The control population consisted of nine black females, six caucasian females, two black males, and one caucasian

male for a total of 18 control subjects. The age range for the total 50 participants completing the study was 25 to 81 years of age. Patient educational levels were diverse. Most patients over 50 years of age had had no formal education. Twenty (63 percent) experimental and twelve (67 percent) of the control subjects either had no formal education or had attended grade school. Of the total study population, 13 (26 percent) had attended high school. Three (six percent) had graduated from high school and two (four percent) had attended college.

Program Components and Evaluation Instruments

Literary Level

The program components, the diabetic diet guide and audiovisual presentation, as well as the evaluation instruments, were developed for the third grade level for undereducated diabetes mellitus patients as recommended by researchers (3-5). Wordlists (8), a checklist (18), and reading formulae (14-16) were utilized. Disease oriented language was analyzed by professional personnel to assure patient familiarity with terms as recommended (12-14). Additional suggestions that were utilized included oral emphasis (19-21), listening (11,21), visualization (6,24-28), and repetitive practice (23,27,31-33). The Grady Memorial Hospital (25), the North Carolina Select-A-Meal (26) and other researchers have previously utilized the visual approach in conjunction with visual images.

Cultural Relevancy

Both the guide and audiovisual presentation integrated foods in the forms eaten by study participants as found in working with non-study participant patients. Professional personnel[1] made recommendations based on knowledge of patients' eating habits for inclusion or exclusion of certain foods in the program components including evaluation instruments.

Diabetic Diet Guide

The diabetic diet guide (Appendix A), developed as a take-home patient educational tool, was patterned after the Grady Memorial Hospital (25) and the North Carolina Select-A-Meal (26) dietary guides. Both guides utilize the food exchange system (45) for following individualized diet prescriptions. The factors which were given particular attention in guide development included literacy level and cultural relevancy. The visual format of the guide provided ease of use for undereducated patients. To account for cultural relevancy foods depicted were those which were common to the area. Further, the foods were illustrated in forms available to the study participants. For example, the vegetable, spinach, was illustrated as frozen spinach in a carton.

Visually, the guide is a two way spiral bound, colored, visually oriented multiple-paged flip chart. The upper portion provides for writing in the diet prescription for each meal and snack time by the

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[1] Dietitians and faculty members of dissertation advisory committee.

number of servings specified for each food group. Other illustrations include actual food group names, realistically illustrated standard measurement methods, unrestricted (free) foods, and restricted foods. The lower portion shows the food serving sizes (colored realistically) in the milk, vegetable, fruit, starch, meat, and fat food groups.

Audiotape Slides

The accompanying fifteen-minute audiotape slide presentation entitled, "How to Follow the Diabetic Diet Guide" (script, Appendix B) uses a cartoon character to explain the illustrated diabetic diet guide. The presentation and guide reenforce the necessary concepts for optimal dietary compliance. The use of the guide provides practice in the application of concepts as recommended by researchers (27,31-33).

Data Collection Instruments

Instruments designed to collect data to determine program effectiveness were the knowledge test (Appendix C), the medical chart information sheet (Appendix D), and the 24-hour dietary recall format (Appendix E).

The knowledge test covers nutritional knowledge basic to diabetes mellitus (nine questions), foods in food groups (38 questions), food serving size measurement (13 questions), unrestricted foods (five questions), and restricted foods (five questions). The 70 questions require yes/no answers.

The medical chart information, measured by hospital personnel and using standard hospital procedures, included body weight, blood

glucose values, and acute complications by visit for each participant. Patients were routinely monitored once a month. If the health care personnel believed the patient's course of disease control was problematic or if the patient called because of illness, additional appointments were scheduled. Additional visits for such reasons were tabulated as acute complications. Emergency hospitalizations for diabetes mellitus problems such as ketoacidosis, dramatic weight gains, and fluctuating blood glucose levels were indicators.

The 24-hour recall format solicits information about eating times, actual foods eaten by food groups, the quantity of food eaten, serving size measurement methods, ways of preparing foods, and the utilization of unrestricted and restricted foods.

In the present study, the 24-hour recall was used at the initial, two month, and four month visits. The author personally interviewed each patient using informal discussion. Beginning questions dealt with when the patient first ate the previous day, what, and how much was eaten. Questions were asked in an accepting, nonthreatening, probing manner to elicit the necessary information.

The time sequence of the study involved program development, solicitation of participant consent, program implementation, and data collection. Program development encompassed the actual design of program and evaluation instruments. Participant consent was obtained and followed by a base line data collection using the knowledge test and the 24-hour dietary recall at the beginning of the study. Experimental subjects were given a diabetic guide and were shown the

audiovisual presentation. At two and four months after beginning the study, data were again collected by the use of the knowledge test and the 24-hour dietary recall. At the conclusion of the four month study, selected information from the patient's medical file was recorded on the medical chart information sheet.

Testing Program Components and Instruments

The basic program components and data collection instruments were developed and tested for literacy level and cultural relevancy.

Literacy Level

The total educational program was especially designed for the third grade reading level for low literacy level. The design was accomplished by the use of audiotape slides, visual emphasis, and flipcharts. Recommendations of researchers were followed by using learning techniques of listening (11), visual portrayal (6,23-28), and repetitive application and/or practice (27,31-33) of presented concepts. The literacy level of the diabetic diet guide was tested in several ways. Dietitians who worked with diabetes mellitus patient populations and members of the author's dissertation advisory committee reviewed and made recommendations relative to the general program component format, eating time portrayal, diet prescription provision, measurement techniques, illustrated drawings of unrestricted and restricted foods, and food group name presentation formats. In addition, the recognizability of foods was reviewed by the site

dietitian, two nurse practitioners, and 11 nonstudy participants.

The audiovisual presentation also was examined for literacy level in regard to concepts presented and the artwork and script promoting the concepts. The dietitians and dissertation advisory committee members checked for the inclusion of basic knowledge areas, manner of presentation, and the progressional portrayal of concepts. Concomitantly, the presentation was checked for systematic repetition and summarization of each concept to enhance learning. The foregoing actions afforded validity to the program components.

The knowledge test was examined by professional group members to assure that basic nutritional knowledge areas were included and that the question format was understandable. The same group checked to see if the 24-hour dietary recall format elicited complete and accurate information. The described procedures served to establish validity.

Cultural Relevancy

Cultural relevancy was also considered and tested for in several ways. One method was the consideration of educational level and learning style as discussed in the prior section. Both the diabetic diet guide and audiovisual presentation were developed and examined by professional group members and nonstudy participants. The program components were reviewed to assure that the foods included within food groups were those which were commonly eaten foods. The visual portrayal of the foods in the form used and the recommended serving size for compliance with the exchange system were examined for

cultural relevancy. The audiovisual presentation also provided for adding foods indicative of an individual's particular lifestyle. The data collection instruments were reviewed by the professional group members and tested with nonstudy participants for clarity of language in line with recommendations and for familiar disease-oriented terms (12-14). To enhance comprehensibility, instruments were administered orally.

Evaluation of Program

The field test evaluation focused on three types of indicators; knowledge, clinical indices, and dietary behavior.

Knowledge Test

The knowledge test described in this section, page 24, was designed to measure the knowledge of essential content presented by program components and therefore provides information necessary to test participant knowledge change. One indication of program effectiveness would be the increase of the dietary knowledge of diabetes mellitus patients. Knowledge test areas included basic nutritional knowledge related to the disease, the foods in the food groups, standard measurement methods to derive standard serving sizes, unrestricted foods, and restricted foods. A total of 70 questions comprised the test instrument.

Clinical Indices

A second indicator of program effectiveness was improvement in selected clinical indices for experimental over control subjects for body weight, blood glucose levels, and acute episodes or complications associated with the lack of dietary compliance. The changes in the clinical indices of body weight and blood glucose levels were measured by comparing parameters at testing times between the experimental and control groups.

Dietary Behavior

A third indication of program effectiveness was considered to be improved dietary behavior of experimental subjects. The 24-hour dietary recall data were analyzed qualitatively and expressed in terms of percentages.

Data Analysis

Knowledge scores, body weight readings, and blood glucose levels were statistically analyzed by analysis of covariance (ANCOVA) (58) with initial data serving as the covariates. Acute complications were analyzed by chi square comparisons between the experimental and control subjects for the total study period.

Chapter IV

FIELD TEST RESULTS

The evaluation of results concentrated on changes in knowledge, clinical indices, and dietary behavior. The parameters of knowledge and clinical indices were analyzed by analysis of covariance (ANCOVA). ANCOVA is a simple analysis of change from pretest to posttest which ensures that initial differences between two groups are taken into account. Initial data for knowledge, body weight, and blood glucose were used as covariates with the two and four month data at the criteria. The ANCOVA adjusted posttest values by controlling for initial differences (59).

