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## An Audio-Tutorial Diet Instruction Program for the Educationally Disadvantaged Hemodialysis Patient

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To the Graduate Council:

I am submitting herewith a thesis written by Virginia King Lawson entitled "An Audio-Tutorial Diet Instruction Program for the Educationally Disadvantaged Hemodialysis Patient." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Nutrition.

Mary Nelle Traylor, Major Professor

We have read this thesis and recommend its acceptance:

Jane R. Savage, William D. Barber

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

November 14, 1973

To the Graduate Council:

I am submitting herewith a thesis written by Virginia King Lawson entitled "An Audio-Tutorial Diet Instruction Program for the Educationally Disadvantaged Hemodialysis Patient." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Nutrition.

Mary Nellie Taylor  
Major Professor

We have read this thesis  
and recommend its acceptance:

Jane R. Savage

William J. Barber

Accepted for the Council:

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AN AUDIO-TUTORIAL DIET INSTRUCTION PROGRAM FOR THE  
EDUCATIONALLY DISADVANTAGED HEMODIALYSIS PATIENT

---

A Thesis  
Presented to  
The Graduate Council of  
The University of Tennessee

---

In Partial Fulfillment  
of the Requirements for the Degree  
Master of Science

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by  
Virginia King Lawson

December 1973

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V.K.L.

## ABSTRACT

Four 10-13 minute color video-tape cassettes were developed and used as a self instructional program. The cassettes were designed to reinforce the initial one-to-one therapeutic diet instruction which is routinely given by the hospital dietitian to maintenance hemodialysis patients. The tapes were shown to the subjects used in this study while they were receiving dialysis therapy in The University of Tennessee Artificial Kidney Center.

One cassette each was prepared pertaining to the dietary adjustments for protein, sodium and fluids, potassium and kilocalories. The content of the tapes was primarily directed to the needs of the educationally disadvantaged, thus obviating the use of printed words in both the information presented and the self-test which was built into each tape. Graphics, cartoon characters with dialogue, food models, actual food examples, live demonstrations and line drawings for the self tests were coordinated with appropriate narration in order to emphasize important components of the diet prescription.

Sixteen subjects were randomly selected to participate in the study. Grades completed in school by these subjects ranged from second grade through the junior year in college. This population sample provided an educational and socioeconomic cross-section of the 29 patients who were currently undergoing maintenance hemodialysis in the Center. In order to assess the efficacy

of the instructional program toward increasing adherence to the diet prescription, identical information and behavioral tests were administered both before the presentation of the video-tapes and one month following the presentation.

Results of the study revealed a statistically significant ( $P < 0.001$ ) increase in the informational recall scores of all participants following instruction by the audio-tutorial program. As was expected, the less educated group effected the greater improvement.

To ascertain the change in dietary adherence, a 24-hour recall of food intake was recorded for each patient at both pre-testing and post-testing. While the dietary recall method lacks precision, the unaccountable errors in estimation of food ingested were considered to be similar at each testing period. Significant changes in percentages of adherence to the diet prescription were observed for kilocalories, sodium and water. The change in protein ingestion was positive for all subjects, but nonsignificant. The better educated group effected a significant, positive change in kilocalorie intake. Both groups showed an understanding of the importance of restricting sodium intake, but need additional reinforcement to achieve the prescribed level. Water was the only dietary variable which approximated the diet prescription at pre-testing. The less educated subjects exhibited a significant decrease in water intake, while the better educated group decreased water intake only slightly.



These changes suggest that diet prescriptions designed to achieve more desirable biochemical profiles are realistic, and with adequate reinforcement, improved behavior should follow.

It was concluded that: (a) the audio-tutorial program was a successful technique for teaching information to the hemodialysis patients participating in this study, regardless of educational background; and (b) further reinforcement measures are required to achieve sufficient application of the information learned in order to attain the desirable adherence to the diet prescription.

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## CHAPTER I

### INTRODUCTION

Burgeoning costs of health care delivery services make it exigent that the entire health profession synergize their efforts toward reducing the number of hospital admissions (1). This assertion is particularly germane for the dietitian and nutritionist considering chronically ill patients, such as those with advanced renal disease, since the ramifications of failure to adhere to the diet prescription are a frequent cause of recurrent hospitalization in these individuals (2). The responsibility of devising more effective techniques for motivating the patient to follow his therapeutic diet must clearly be assumed by the dietitian and the nutritionist (3).

In the hospital setting, the dietitian:patient ratio is often so low that time is insufficient to afford the necessary conferences with each patient which will assure an appreciable inculcation of his modified diet prescription (4). The customary procedure for instructing the patient in his therapeutic diet consists of a didactic elucidation of the appropriate printed diet form used in the hospital or clinic. If time permits, the dietitian augments this with meaningful visual aids and examples. The printed diet instruction consists of the daily meal pattern and lists of foods from which the patient may select his menus. Frequency and

quantity of allowed food items are adjusted to the individual diet prescription by the dietitian. The alert hospital dietitian will present the diet instruction at the earliest opportunity in order to permit the patient to utilize his daily hospital food intakes as examples of the meal pattern he will follow when he is discharged.

Group sessions with patients who have similar diet prescriptions permit both a reinforcement of the initial diet and an exchange of ideas among the participants. Other methods of reinforcing diet instructions have been reported. Tape recordings with matching booklets (5) provide an opportunity for specially trained nonprofessionals to follow up the dietitian's one-to-one instruction to the patient. Closed-circuit television (6) permits the dietitian to simultaneously instruct or reinforce the initial instruction for several patients who have similar diet prescriptions.

Dietary control, ingestion of prescribed medications and regular hemodialysis are essential components in the management of advanced chronic renal failure. However, limitations of the diet contribute to its poor acceptability by these patients, thus complicating the problem (4). For example, many food items which are indigenous to the South are either severely restricted or completely deleted.

The exorbitant cost of the dialysis treatment, plus the lack of facilities to provide greater numbers of severely uremic patients with the benefits of the artificial kidney machine, have intrinsic,

long-range economic and public health implications. The University of Tennessee Artificial Kidney Center, Memphis, serves approximately 30 patients who receive hemodialysis twice each week. The cost of this treatment is about \$14,000 a year per patient. In addition, 17 patients are presently using a kidney machine at home. These patients come to the Center for supplies, medicine, routine physical examinations, medical treatment as needed and diet counseling.

The prevailing philosophy of the medical staff in the Center is to nephrectomize, then transplant most of the patients who are on maintenance dialysis. Obviously, the dialysis treatment, medications and therapeutic diet become even more significant during the interim period. The cooperative patient would be able to enjoy a relatively normal life (including full or part-time employment) without emergency hospitalizations.

Failure to adhere to his diet by the literate patient may partially be attributed to a combined lack of motivation, poor support by the medical team, socioeconomic level and psychological determinations (7). The educationally deprived patient is beset with additional failure factors. Johnson (8) lists language deficiency, weak perception, poor discrimination, limited attention span, low self esteem and a unique learning style as deterrents to learning in children. These factors are exhibited in many of the educationally deprived adult population (9). Approximately 25 percent of the patients who come to this Center have had less than a sixth grade education. Of these patients, nearly half exhibit very poor or no reading skills.



The purpose of this study was to develop and assess the efficacy of an audio-tutorial program which was designed to improve the dietary adherence of hemodialysis patients, particularly the educationally disadvantaged. While the nature of the diet cannot be changed, a better understanding of the rationale for the restrictions and the importance of complying to these restrictions could lead to desirable changes in motivation and implementation.

## CHAPTER II

### REVIEW OF THE LITERATURE

#### I. DIMENSIONS OF CHANGING BEHAVIOR

##### Developing Instructional or Behavioral Objectives

A behavioral objective is a statement of what the learner should be able to do after he has completed a specific set of instructional material.<sup>1</sup> To be meaningful to the learner, the objectives must successfully communicate the intent by "eliminating the greatest number of possible alternatives to the goal." (10)

Bloom (11) lists clear cut verbs to depict each instructional or behavioral goal so that it can be measured or observed. For example: (a) at the "knowledge" level, use "list" or "recall"; (b) at the "comprehension" level, use "locate" or "identify"; (c) at the "application" level, use "demonstrate" or "use"; (d) at the "analysis" level, use "experiment" or "examine"; (e) at the "synthesis" level, use "design" or "construct"; and, (f) at the "evaluation" level, use "evaluate" or "compare."