Knowledge

As can be seen in Figure 1, the initial raw mean knowledge scores of control and experimental groups were $\bar{x} = 44.8 \pm 6.42$, 48.3 ± 6.18, respectively. The experimental group adjusted mean scores at two and four months were 65.2 ± 5.55, 67.0 ± 54.7 (raw means = $\bar{x} = 65.4 \pm 6.32$ and 67.3 ± 6.56). The control adjusted mean scores for two and four months were 47.3 ± 5.3, and 48.3 ± 4.9 (raw means = $\bar{x} = 44.9 \pm 6.1$, $\bar{x} = 45.6 \pm 5.9$), respectively. The difference at two months (using the initial results as covariates) was statistically significant $F(1,47) = 111.20$, $p \leq 0.0001$ (see Table 1). The difference at four months was also determined to be statistically reliable, $(F1,47) = 125.6$, $p \leq 0.001$ (see Table 1). The estimation of reliability of the knowledge test was determined by the Kuder

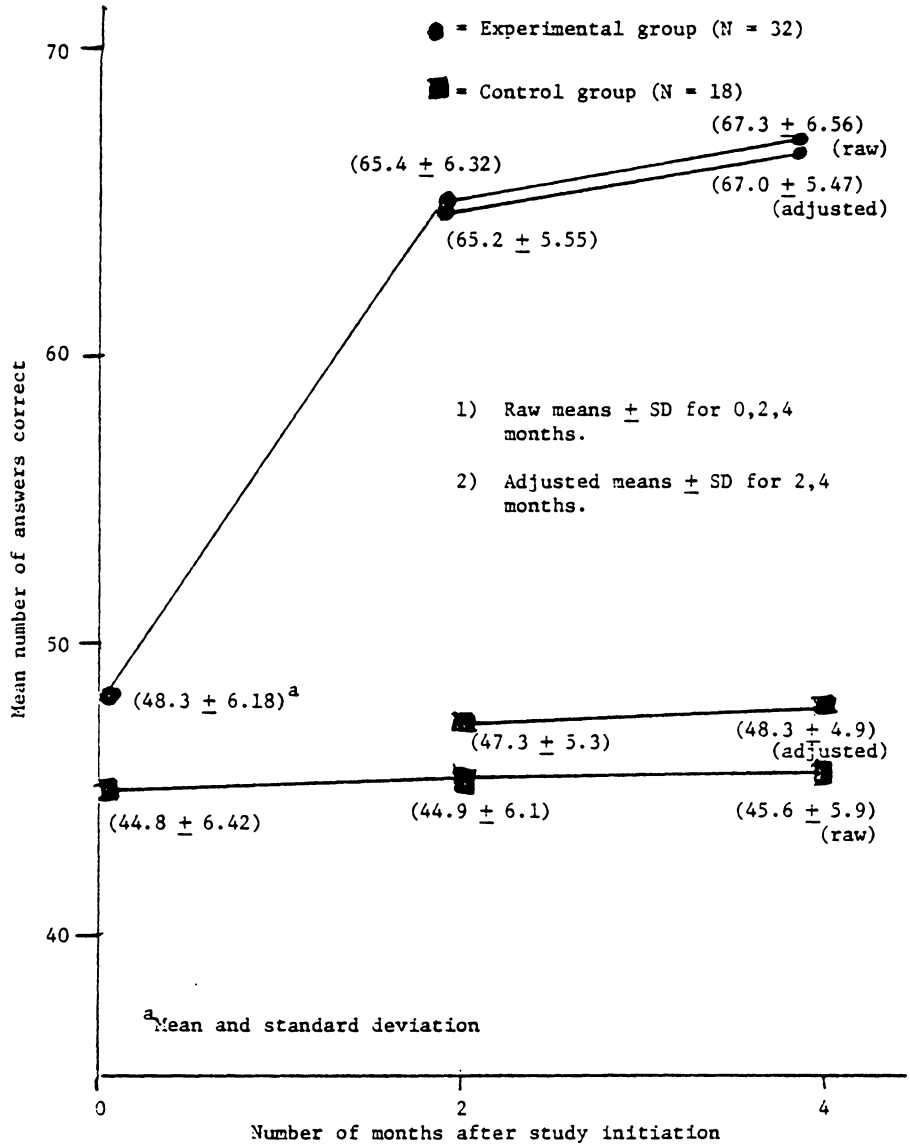

Figure 1. Mean number of correct answers for knowledge test administered to diabetes mellitus patients.

Table 1. Knowledge of diabetes mellitus patients at two months and four months

ANCOVA: (SAS Proc GLM Type IV)

Two months

Source	d.f.	SS	F	P
Group	1	3421.01	111.20	0.0001
Initial score	1	432.65	14.06	0.0005
Error	47	1405.93		

Four months

Source	d.f.	SS	F	P
Group	1	3756.13	125.55	0.0001
Initial score	1	551.74	18.44	0.0001
Error	47			

Richardson Formula 20 at the original test administration was 0.79 (60).

Weight

Figure 2 shows the adjusted and raw mean body weights of experimental and control participants. The raw mean body weights of experimental and control groups were 178.2 $\pm$ 38.1 and 177.3 $\pm$ 45.3, respectively. Control group participants increased in average body weight at two months as shown by adjusted mean weight of 178.91 $\pm$ 4.93 (raw $\bar{x}$ = 177.7 $\pm$ 44.7) and 181.20 $\pm$ 6.62 (raw $\bar{x}$ = 179.9 $\pm$ 46.1) at four months. The weight of the experimental subjects ranged from an adjusted mean of 179.61 $\pm$ 4.93 (raw $\bar{x}$ = 178.9 $\pm$ 38.2) at two months and an adjusted mean of 178.38 $\pm$ 6.62 (raw $\bar{x}$ = 177.6 $\pm$ 38.8) at four months. Although the difference was not statistically significant between groups at two months, $F(1,46) = 0.227$, $p = 0.636$, nor at four months, $F(1,46) = 2.083$, $p = 0.156$, the data reflect a trend in weight reduction for the experimental group (Table 2) (NOTE: The reading of an underweight male was deleted for ANCOVA analysis).

Blood Glucose

Blood glucose values (expressed as mg/100 ml) shown in figure 3 indicate recognizable differences between groups initially and over the study period. The adjusted mean values at 2 and 4 months for the control group were 215.4 $\pm$ 54.3 - 2 months and 222.2 $\pm$ 43.9 - 4 months. (raw $\bar{x}$ = 231 $\pm$ 75.3, and 220.5 $\pm$ 70.8, and 228.5 $\pm$ 69.1, respectively). For the experimental group, blood glucose values (raw mean 217.2 $\pm$ 77.7)

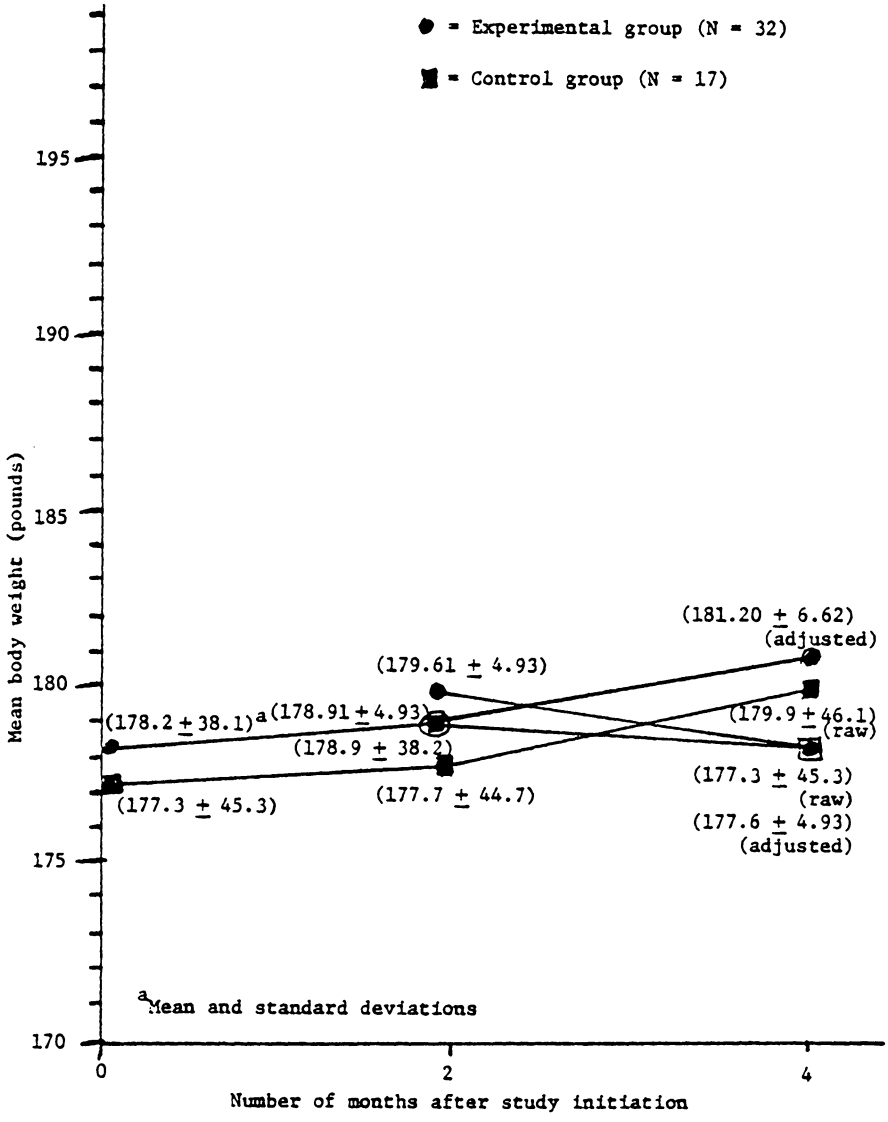

Figure 2. Mean body weight of diabetes mellitus patients.