Elements which should be developed sequentially in preparing the objectives are: (a) identify the behavior by specifying the kind of performance which will be accepted as evidence that the

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<sup>1</sup>Swenson, E. J. 1971 Developing behavioral objectives. Proceedings from the Workshop on The Role of the Clinical Instructor in Dietetics. Birmingham, Alabama.

learner has achieved the objective; (b) state the conditions under which the behavior will be expected to occur; and (c) specify the criteria for the minimum acceptable level of performance, as well as the method of evaluation to be used.

Three "domains" which classify all objectives describing student or learner behavior are defined by Bloom (11). The "cognitive domain" includes the recall or recognition of knowledge and the development of intellectual abilities and skills. The "affective domain" includes objectives which describe changes in interest, attitudes and values and the development of appreciation and adequate adjustment. The third domain, "psycho-motor skills," is not applicable in this study.

### Changing Behavior

The challenge to change the behavior of people is the common denominator of education processes. In 1955, Bohlen and Beale (12) described the "adoption" or "diffusion" method of accepting a new idea. This method is practically analagous to the "learning process" as listed by Craig (13). The key words, (a) awareness or attention, (b) interest or desire, (c) information, (d) trial or action, and (e) adoption or satisfaction, show the stages of behavioral change. An abundance of information appears in the literature describing methods and techniques employed in implementing these steps. The learning process is a complex combination of entities which, in part, is motivated by the individual's socio-

economic level, his needs, his goals and by appropriate behavior modification (14, 15).

### Behavior Modification

A systematic application of learning or reinforcement theories to problems of human behavior is referred to as behavior modification (16). New behavior is more apt to be maintained when the individual perceives that he is responsible for his behavior change. The "reinforcement contingency" or reward is based upon "if--then" and success is effected through the consistency of the teacher.

### Amount and Retention of Learning

Most of the studies of retention have been based on a learner's ability to reproduce, at some later date, a response which he once could make (17). Material which is meaningful to the student is remembered much better than material which is not. Making learning meaningful is a matter of selecting the right content and helping the student see its applicability to situations which concern him. Active participation by the student in the learning process by involving as many sense organs as possible is highly advantageous.

### Individualized Instruction

Recent literature reveals that progressive, contemporary educators are applying the concept of individualized instruction (18).

The individualized system of educating has an inherent process of reinforcing learned skills or information, since the student is encouraged to repeat any given segment until he has mastered it (19). That each individual must be allowed to progress at his own pace is well documented. The educational environment should, therefore, be adjusted to the individual, based on his affinity for learning (20). If the student's measurable performance is not increased by one method of instruction, it is the teacher's responsibility to design an environment which will produce commensurate results.

Programmed instruction. Programmed instruction has been widely accepted as an excellent individualized technique in industry, the armed forces and all levels of formal education (21). The program usually consists of printed material which simulates the relationship between the teacher and the student by presenting small quantities of information in segments. Each segment is followed by appropriate questions which the student must answer correctly before proceeding to the subsequent section (3). The material may be manually or mechanically presented.

The use of programmed instruction in diet therapy has great merit. A textbook type of program allows instruction to take place away from the hospital setting where the patient's anxiety level may not be so high (2, 22). Not only can the patient work at his own speed but he can rest when he is tired without missing

part of the instructions. He can review the material whenever he likes; this provides a high reinforcement potential. Programmed instructions have been developed for patients with chronic uremia (2), with diabetes mellitus (3) and with heart disease (22). The disadvantage of this type program is that only those persons with at least moderate reading skills can participate.

Audio-tutorial systems. In 1961, Postlethwait (23) devised an audio-tutorial system in an attempt to make an adjustment for the diversity of backgrounds of students in a freshman science class at Purdue University. Supplementary lectures were taped and coordinated with illustrative slides for the students with poor backgrounds, thus enabling them to compete more effectively. Subsequently, self-instructional packets of this type have been successfully developed for many levels and diverse areas of learning (24).

The audio-tutorial technique for individualized learning has infinite versatility. Instructional material can be recorded using photographic or graphic art slides, motion picture films or video tapes (25, 26). Each of these includes a synchronized sound recording. Deleting printed words obviates the need for reading skills (9, 27).

The expertise of both a sophisticated instructional service and a highly skilled audio-visual communications department is vital to the success of an audio-tutorial system. A poorly conceived instructional program becomes even worse when recorded on tape or film (28).

Advantages of individualized instructional programs in diet therapy. Individualized instructional programs in diet therapy contain the intrinsic advantage of allowing the dietitian or nutritionist to devote more time to concentrating on the vital task of stimulating the learning process as well as many other worthwhile projects which usually must be disregarded (21, 29). Verbally repeating the basic diet information on a one-to-one basis to each patient could be discontinued in many instances. If qualified technical assistance is available, the dietitian or nutritionist can develop extremely functional audio-tutorial systems for use in instructional programs, since they can be designed for use by patients at all educational levels (24).

Preparing the audio-tutorial program. Brown (30) describes certain procedures which are mandatory in preparing the audio-tutorial program. Once the informational input has been affirmed, the various materials which might be effective for visuals and demonstrations should be considered in developing the format of the program. A conference with the audio-visual director, producer, production personnel and staff artist is necessary to edit the informational content in a step-by-step manner. From this, a "storyboard" (31) can be developed by listing each important item on index cards. The appropriate visual, graphic or desired demonstration can then be designated on each card. The cards are then arranged in sequence on a large sheet of construction paper and

reviewed for feasibility of production. When revisions have been made, the tentative program, in storyboard form, should be submitted for critique by colleagues, other staff members and students. Comments regarding clarity, adequacy and length of the program should be recorded and used for revision as needed.

For an effective presentation certain performance techniques should be observed. In order to give the student-viewer the feeling that the narrator is talking specifically to him, a conversational type inflection should prevail throughout the program (32). A well modulated voice, distinct delivery and a moderate rate of speed are important. If the program is to be video-taped, additional compliances must be made. The narrator should look directly at the camera to give an "eye-ball to eye-ball" effect. When a tele-prompter is not available, the script should be memorized so that certain cue words or phrases will remain in continuity for the production staff responsible for arranging visuals or graphics. The narrator can provide increased emphasis for certain visuals by holding the items in his hands or by using a pointer. Tasteful, comfortable, solid-color clothing should be worn for video-taping, and the narrator should be well groomed. Noisy, dangling jewelry is distracting to the viewer. The narrator should keep in mind that he is a member of the production team (30).

#### Measurement and Evaluation of Behavioral and Informational Change

The goals of an instructional program are stated as behavioral objectives (10, 19). Evaluation of the progress of the learner



must be related to these objectives (24). Cormier et al.<sup>2</sup> state that "external behavioral events shall be dealt with and described." The behavioral objectives cannot be defined in abstract terms, but must be delineated in terms of observable behavior. Evaluation of the student's performance should be made according to the goals originally suggested.

The pre-test is a measurement of "entry" behavior (23). By determining the behavior of the learner before presenting the information, a program can be designed which will carry him from his present level of performance to an acceptable mastery of the objectives of the program (33). This pre-test should be used as a baseline for evaluating a change in behavior.

Informational change is generally measured by appropriate oral or written examinations to test recall. A change in performance or behavior can be evaluated by change in skills or attitude (10). Attitudinal changes are difficult to state in terms of objectives. However, the learner's attitude may be discernable through the amount of change in performance or skills.<sup>3</sup>

Implementation of a changed behavior, such as an increased adherence to a therapeutic diet, can further be measured or validated by improved, appropriate biochemical levels in the individual (2).

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<sup>2</sup>Cormier, W. H., T. George and H. Wilson 1972 Individualization of Learning: A Systems Approach. The University of Tennessee, Knoxville.

<sup>3</sup>See footnote 1.

However, these criteria are subject to certain limitations, since parameters other than diet can also affect biochemical characteristics. For example, a surgical procedure such as a bilateral nephrectomy during the testing period can adversely alter the biochemical profile of a hemodialysis patient (34). Hyperkalemia, increased blood urea nitrogen, decreased serum albumin and dehydration are some of the factors which are observed following major surgery in uremic patients. The routine post-surgery dietary procedures require intravenous glucose or dextrose followed by surgical liquids until the patient is able to tolerate solid foods. Caloric intake is minimal and protein intake is zero to very low, resulting in both weight loss and endogenous protein catabolism.