Table 2. Body weights of diabetes mellitus patients at two and four months

1. Two months

ANCOVA: SPSS (analysis of variance and covariance procedure, default option)

Source	d.f.	SS	F	P
Initial weight	1	76107.95	-	-
Group	1	5.50	.226	0.636
Error	46	1117.69		

2. Four months

Source	d.f.	SS	F	P
Initial weight	1	78480.63	-	-
Group	1	91.19	2.08	0.156
Error	46	2013.31		

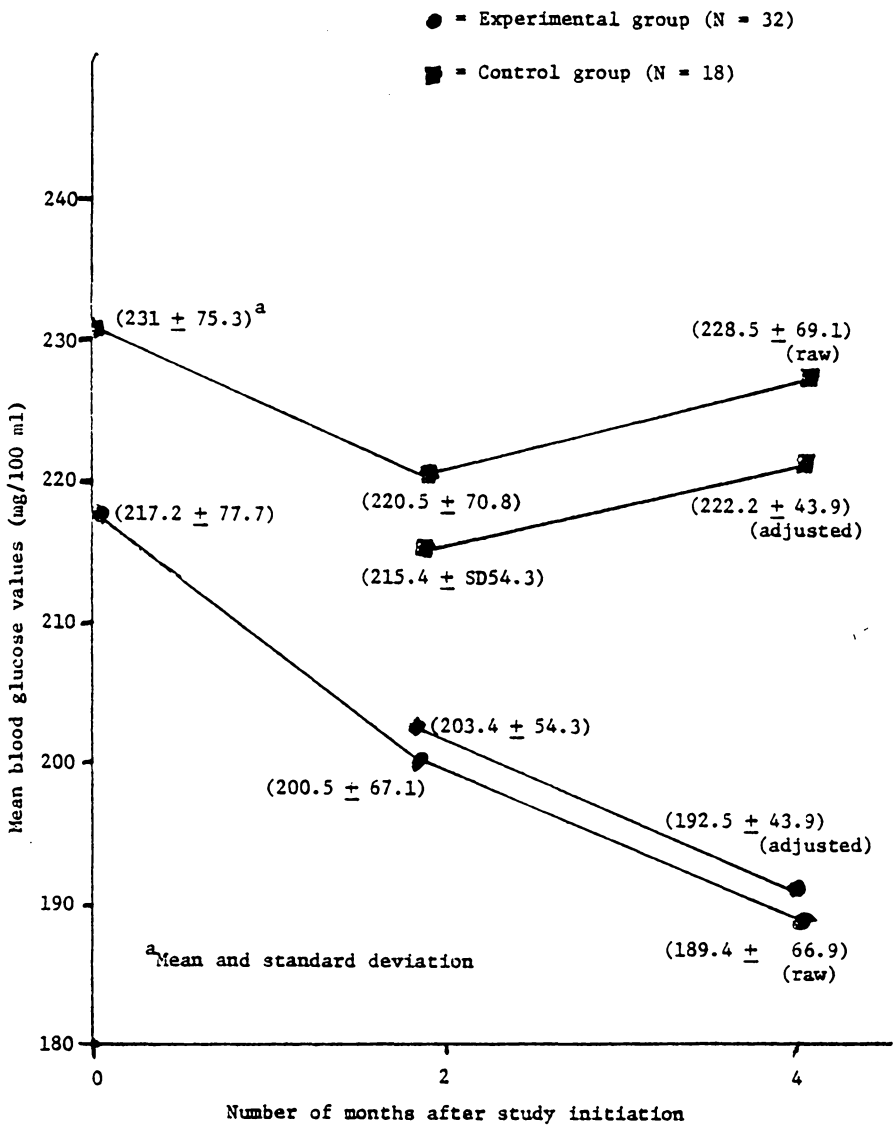

Figure 3. Mean blood glucose values of diabetes mellitus patients

were lower initially than the control group. Over the duration of the program, blood glucose levels for the experimental group declined to an adjusted mean of 203.4 $\pm$ 54.3 at 2 months (raw $\bar{x}$ = 200.5 $\pm$ 67.1) at two months. At four months adjusted means were $\bar{x}$ = 192.5 $\pm$ 43.9 (raw $\bar{x}$ = 189.4 $\pm$ 66.9). The data thus indicate a reduction for four months of a raw mean of 27.6 mg per 100 ml for the experimental and 3.2 mg per 100 ml for control participants. The trend for both groups is toward normality (fasting - 80 to 120 mg per 100 ml, 2 hour post-prandial - 120 to 140 mg per 100 ml) but the experimental group shows a more consistent decline. ANCOVA with the initial blood glucose value as the covariate determined $F(1,47) = 0.555$, $p = 0.460$, at two months. At four months, analysis indicated $F(1,47) = 5.092$, $p = 0.029$ indicating a statistically significant difference (Table 3).

Acute Complications

The acute complication frequency data are shown in Figure 4. The actual number of episodes for control participants (N = 18) exceeded the number of complications for the experimental participants (N = 32) except at two months when both groups had had five emergency visits. Chi square analysis of frequency data as shown in Table 4, reflects a significant difference of 15.8 at the $p \leq 0.05$ level for acute complications for experimental over control participants as does the mean number of complications. The control group had an average of 1.4 $\pm$ 2.1 acute complications and the experimental subjects had 0.4 $\pm$ .8 per participant.

Table 3. Blood glucose values of diabetes mellitus patients at two and four months

1. Dependent Variable - Two months

ANCOVA: SPSS (analysis of variance and covariance procedure, default option)

Source	d.f.	SS	F	P
Initial blood glucose	1	89132.7	-	
Group	1	1637.2	0.56	0.46
Error	47	138746.9		

2. Dependent Variable - Four months

Source	d.f.	SS	F	P
Initial blood glucose	1	137013.1	-	
Group	1	9828.3	5.09	0.029
Error	47	90717.7		

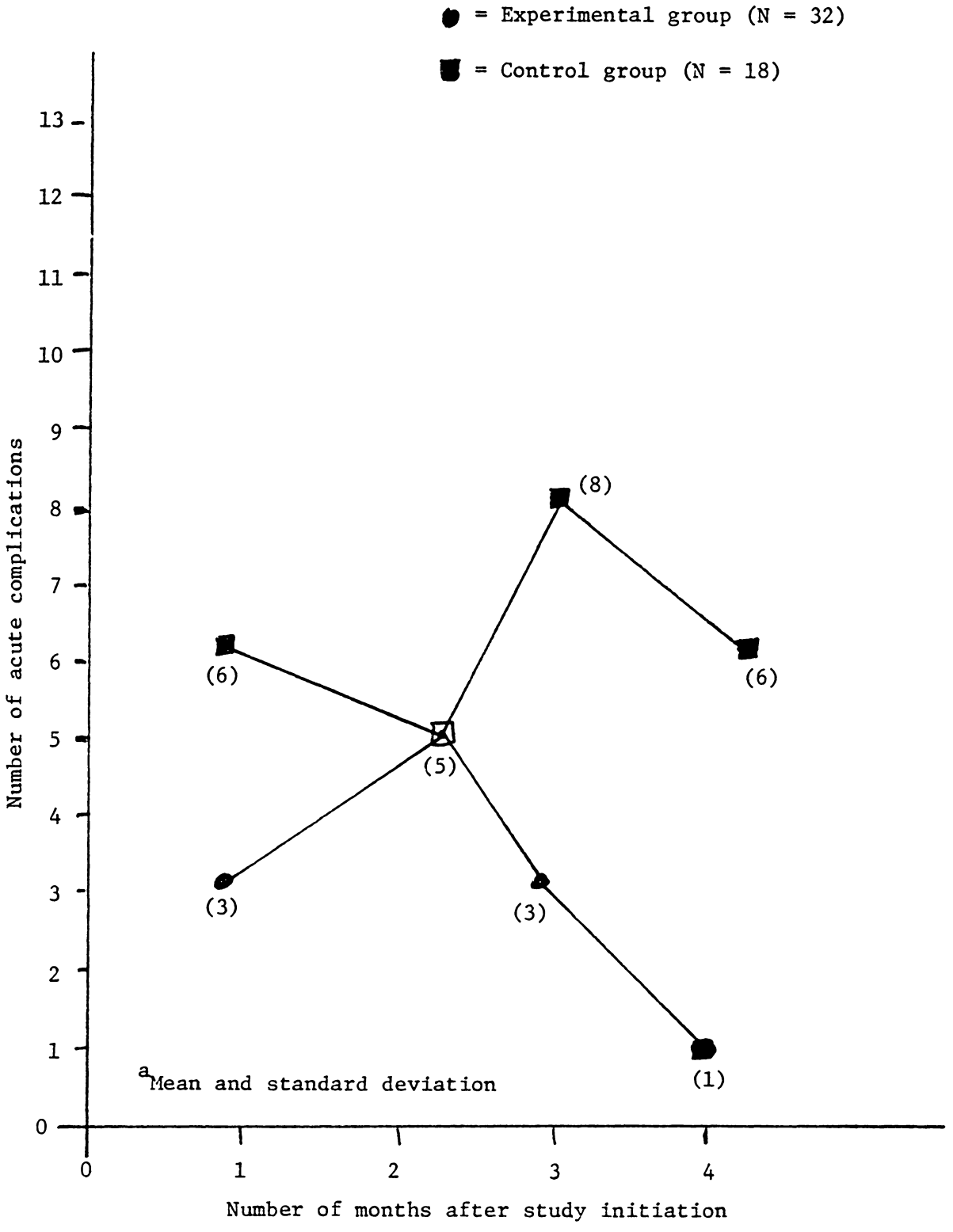

Figure 4. Acute complications of diabetes mellitus patients

Table 4. Number of acute complications per diabetes mellitus patient

	Number of complications			
Group	0	1	>1	Participants
Control	3	7	8	18
Experimental	21	10	1	32
	24	17	9	50

Chi square = 15.8, $p \leq 0.05$.

Dietary Behavior

Reported dietary behavioral data are less conducive to statistical manipulation than hard data, so qualitative analysis was done relative to when patients ate, foods eaten from food groups, serving sizes, method of serving size measurement, method of food preparation, and food consumption of unrestricted and restricted foods. The reported 24-hour dietary recall information was compared to the individual patient's diet prescription in order to ascertain dietary compliance.

The percent of compliance was derived by dividing the maximum number of food exchanges by the number reported as eaten. One hundred percent dietary compliance means that the patient consumes all prescribed foods by exchange groups in standard serving sizes.