Additional observation of the educationally disadvantaged individual may be required to ascertain the threshold at which skills learned can be combined with verbal ability to recall (9, 27). Low educational aspirations, language deficiency, slower compulsion and lack of familiarity with middle class standards and standard middle class English create restrictions which must be considered when designing the informational content as well as both pre-tests and post-tests (8).

## II. MANAGEMENT OF CHRONIC UREMIA

### Introduction

Diet therapy is an indispensable component of the efficient management of chronic uremia, regardless of additional modes of treatment (35). Protein, dietary and/or endogenous, is one of the

main sources of toxins in uremia. Metabolic products of protein contribute to most of the symptoms in the uremic syndrome (34). Excessive catabolism of body protein and amino acids is prevented by an adequate intake of calories from carbohydrate and fat sources (35).

The daily allowance of protein and amino acids has not been clearly established in the uremic patient (35, 36). Recent work suggests that these patients have a lower requirement than the normal person.<sup>4</sup> There is also good evidence to indicate that important enzyme adaptations may occur in subjects fed low protein diets, leading to a greater utilization of amino acids for protein synthesis in the liver, rather than total degradation to nitrogenous end products.

In general, the overall treatment of chronic uremia has several basic objectives: (a) to prevent negative nitrogen balance due to excessive protein catabolism; (b) to avoid dehydration or overhydration; (c) to carefully correct acidosis; (d) to correct electrolyte depletions and avoid excesses; (e) to control fluid and electrolyte losses due to vomiting and diarrhea; (f) to maintain nutrition and weight; (g) to maintain appetite and morale; and (h) to control complications such as hypertension, bone pain and neuropathy (34).

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<sup>4</sup>Compty, C. M. 1973 Protein in uremia. Notes from lecture presented at the National Conference on the Nutritional Aspects of Kidney Disease. St. Paul, Minnesota.

## Dietary Management

Protein, amino acid and nitrogen requirements in the normal adult. In the normal, healthy adult who ingests adequate calories and other nutrients, a constant supply of protein providing essential amino acids and utilizable nitrogen is required to maintain nitrogen equilibrium by replacing nitrogen losses in urine, feces, sweat and desquamation of epithelial cells and for the synthesis of such tissues as hair and nails. In addition, the integrity of nitrogen containing substances such as hormones, enzymes and hemoglobin is dependent upon an adequate supply of protein (37, 38, 39).

The quality and digestibility of protein food, as well as the individual's body size and nutritional status, must be considered in determining protein requirement (37). The quality of a protein food depends upon its proportion of essential amino acids relative to the amounts required by the body. Irwin and Hegsted (40) indicate that the protein requirement in the adult is a variable estimate due to a lack of precise and adequate methods of evaluating nutritional status with regard to protein. Nitrogen balance has been the most commonly used method for determining protein requirement in many reported studies. The values obtained are useful but represent only an algebraic sum of gains and losses (37). The accuracy of the results from these studies is questionable due to such factors as: (a) the reported changes in body size or composition are not proportional to nitrogen retention; (b) the interrelationship between protein and calorie intake is not sufficiently considered; (c) a definition of the quality of the protein fed is

not stated; (d) the losses from sweat, skin, hair and nitrogenous gas are not included in the calculation; (e) the nutritional status, particularly protein reserves, of the individuals being studied is not indicated; (f) the effects of stress and individual variability are not accounted for; (g) muscular activity, climate and environmental variations of the individuals studied are not defined; (h) the number of technical errors and other determinants which occur are not yet clearly identified (40, 41).

It is generally assumed that the higher the quality of protein fed, the less amount of protein is needed to achieve nitrogen balance. Biological balance techniques to determine protein quality which are frequently reported are: (a) protein efficiency ratio (PER), which is the ratio of weight gain to protein intake in grams (42); (b) true or apparent biological value (BV), which measures the retention of absorbed nitrogen. The true BV is calculated by use of the following formula: 
$$\frac{I - (F_t - F_k) - (U_t - U_k)^5}{I - (F_t - F_k)} \times 100 \quad (43);$$
 apparent BV calculations omit the endogenous losses in urine and feces. Other methods include: (a) net protein utilization (NPU), which measures the amount of nitrogen ingested that is retained by calculating: 
$$\frac{I - (F_t - F_k) - (U_t - U_k)}{I} \times 100 \quad (43);$$
 and (b) net dietary protein-calories percent (ND<sub>p</sub>Cal%), by calculating:

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<sup>5</sup>Where I represents nitrogen intake, F<sub>t</sub> and U<sub>t</sub> are total fecal and urine nitrogen; F<sub>k</sub> and U<sub>k</sub> are fecal and urine nitrogen excreted when subjects are fed a nitrogen-free or nearly nitrogen-free diet.

$\frac{\text{g P/day} \times 4 \text{ kcal/g}}{\text{Total kcal/day}} \times \text{NPU}_{\text{op}}^6 \times 100$  (44). In the latter, the results are expressed in kilocalories and the total kilocalories would have to be adequate for energy needs to prevent the use of protein for energy.

Eight essential amino acids (EAA) are required in the diet of the adult. These are: tryptophan, phenylalanine, lysine, threonine, methionine, leucine, isoleucine and valine. They are labeled essential because their carbon skeleton cannot be formed in sufficient quantities from endogenous carbon fragments and nitrogen (38).

It is generally agreed that the BV is a quantitative measure of the ability of the protein to fulfill the needs of the body for the essential amino acids (45). Removal of any EAA from the diet will result in a general lowering of protein synthesis and increased nitrogen excretion (37). Thus, a protein of optimal nutritional value presumably supplies all the essential amino acids in correct proportion and amounts to meet the synthetic needs of the body. Biological value is thought to be the single constituent which determines the maximum extent to which protein synthesis can proceed (44). The high BV of egg protein is followed by milk, meat, fish and fowl. Cereal and vegetable proteins have lower values than animal proteins.

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<sup>6</sup>NPU<sub>op</sub> refers to conditions other than determinations made when proteins are fed at a minimum requirement or below--that is, mixtures of food as ordinarily eaten by man, fed without modifications and in comparable amounts.

The Food and Agricultural Organization (FAO) factorial method of determining nitrogen requirements for equilibrium (41) considers daily endogenous urinary losses to be 2.0 mg nitrogen per basal kilocalorie and endogenous fecal and cutaneous losses at 20 mg/kg body weight each, then adds 10 percent of the total loss to compensate for minor stress. To calculate the total protein requirement, the conventional conversion factor, 6.25 g protein per g nitrogen, is used; this assumes that all nitrogen is from protein and that all proteins have 16 percent nitrogen. The total protein requirement for this calculation assumes that the protein fed has an NPU of 100, but would be adjusted for the actual NPU of the diet for practical purposes. The FAO group recommended an allowance of 0.73 g of reference protein/kg of body weight/day for adults.

The Food and Nutrition Board of the National Research Council Recommended Daily Allowance of protein for the healthy adult, assumed to be consuming all other nutrients within the recommended range, is 0.9 g/kg of body weight/day, taking the NPU value of 70 for mixed food proteins (39). However, Scrimshaw and colleagues (46) reported that intake of 0.38 g protein/kg of body weight/day did not result in a negative nitrogen balance if all other nutrients, particularly calories, were present in adequate amounts. Furthermore, Hegsted (47) stated that the minimum daily protein requirement is closer to 12 - 18 g, if one assumes that the BV of that protein intake is equivalent to egg protein.

## Urea Synthesis

The synthesis of urea occurs in the liver and is the result of the degradation of amino acids and other nitrogenous materials in the body. In the normal man, ammonia from these sources is excreted through the urine in the form of urea (48). Urea is formed by a cyclic mechanism in which ornithine, citrulline or arginine stimulate urea production in the presence of ammonia and requires several nitrogen containing enzymes for its completion (49).

In the uremic individual, with severely damaged kidneys and few or no nephrons functioning, a high concentration of urea and other excretory metabolic end products collect in the body fluids. It is presently theorized that the urea is broken down to ammonia by urease in the intestinal tract and that the ammonia is re-absorbed and utilized by the liver as a source of nitrogen (35).