At the beginning of the study 53 percent of the experimental patients and 50 percent of the control patients reported following the meal and snack spacing indicated by the diet prescription. Twenty-five percent of the experimental patients and 28 percent of the control patients reported having eaten only two meals a day. At the close of the study, 88 percent of the experimental patients and 56 percent of the control subjects reported following the prescribed meal and snack spacing as shown on the diet prescription in a routine manner with meals approximately four hours apart.

Initially 19 percent of the experimental and 16 percent of the control subjects reported total compliance (100 percent) with the prescribed foods for the food groups as required by the diet prescription. Examination of the three 24-hour dietary recall records

indicates improvement trends occurred relative to dietary compliance. At the end of the study, 50 percent of the experimental patient population reported following the diet prescription with a 95 to 100 percent compliance. Thirty-three percent of the control population at the time of the final recall record indicated dietary adherence with a 92 to 100 percent compliance (pooled percentages).

Patients did not report measuring food serving sizes using standard measurement methods at the start of the study (i.e., with ruler, cups, spoons, or scales). At the four month dietary recall, 50 percent of the experimental patient population reported that standard measurements were routinely used to measure sizes of food eaten or practice had enabled the patient to estimate serving sizes as compared with thirteen percent of the control population who either reported measuring foods by standard measurement methods at all times or that food sizes were also occasionally estimated by having practiced measuring serving sizes over time.

At the beginning of the study, close to 50 percent of both sample populations reported using fat in food preparation. At the end of the study, only 31 percent of the experimental participants reported using fat in preparing vegetables such as greens or in the frying of foods. There was no reported change in the use of fat in food preparation for control participants.

Close to 20 percent of both populations utilized unrestricted foods in diets as shown by the initial 24-hour dietary recall. About 35 percent of the experimental population reported using lettuce,

dietary beverages, and low calorie condiments at the end of the study. The practice of the control participants showed no change.

When testing patient knowledge during the pretest by asking which foods the patient had consumed the previous day which were unrestricted to the diet, patients in both populations were confused. Close to 33 percent of both populations named vegetables such as peas, beans, and tomatoes as examples of unrestricted foods. After four months, the experimental subjects accurately named the foods allowed in the diet in unlimited quantities. The control group exhibited no change in the knowledge of unrestricted foods.

At the outset of the study, patients of both populations were aware of the foods that were restricted from the diet. Rarely, if at all, were foods which were restricted reported as having been consumed by patients. A teaspoon of sugar was reported being used in coffee or tea by one or two patients. Patients reported using a sugar substitute in beverages.

Chapter V

DISCUSSION

The education program designed for the study accentuated attention on literacy level as recommended by several researchers (3-5). Wordlists (8), the checklist (18), and reading formulae (14-16) were used to develop the program at a third grade reading level. No reports were found in the literature relative to diabetes educational programs which indicated the preparation of educational materials at specific grade level. Nutritional education researcher recommendations which were utilized included oral emphasis (19-21), listening (11,23), visualization (6,24-28), and practice (23,27,31-33). A strength of the program developed for this study was the lack of reliance on written instructions to supplement visual images. Although researchers (6,25-28) have indicated the need for considering literacy level, only Davidson and Goldsmith (25) have indicated that literacy level was considered and documentation was lacking in that study.

Cultural relevancy emphasis centered on the commonly eaten foods as had been suggested by others (5,21,25,26,27,39,41). Actual documentation of cultural relevancy in program design has been relatively limited in that only a few researchers have mentioned considering that parameter. Nonstudy participants and outpatient staff personnel were helpful in selecting commonly eaten foods to be included in the guide.

The knowledge content emphasized in the program components was held to a minimum but followed the general consensus of earlier

researchers (23,25,28,39,41). The program integrated the topics of nutritional knowledge basic to the disease, foods in food groups, standard measurement methods for serving sizes, and unrestricted and restricted foods. Required knowledge is essential if behavior is to change beneficially. The knowledge increases for experimental subjects over control subjects, as shown in Figure 1, was statistically significant. Comparison with results of other studies is difficult in that measurement varies so widely. Most increases in knowledge reported in prior studies have been attributed to dietary behavior (1,37,49) or clinical indices change (19,39,41,47).

For optimal evaluation of the program, a reduction in clinical indices of weight and blood glucose values is desirable. The incidence of acute complications also reflect the degree to which patients, through expressed behavior, control the course of the disease.

Weight change results shown in Figure 2 were not statistically significant. However, the experimental subjects' mean weight loss at four months indicated a trend toward weight loss and stabilization. Despite the short duration of the study and other population factors such as age, race, and gender diversity, the total experimental population experienced greater success than did the control subjects. Fifty-nine percent of the experimental subjects lost some weight during the four month study. Twelve percent neither lost or gained. Twenty-nine percent gained weight. However, one patient gained twelve pounds which negated the losses of the patients who lost when mean values were calculated. The study results were less dramatic and

conclusive than results reported by Davidson and coworkers (39,41) or Greene (47). The Greene study covered a five month period, however, while the Davidson reports were annual. Therefore, comparison of results is difficult.

Blood glucose values consistently declined for the experimental patients throughout the study (See Figure 3). The comparison between groups determined by ANCOVA showed the difference between groups to be statistically significant at the end of the study ($p < 0.05$). The results agree with earlier findings reported by Chandalia and Bagrodia (19), Davidson and coworkers (39,41) and Greene (47).

Figure 4 represents the number of acute complications for the duration of the study. The results graphically show fewer complications for the experimental than for the control patients (i.e., fewer clinical appointments were required by experimental subjects). The low average number of acute complications for the experimental patients is attributed to the success of the patients in adhering to prescribed diets.

Dietary behavioral data are not as conclusive an indicator as clinical measurements. However, the observed qualitative dietary improvement correlates with desirable decreases in clinical indices of weight, blood glucose values, and acute complications for experimental patients.

Increased knowledge, decreased weight and blood glucose values, and minimal acute complications point to program success. Over the study, knowledge was greater for experimental than for subjects ($p \leq 0.0001$). A comparison of blood glucose levels showed a

significant decrease for experimental patients ($p < 0.05$). Difference in weight reduction between groups was not significant although a desirable trend was noted in the experimental group.

When examining results of selected educational programs, several differences were observed. The time frame for the studies follow: Chandalia and Bagrodia (19) one month, Davidson (39,41) one year, Greene (47) five months, and the current study four months. Another important parameter is that of professional educator time. Chandalia and Bagrodia (19) conducted a one hour teaching session with three to five individuals. Davidson and coworkers (39,41) reported that educational hours of approximately 25 hours per year are a combination of group and individual educational time. Greene's (47) behavior modification program was divided into four sessions. The program which is currently being evaluated utilized 20 to 25 minutes per patient at the time of the patient's appointment. If facilities were available for the audiovisual equipment, patients could intermittently review projected concepts without professional supervision. Another factor that eludes comparison among studies is the difference in educational levels and learning styles of the populations. The Chandalia and Bagrodia (19) study specified the population as semiliterate. Davidson and coworkers (39,41) mentioned that some patients were of low literacy level. The educational level of the population in Greene's (47) study was not indicated. In the present study, the majority of patients (64 percent) had no formal education or had attended grade school.

Another documented difference in the other studies is that consideration of patient literacy level is absent in the Davidson and coworkers study (39,41). Comment was made that materials were developed for literacy level but the way in which this was accomplished was not stated. The current study also was developed for cultural relevance to the particular population being educated. Although both Chandalia and Bagrodia (19) and Davidson and coworkers (39,41) actually seemed to consider individual lifestyles to some extent, no documentation was made. West (1) and Stone (37), among others, have indicated that the lack of attention to individual needs contributed to the failure of dietary adherence.

The current study shows that the newly developed program has been successful in educating undereducated diabetes mellitus patients in the realm of diet. The statement is statistically supported by the changes in knowledge, body weight, and blood glucose values as well as the fewer number of acute complications in the experimental subjects when compared to control subjects. Program success is further indicated by the observed qualitative changes reported in the three 24-hour dietary recall records. The differences in the initial and final data point to a definite improvement in eating habits relative to optimal practice in following the diabetic diet.

Chapter VI

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of the study was to develop and test an educational program for undereducated diabetes mellitus patients. The program designed integrated recommended emphases found in the literature for the development of educational programs for low literacy levels and accounted for cultural relevancy.

The program components were composed of the diabetic diet guide and an audiotape-slide presentation entitled, "How to Follow the Diabetic Diet Guide." Concentrated efforts were made to develop materials that were understandable by using techniques to assure for readability and applicable by providing for repetition and practice of concepts. The expertise of educators and professional dietitians was utilized to test the validity of concepts presented and comprehensibility of the language and formats used. In addition, undereducated diabetes mellitus patients volunteered cooperation in examining materials for realism, application to the daily dietary regimen, and for comprehensibility.

The guide and audiovisual presentation which reenforce each other are simple, to the point, colorful, visually understandable and interesting. The guide which is easy to follow and is used daily allows for repetitive application of required dietary principles.

The content emphasis was on the teaching of those concepts necessary for dietary control of the disease. The knowledge areas included were the nutritional knowledge basic to the disease, the

foods in the food groups, the measurement of serving sizes of foods using standard methods, unrestricted and restricted foods, the use of fat in food preparation, and the advocacy of an established eating routine throughout the day from day-to-day. In the diabetic diet guide, eating times, individual diet prescriptions, foods in food groups, serving sizes, standard measurement methods, unrestricted and restricted foods were pictorally depicted. The audiovisual presentation explaining the use of the guide utilized a unisexual cartoon character to convey necessary concepts. The materials were rigorously examined for comprehensibility through the use of wordlists, reading formulae, and checklists recommended by educational experts. Concomitantly, reports of successful educational strategies were explored and subsequently integrated into program development.