History of the prevailing low protein diet for chronic uremia. In 1963, Giordano (50) reported that feeding uremic patients with a creatinine clearance of 2-5 ml/min/1.73 sq.m. of body surface, 2 g of essential amino acid nitrogen plus adequate calories, vitamins and minerals was accompanied by a decline in the blood urea nitrogen (BUN) and a reduction of endogenous protein catabolism. Positive nitrogen balance was attained, and many of the uremic symptoms disappeared. These results were interpreted as an indication that endogenous urea was utilized in the synthesis of nonessential amino acids. The study further disclosed that in order to utilize endogenous urea there must be sufficient amino



acids and calories, and that exogenous nonessential amino acids must be depleted to encourage utilization of urea. Thus, a low protein diet of high biological value with sufficient calories for normal metabolism was implied.

Giovannetti and Maggiore (51) achieved similar results in 1964, using high calorie, low protein foods and a powdered essential amino acid mixture or eggs. Low protein, wheat starch products were used as a bread substitute to supply adequate calories and minimize ingestion of nonessential amino acids.

The following year, Berlyne, Shaw and co-workers (52) reported their experiences with a modification of the Giovannetti diet suitable for British tastes. They used an 18-21 g protein diet, with 12 g supplied by eggs and milk. With the exception of methionine, the diet provided the minimum daily requirement of all the essential amino acids as estimated by Rose and associates for young men (53). Adequate methionine was provided by a supplement. Multivitamins and iron were also prescribed. Again, wheat starch flour bread and other products were used to minimize ingestion of nonessential amino acids and to provide calories. These patients experienced an amelioration of both clinical and physical symptoms.

Diet therapy for the hemodialysis patient. A creatinine clearance of less than 2 ml/min is indicative of nearly complete nephron deterioration. This critical condition requires the institution of artificial kidney therapy in order to sustain life. Complications of neuropathy, uncontrollable hypertension or congestive heart failure are some of the other conditions which determine

the need for hemodialysis (54).

Dietary management of the patient on maintenance hemodialysis is somewhat controversial (34). Burton (4) states that 18-20g protein per day is not sufficient to provide the hemodialysis patient with adequate needs since much protein is lost to the dialysate. Ginn and associates (55) suggest that these patients require approximately 0.75 g protein per kg body weight per day to maintain either a neutral or slightly positive nitrogen balance and a favorable serum albumin concentration. In a study to determine nitrogen balance in hemodialysis patients, Ginn et al fed two anephric subjects 18 g of balanced protein per day (3 g nitrogen in the form of egg protein) and 50-55 kilocalories per kg per day. The subjects were receiving two 6-7 hour dialyses per week. Nitrogen equilibrium was not maintained as the negative nitrogen balances amounted to more than 3 g per day and serum albumin concentrations were appreciably lowered in the two subjects. Nitrogen content determinations of the dialysate following treatment of these patients amounted to  $20 \pm 1.85$  gm per dialysis throughout the study. Also observed were decrements of all plasma essential amino acids except threonine, obvious muscle wasting and a moderate degree of peripheral neuropathy. When a third hemodialysis patient was fed 1.11 g per kg body weight of high quality protein and 50-55 kilocalories per kg per day for two 12-day periods the nitrogen balance was positive, serum albumin concentrations increased and fasting plasma individual essential amino acids were within normal range. However, pre-dialysis blood urea nitrogen levels increased without

further augmenting the nitrogen balance. When this patient was fed 0.75 g high quality protein per kg body weight and 50-55 kilocalories per kg body weight per day for a 12-day period, a neutral or slightly positive nitrogen balance occurred, increased serum albumin concentrations were observed, fasting plasma individual essential amino acids remained within a normal range and the pre-dialysis blood urea nitrogen levels were lowered. Kopple et al. (56) reported similar results when comparing diets containing 0.75 g protein (0.63 g high biological value protein) per kg body weight and 1.25 g protein (0.88 g high biological value protein) per kg body weight fed to patients per day. Adequate calories and vitamin supplements were provided to each group studied. With the higher protein intake, most of the additional nitrogen ingested appeared as serum and dialysate urea and fecal nitrogen; thus, an improved nitrogen balance was not observed.

Dialysis centers which have adequate facilities and personnel propose a fairly liberal diet and frequent dialysis (three to four treatments per week). Centers faced with a minimum number of artificial kidneys and limited personnel are using diet plans which limit the protein, sodium and potassium intakes quite severely. Most centers use a diet prescription which is mid-way between these (34, 36).