Evaluation instruments were designed to test the effectiveness of the program with a representative undereducated diabetes mellitus patient population. The instruments included a knowledge test, 24-hour dietary recall record, and a medical chart information record sheet.

After the program was designed, the field test trial was conducted with 50 participants served on an outpatient basis at the funded by health department High Point Memorial Hospital Outpatient Clinic. Consenting participants were randomly assigned to experimental and control groups by a ratio of two to one by race and sex. All data collection instruments were administered to all participants initially, and at two and four months. Administration was conducted orally to prevent embarrassment and obtain correct information. The educational

tools were presented to the experimental participants.

Statistical evaluation of the collected data at the end of the four month study period indicated success. The parameters that indicated success were increased knowledge, decreased weight, decreased blood glucose values, and fewer acute complications for experimental over control participants.

Variation in control and experimental participants were statistically controlled by the use of ANCOVA. The method used the initial scores or values as the covariate to control for initial differences between groups.

The knowledge scores of the group receiving the educational intervention differed significantly ($p \leq 0.0001$). The acquisition of necessary knowledge is essential to eventual behavior modification.

The idea that knowledge must precede behavior is reasonable. Indirect evidence that the desired behaviors were generated during the four month study is exemplified by the difference of blood glucose values at a significance level of $p < 0.05$ for the experimental group. Although weight reduction was less dramatic, definite trends to desirable body weight were observed. At the same time, fewer occurrences of acute complications were observed for the experimental than the control participants.

The general consensus is that diabetic control requires stabilization of clinical indices through dietary behavior. Dietary behavior is not conducive to statistical analysis but examination for qualitative changes can provide substantial information to determine

whether study participants are adhering to diet prescriptions. The qualitative exploration of 24-hour recall data conclusively indicated improved eating habits for experimental participants.

The newly designed program utilizing established and new educational techniques was successful in educating undereducated diabetes mellitus patients to follow the required diet. Particular attention to patient learning styles and cultural lifestyles has been proven to be a worthwhile endeavor. Success has been accomplished in an area that has long been declared a failure. The exploration and integration of diverse educational techniques and tools have yielded an educational program that works.

Since program success was achieved, recommendations are minimal. The researcher has two specific recommendations. One is to extend the length of the study period to six months or a year. Weight values are more likely to reflect dietary adherence for such a length of time. The second recommendation is to test the program with diverse populations in other geographical locations modifying the program to be relevant culturally to the population studied.

The author has an additional general recommendation. Nutritional education materials should be developed by the integration of the techniques used in the study. By accounting for literacy levels and cultural relevancy, improved educational results can be achieved.

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APPENDICES

Appendix A

DIABETIC DIET GUIDE

The original guide is spiral bound at both the top and bottom. The upper section is cut horizontally and flips back. The lower section is cut vertically into six sections and flips back.

The top section is color-coded by:

1. eating times - white
2. measurement techniques - yellow
3. free foods - individually colored on white
4. foods to avoid - cherry pink

The foods depicted by food groups in lower portion are individually colored on white.

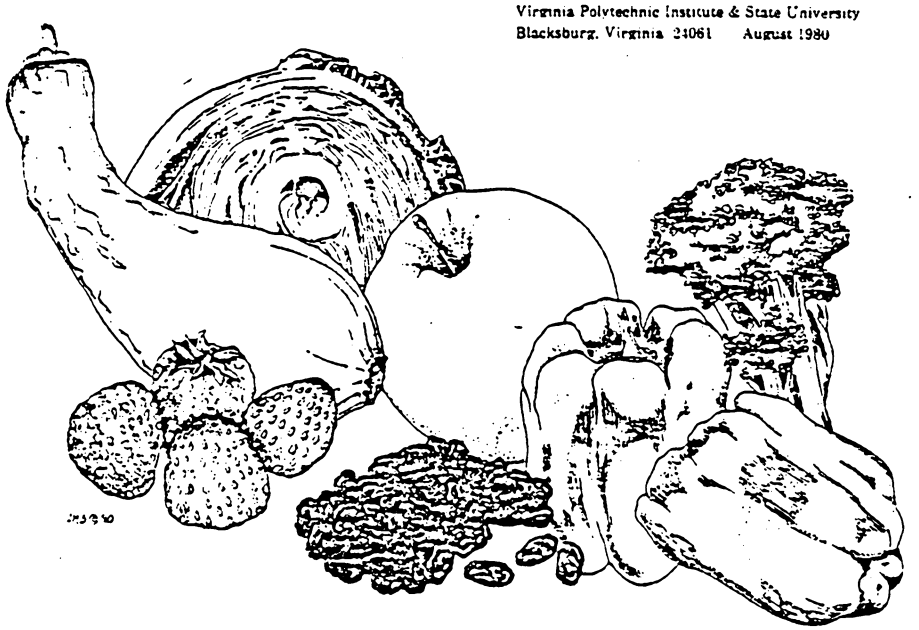
Page size was reduced by 35 percent.

DIABETIC DIET GUIDE

NAME _____

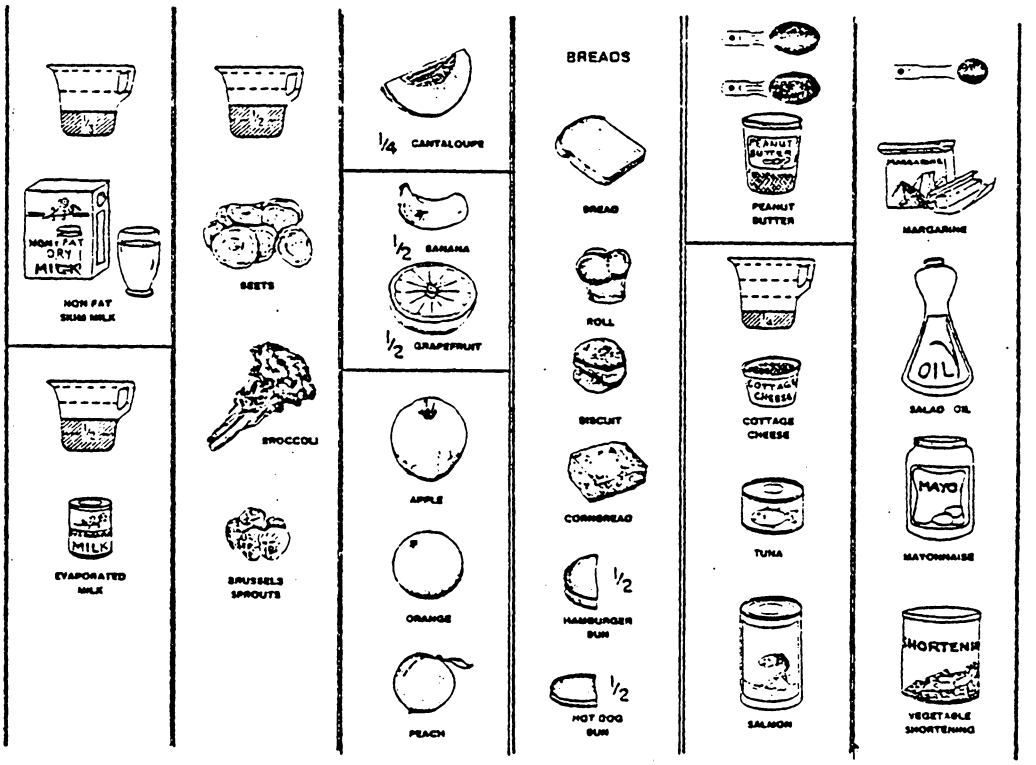
DESIGNED BY C. JEAN BARNES, M.S., R.D.
Illustrated by A. Marshall Baker

Department of Human Nutrition & Foods
Extension Division
Graphics & Photo Lab of the LRC
Virginia Polytechnic Institute & State University
Blacksburg, Virginia 24061 August 1980



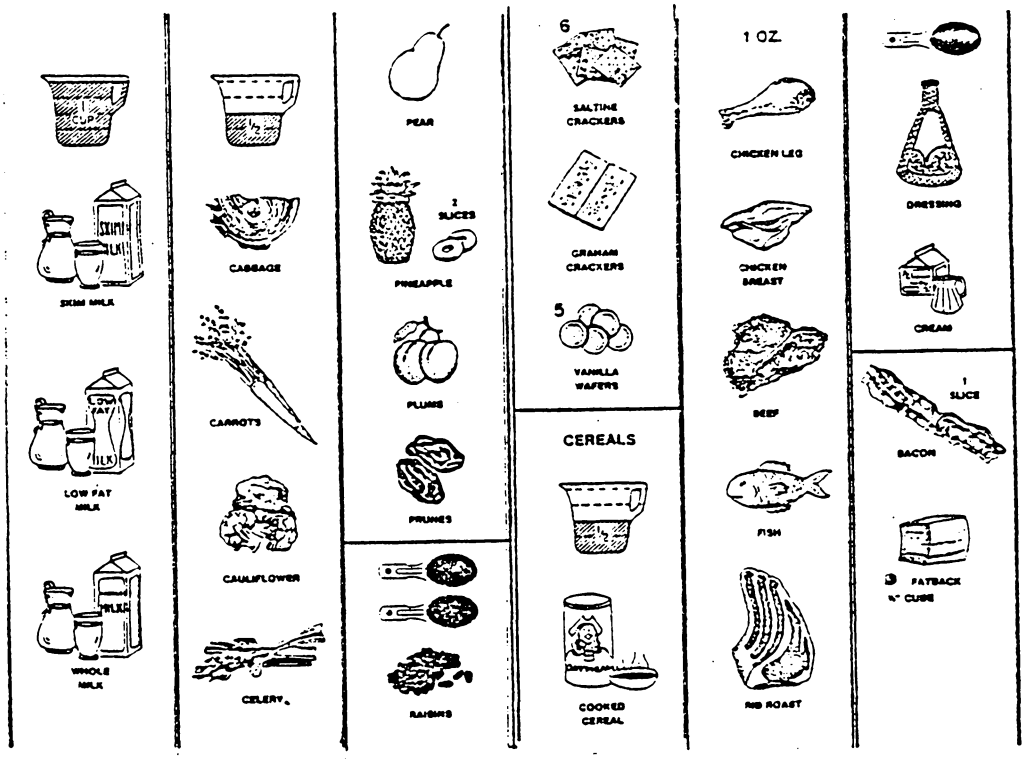
MORNING

NUMBER OF CHOICES					
1	0	2	1	1	1



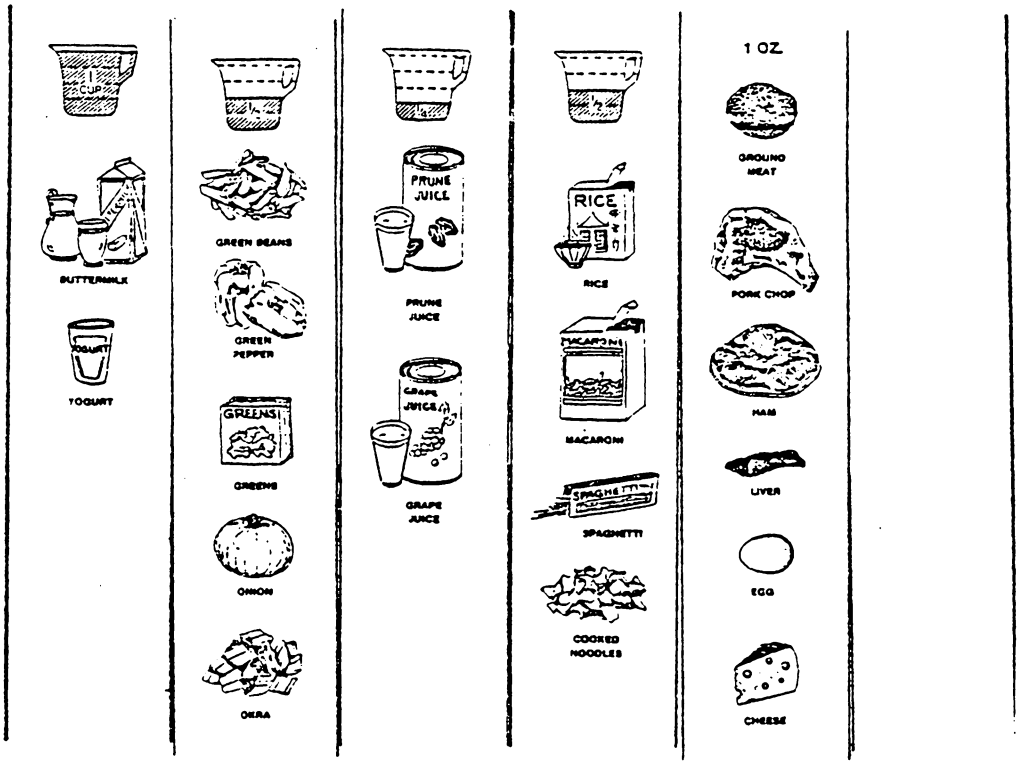
MID-MORNING

NUMBER OF CHOICES					



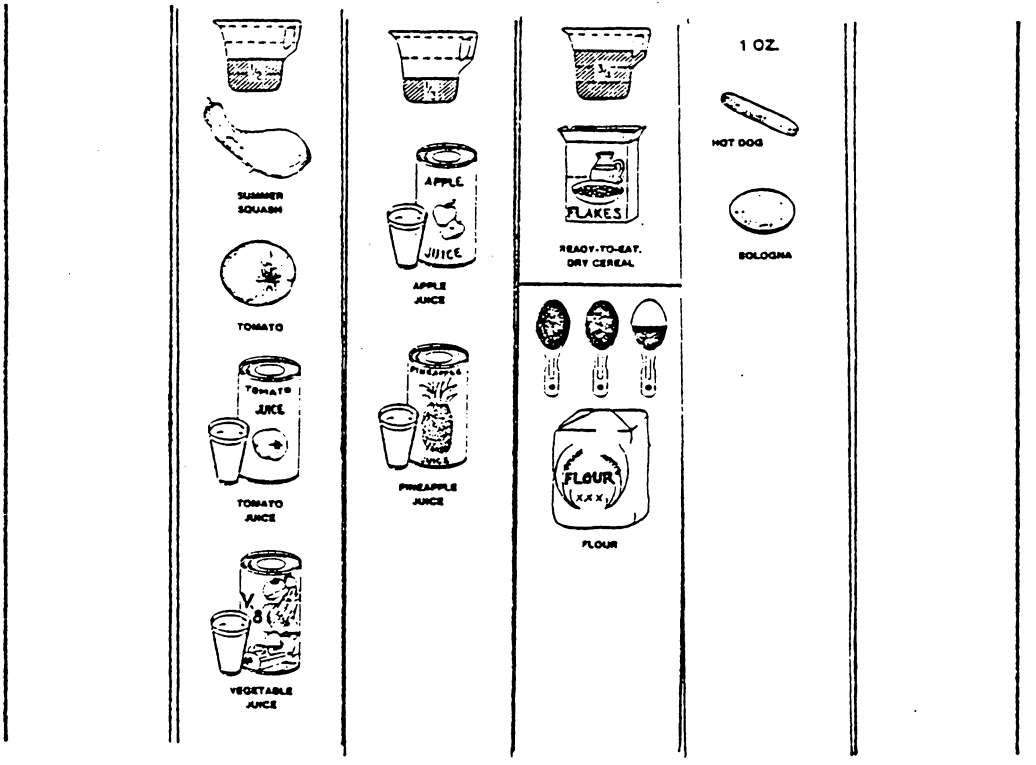
NOON

NUMBER OF CHOICES					
0	2	1	1	2	1



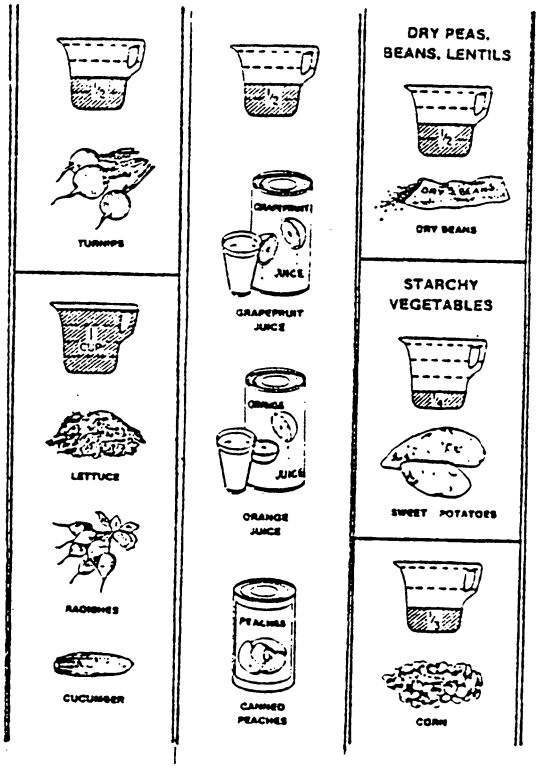
MID-AFTERNOON

NUMBER OF CHOICES					



EVENING

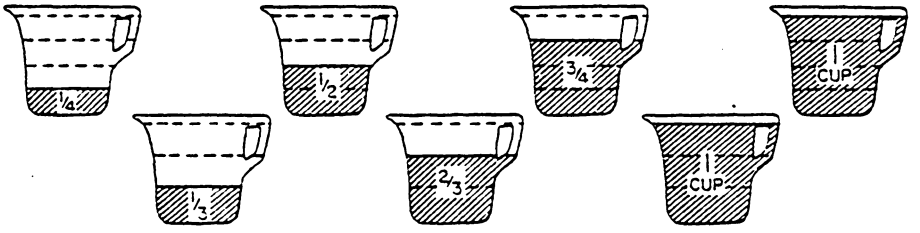
NUMBER OF CHOICES					



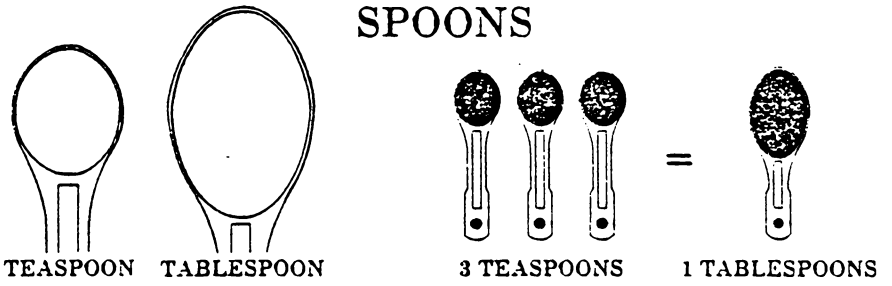
BEDTIME

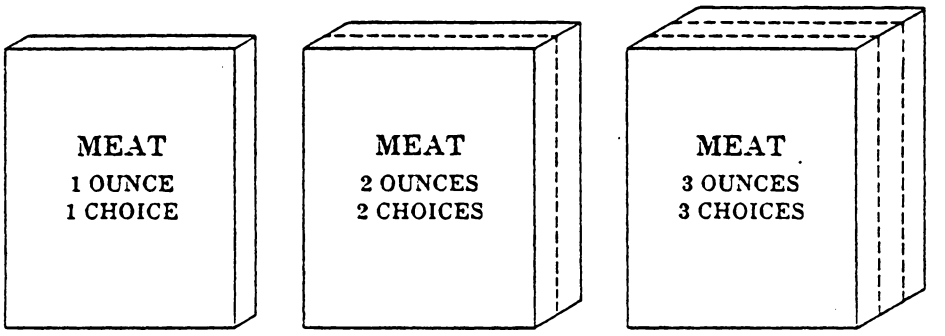
NUMBER OF CHOICES					
FOOD GROUPS					
MILK	VEGETABLE	FRUIT	STARCH	MEAT	FAT
		½ CANNED PINEAPPLE	½ PEAS		
		½ STRAWBERRIES	LIMA BEANS		
		1 CUP WATERMELON	POTATOES CREAM SOUP		
			⅓ CORN ON-THE-COB		

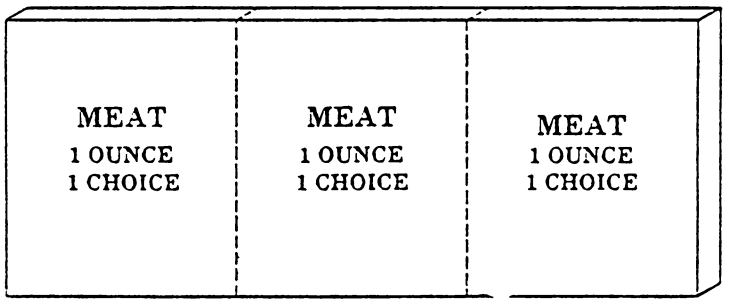
MEASURE LIQUIDS

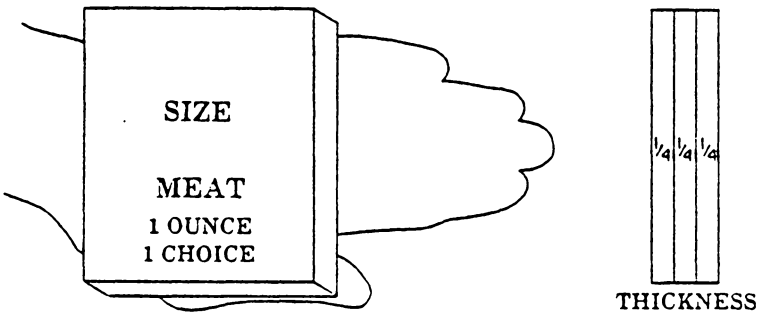


SPOONS




MEAT
1 OUNCE
1 CHOICE
MEAT
2 OUNCES
2 CHOICES
MEAT
3 OUNCES
3 CHOICES


MEAT
1 OUNCE
1 CHOICE
MEAT
1 OUNCE
1 CHOICE
MEAT
1 OUNCE
1 CHOICE


SIZE
MEAT
1 OUNCE
1 CHOICE
1/4 1/4 1/4
THICKNESS

FREE FOODS

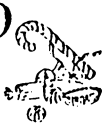

SALT & PEPPER
SPICES
DILL PICKLES
CUCUMBER
GARLIC
RADISHES
LEMON/LIME
LETTUCE
COFFEE
TEA
BOUILLON
ICED TEA
VINEGAR
DIET DRINK
MINT
UNSWEETENED GELATIN

NO

SUGAR

JAM/JELLY

GUM



CANDY

HONEY

SYRUP

SOFT DRINK

COOKIES

CAKE

DOUGHNUTS

PIE

Appendix B

SCRIPT. "HOW TO FOLLOW THE DIABETIC DIET GUIDE"

Slide #	Script
1	How to Follow Your Diabetic Diet
2	Presented by Department of Nutrition and Foods and Extension Service
3	Virginia Polytechnic Institute and State University Blacksburg, Virginia Developed by Jean Barnes
4	This slide series 1) tells how to use the diabetic diet guide, 2) reviews the foods in the guide, and 3) shows how to measure serving sizes of foods
5	There are many food guides that tell people what to eat. The diabetic diet guide plans diets for persons with diabetes.
6	The diabetic person needs food throughout the day.
7	The diabetic diet guide describes regular eating times, food choice patterns,
8	and measured serving sizes.
9	A person with diabetes should eat within one-half hour after waking and eat at the same times each day if a person is on insulin.
10	One might eat meals at the times shown in this slide. Actual eating times depend on a person's routine. Meals eaten throughout the day supply food energy evenly.
11	The number of snacks in the diabetic diet depends on the activity, age, size, and sex of the person and the treatment for diabetes. Larger, more active, younger persons need more food than smaller less active older persons.
12	The nutritionist can help the diabetic patient know what and when to eat. For example, when one does heavier exercise, extra food is needed.
13	A bedtime snack gives food energy while the person sleeps. A diabetic person should eat before going to bed if on insulin.
14	The diabetic patient needs to eat meals throughout the day by following a regular eating routine.

15 Foods can be grouped by milk, vegetables, fruits, starches, meats, and fats. The food groups are called exchanges or choices.

16 Follow the personal diet plan to control blood sugar and weight.

17 Many common foods are found in the food groupings. If a diabetic person can have foods not listed in the guide, the nutritionist can add it.

18 The first group is milk. Many kinds of milk are shown in the guide. Yogurt is here. Cheeses are in the meat group.

19 The nutritionists can help the diabetic person choose other foods if milk is not liked or cannot be a part of the diet.

20 The second group is vegetables. Foods in this group are low in calories and starch.

21 The third group is fruits. Most fruits can be eaten fresh, frozen, or canned for snacks, desserts, and salads. A diabetic person should avoid sweetened juices, and fruits packed in sugar or heavy syrups.

22 The fourth group is starch. Breads, crackers, cereals, dried beans, and starchy vegetables belong here as well as many other starch foods.

23 The fifth group is meat. The nutritionist can help the diabetic person choose other foods from this group if meat is not included in the diet.

24 The sixth group is fats. Fats and oils are used in spreads, salad dressings, and for frying. Fats are high in calories.

25 Can you name the food groups? They are milk, vegetables, fruits, starches, meats, and fats.

26 By using the diabetic diet guide, one learns the foods in the food groups. Serving sizes are important, too. Serving sizes are measured using cups, spoons, scales, and rulers.

27 Serving sizes should be measured when on the diabetic diet until one can correctly estimate them.

28 The use of standard measuring cups is one way to measure serving sizes.

29 Standard measuring cups may be made of glass, metal, or plastic. Marked jars may be used too. Do not use a coffee cup unless you know its size.

30 Liquids are easier to measure if the cup has space above the fill line to avoid spilling.

31 Nonfat dry milk powder and water equals liquid skim milk. Use 1/3 cup powder and fill with water to the one cup line.

32 The serving size of cooked and raw vegetables is one-half cup.

33 The serving size of fruit depends on how much natural sugar is in it. The guide tells serving sizes for each fruit.

34 The serving size for cooked cereal is one-half cup.

35 The serving sizes of starchy vegetables vary. Check serving sizes in the diet guide. Some of these are different from those in the vegetable group.

36 Canned fish and cottage cheese from the meat group may be measured as 1/4 cup.

37 Foods can be measured with standard measuring spoons, too. Be sure the measure is level.

38 A serving size of flour, a starch, is two and one-half tablespoons. Flour is used as a thickener for sauces, soups, and gravies.

39 A serving of the fats pictured is one teaspoon.

40 One serving of light or sour cream, also fats, is two tablespoons. Some people use light cream in hot beverages or over fruit desserts.

41 The serving size for salad dressing is one tablespoon. French dressing or vinegar and oil are also choices from the fat group.

42 We have talked about using cups, tablespoons, and teaspoons to measure serving sizes. There are other ways to measure food.

43 Another way to measure serving size is by number such as six crackers, five vanilla wafers or two plums.

44 Foods in the meat group can be weighed or measured by a ruler. This slide shows foods that are one meat choice.

45 One choice from the meat group equals one ounce of meat. This slide shows how to measure one meat choice with a ruler.

46 Remember one choice is 2 1/2" wide and 1/4" thick. So two choices is two times as thick. Three choices would be three times as thick.

47 This example shows meat the same thickness as one choice of meat but three times as long.

48 One choice is the size of your palm and about 1/4" thick. Two choices would be two times as thick - 1/2". Three choices would be three times as thick - 3/4" thick.

49 Scales can be used to weigh meat choices. One ounce is one meat choice. Two ounces are two choices. Three ounces are three choices.

50 The use of standard measuring cups, spoons, rulers, scales, and the palm of the hand have been explained for all kinds of foods.

51 Free foods can be eaten any time in any amount. These foods have few calories, and little sugar or starch.

52 Foods with refined sugar should not be used in a diabetic diet. See the guide for foods to avoid.

53 Too little food or too little carbohydrate may cause low blood sugar for anyone. Just coffee and toast do not give enough food to supply an even energy supply for the person with diabetes.

54 Skipping meals can easily make a person with diabetes dizzy, weal, or lightheaded.

55 Too much food can cause the urine and blood to be high in sugar and make the diabetic person very thirsty. How does the diabetic person keep from having high or low blood sugar? One can control blood sugar by following the diabetic diet.

56 To review, the diabetic diet plans give numbers of food choices for meal times or for meals and snacks.

57 Remember that routine eating times, measured serving sizes of food choices for meals and snacks are important for the diabetic person. Following the diet controls the diabetes.

58 Can you plan a meal like this?

59 1. If milk is in your diet plan, measure it using a standard measuring cup.

60 2. Which fruits would you choose for the morning meal? This plan has two choices. Do you want an orange, orange juice, banana, or an apple? Let us choose an orange and 1/2 of a banana.

61 3. What starches would you like? The sample diet gives one choice. Would you like 1/2 cup cooked cereal or a slice of toast?

62 4. Which meat group food would you choose? There are a number of choices such as a poached egg or a piece of cheese.

63 5. Most people like margarine on toast. Why not use the one fat choice here?

64 Now, this is a complete morning meal following a sample diet plan.

65 Do you think you can use the diabetic diet guide to plan for the whole day just as we did for the morning meal?

66 The steps for following a diabetic diet have been explained. Practice will make meal planning easier. Eat all meals at regular times, use all food choices, and measure serving sizes of foods.

67 THE END.

Appendix C

KNOWLEDGE TEST

HOW TO FOLLOW YOUR DIABETIC DIET"

COL# CODE
1-2____ID

3-4____Card #

1. A diabetic patient should eat at approximately the same times each day.

5__1__* 1 Yes 2 No

2. The number of snacks allowed on a diabetic diet depend upon

6__1__ 1 Yes 2 No The size of the person

7__1__ 1 Yes 2 No The sex of the person

8__1__ 1 Yes 2 No The activity level of the person

9__1__ 1 Yes 2 No The type of treatment prescribed

3. When on a diabetic diet, is it all right to skil meals?

10_2__ 1 Yes 2 No

4. Can a person control the following things by following the diabetic diet?

11_1__ 1 Yes 2 No The amount of sugar in the blood

12_1__ 1 Yes 2 No The amount of sugar in the urine

5. Heavier exercise or prolonged exercise may require more food than light exercise for a short time.

13_1__ 1 Yes 2 No

6. Which of the following foods are in the milk group?

14_1__ 1 Yes 2 No All liquid milks

15_2__ 1 Yes 2 No Cottage cheese

16_2__ 1 Yes 2 No Yogurt

17_2__ 1 Yes 2 No Cheese

18_1__ 1 Yes 2 No Cream

*Correct answer

7. Which of the following foods are in the vegetable group?

19 1 — 1 Yes 2 No — Tomato juice

20 1 — 1 Yes 2 No — Broccoli

21 2 — 1 Yes 2 No — Potatoes (white and sweet)

22 2 — 1 Yes 2 No — Green peas

23 1 — 1 Yes 2 No — Greens

8. Which of the following foods are in the fruit group?

24 1 — 1 Yes 2 No — Orange juice

25 1 — 1 Yes 2 No — Bananas

26 2 — 1 Yes 2 No — Tomatoes

27 1 — 1 Yes 2 No — Canned peaches

28 1 — 1 Yes 2 No — Plums

9. Which of the following foods are in the starch group?

29 1 — 1 Yes 2 No — Breads

30 1 — 1 Yes 2 No — Dried beans, peas, legumes

31 2 — 1 Yes 2 No — Carrots

32 1 — 1 Yes 2 No — Oatmeal, grits, barley

33 1 — 1 Yes 2 No — Green peas

10. Which of the following foods are in the meat group?

34 1 — 1 Yes 2 No — Eggs

35 1 — 1 Yes 2 No — Cheese

36 1 — 1 Yes 2 No — Luncheon meats

37 2 — 1 Yes 2 No — Bacon

38 1 — 1 Yes 2 No — Fish

11. Which of the following foods are in the fat group?

39 2	1 Yes	2 No	Pork chop		
40 1	1 Yes	2 No	Salad dressing		
41 1	1 Yes	2 No	Cream		
42 1	1 Yes	2 No	Margarine		

12. Are the following food choices measured by the following standard measurement?

43 1	1 Yes	2 No	Cups	Milk
44 2	1 Yes	2 No	Cups	Hot dog
45 1	1 Yes	2 No	Tablespoons	Cream/Peanut butter
46 1	1 Yes	2 No	Ruler	Roast beef
47 1	1 Yes	2 No	Scales	Boned chicken
48 2	1 Yes	2 No	Scales	Bananas

13. Which of the following foods may be eaten in unlimited amounts on the diabetic diet?

49 2	1 Yes	2 No	Green peas
50 2	1 Yes	2 No	Tomatoes
51 1	1 Yes	2 No	Lettuce
52 2	1 Yes	2 No	Gravies
53 2	1 Yes	2 No	Soft drinks

14. Which of the following items should be avoided on the diabetic diet?

54 1	1 Yes	2 No	Honey
55 2	1 Yes	2 No	Fruits canned in water or juice
56 1	1 Yes	2 No	Sugar
57 1	1 Yes	2 No	Cakes/pies
58 2	1 Yes	2 No	Beverages without sugar

15. What is the measurement for a food choice for the following foods?

59 1 1 Yes 2 No 1/2 banana

60 2 1 Yes 2 No 1 cup orange juice

61 1 1 Yes 2 No 1/2 cup tomatoes

62 2 1 Yes 2 No 2 slices bread

63 2 1 Yes 2 No 1 cup pinto beans

64 2 1 Yes 2 No 1/2 cup tuna

65 1 1 Yes 2 No 1 teaspoon margarine/salad dressing

16. Are the following food groups used in the diabetic diet guide?

66 2 1 Yes 2 No Breads

67 1 1 Yes 2 No Vegetables

68 1 1 Yes 2 No Fruits

69 2 1 Yes 2 No Breads and cereals

70 1 1 Yes 2 No Starch

71 1 1 Yes 2 No Meat

72 1 1 Yes 2 No Fat

73 1 1 Yes 2 No Milk

74 2 1 Yes 2 No Dairy products

Appendix D

MEDICAL CHART INFORMATION RECORD SHEET

RECORD OF LABORATORY INDICES - DIABETES OUTPATIENT CLINIC STUDY

1. ID #_____ NAME_____
first middle LAST

2. TREATMENT_____

3. FBG - Fasting Blood Glucose; PBG - Postprandrial Blood Glucose

a. Visit Date	b. FBG Value	c. PBG Value

4. Weight readings. Height_____ IBW_____

a. Visit Date	b. Reading	c. Change

5. Acute complications. (Problems that occurred between visits).

a. Date	b. Problem	c. Treatment

MISCELLANEOUS

Appendix E

24-HOUR DIETARY RECALL RECORD

RECORD TWENTY-FOUR HOUR RECALL:

ID#_____ NAME_____
First middle LAST

DATE OF VISIT_____ 1 2 3 4

FOOD GROUP	#	AM TIME	#	MID AM TIME	#	NOON TIME	#	MID PM TIME	#	EVE TIME	#	MID PM TIME	MISC
		Food Amt. Prep.		Food Amt. Prep.		Food Amt. Prep.		Food Amt. Prep.		Food Amt. Prep.		Food Amt. Prep.	
MILK													
VEG.													
FRUIT													
STARCH													
MEAT													
FAT													
OTHER													

[1]Amt. - Amount shown by cup (C); teaspoon (t); tablespoon (T); ounces (oz.); Estimate (E); Not measure (NM).

[2]Prep. - Method used to prepare food recorded as purchased (P); Boil/Steam (BS); Bake (B); Broil (BR) Roast (R); Raw (Raw).

Which of the foods that you ate yesterday could be eaten in unlimited quantities or can be called free?_____

Which of the foods that you ate yesterday could be foods that should be avoided on a diabetic diet?_____

COMMENTS:

The vita has been removed from the scanned document

EVALUATION OF THE EFFECTIVENESS OF AN EDUCATIONAL PROGRAM DESIGNED TO TRAIN UNDEREDUCATED DIABETES MELLITUS PATIENTS TO FOLLOW THE DIABETIC DIET

by

Clara Jean H. Barnes

(ABSTRACT)

The study was conducted for the purpose of designing and evaluating an educational program for undereducated diabetes mellitus patients. The program as designed integrated recommended emphases found in the literature for the development of educational programs for low literacy levels and accounted for cultural relevancy.

Developed program components were the diabetic diet guide and an audiotape-slide presentation entitled, "How to Follow the Diabetic Diet Guide." Concentrated efforts were made to develop understandable and applicable dietary education materials. Educator and professional dietitian expertise were utilized in the formation and completion of the program design. Patients similar to potential study participants voluntarily served as trial learners provided input relative to realistic content transmission, application to the daily dietary regimen, and comprehensibility.

The program components are clear, concise, colorful, visually-oriented, and interesting. The provision of an easy-to-follow guide for regular home use allows for repetitive application of required dietary principles.

The content emphasis was on the necessary concepts for dietary control of the disease. Knowledge areas included nutritional knowledge basic to the disease, the foods in food groups, the measurement of serving sizes of foods using standard methods, unrestricted foods, restricted foods, the use of fat in food preparation, and the advocacy of an established eating routine throughout the day from day-to-day. In the diabetic diet guide, the aforementioned concepts were clearly and colorfully presented so that literacy was not required. The same concepts utilizing portions of the guide were reenforced by a unisex cartoon character explaining use of the guide.

Evaluation instruments were designed to test program effectiveness with an undereducated diabetes mellitus patient population. The instruments (developed by the researcher) were a 70-item knowledge test, a 24-hour recall record, and a medical chart information sheet.

A field test trial was conducted with 50 participants who are served on an outpatient basis. The site was the High Point Memorial Hospital Outpatient Clinic, funded by the health department. Fifty consenting participants were randomly assigned to experimental and control groups by a ratio of two to one by race and sex. Thirty-two experimental and 18 control subjects completed the study. All data collection was orally solicited initially, at two months, and at four months. The educational intervention was presented only to experimental subjects.

Evaluation of increments in knowledge, decreases in weight, blood glucose values, and minimal acute complications indicated the newly designed program was successful. The data was subjected to

statistical analysis using analysis of covariance. The initial scores or readings were used as covariates to control for initial variances.

Knowledge scores improved significantly from the beginning to the end of the study ($p \leq 0.0001$). Knowledge attainment must occur for subsequent application as reflected by clinical measurements.

The desirable clinical measurements were generated during the four-month study as shown by statistically significant decreases in blood glucose values ($p < 0.05$) and a pronounced trend in weight loss. A further indication of success was that the experimental population had fewer acute complications than the control subjects.