The daily protein intake usually ranges from 0.75 - 1.0 g per kg of ideal body weight, with 0.63 - 0.84 g as high biological value protein (35). Sodium intakes range from 90-120 mEq per day in the presence of edema and hypertension (diastolic blood pressure greater than 110 mm Hg). Patients whose renal failure is due to

chronic glomerulonephritis are more likely to have hypertension and excess extracellular fluid volume, thus are restricted to 40-75 mEq of sodium per day (54). The potassium intake is restricted to 45-75 mEq per day, usually depending on the number and hours of dialysis treatment. Fluid restriction is governed by urinary output. The range is from 600 ml per day (including water content of the solid foods) to ad libitum. Total kilocalories range from 1800-3500, calculated from the patient's ideal weight and daily activities. When the chronic uremic patient is obese, calorie restriction may be too hazardous unless the reason for immediate weight loss is compelling (35).

Format of the diet pattern in chronic uremia. Cullen (57) described a diet plan which was patterned after the exchange lists used by The American Dietetic Association for patients with diabetes. This plan is used in most sections of the United States. Recently, Stein and Winn (58) developed a "point system" for calculating the protein, sodium, potassium and fluid allowances.

Adherence to dietary management. Changing an individual's life-long food habits to any degree constitutes a major effort on the part of the dietitian or nutritionist (59). Adherence to the diet by the severely uremic patient, with or without the benefit of regular hemodialysis, has met with varying success (60). The diets for all states of chronic uremia are usually encountered with great resistance by the patient.

Dietitians and nutritionists faced with the dietary management of uremic patients have endeavored to make the diet more

palatable for the hospitalized patient (61). Much time is spent instructing the patient in the basic principles of the diet and advising him in planning and preparing meals for use at home (62). The low protein (wheat starch) products which must frequently be incorporated into these diets are difficult to prepare and are not readily accepted. Recipes for making low protein breads, cookies and other desserts are provided by the dietitian (61, 63, 64).

The dialysis center at the Los Angeles County-University of Southern California Medical Center reports the installation of a dietetic food store in the hospital which provides a wide variety of dietetic items not commonly available in the local stores at a minimal cost to the patient. Each patient in the center is given a gram scale for use at home. Another technique used in this center is group discussion concerning diet while the patients, each provided with a set of head phones and a microphone, are receiving dialysis therapy (65).

Stress as a deterrent factor. For the hemodialysis patient, ensuing traumatic physiological, psychological, social, cultural and economic changes have prevented the full realization of the necessary dietary control (61). The dietitian working with the dialysis patient should attempt to recognize the level and sources of stress (66). The structure and limitations of the diet itself bring numerous complaints, so the dietitian frequently finds herself in the position of "scape goat" for the patient's frustrations.

The initial physiological stress of hemodialysis is considerable. As the patient becomes totally aware of abject dependency on the kidney machine and the medical staff, psychological problems follow (67). One of the manifestations of the patient's intense anxiety is to openly disregard dietary and fluid restrictions.

### Medical Management Related to Important Metabolic and Physiological Disorders

Electrolytes and water. As the number of functioning nephrons decrease, the diseased kidneys lose the ability to excrete extra water, sodium and potassium when the intake of these is excessive. Conversely, a markedly reduced intake of sodium, potassium and water prevents a conservation of the amount needed for balance (35).

With sodium depletion, the uremic patients lose more sodium in the urine than normal subjects under similar conditions. As extremely low sodium intake may result in muscle cramps, convulsions, hypotension and further deterioration of renal function (68). Excessive sodium intakes can contribute to or aggravate hypertension, pulmonary congestion and heart failure.

Hyperkalemia is a common and serious problem in chronic renal insufficiency (7, 34). It is often precipitated by the associated metabolic acidosis in this disease. The fall in pH forces migration of hydrogen into cells, driving potassium out of the cells (68). The food intake pattern for the uremic patient is high in fruits and vegetables. These foods, as well as the necessary

protein foods, are naturally high in potassium. An excessive elevation in serum potassium is a frequent cause of sudden death. Regular monitoring of the serum potassium is essential. When appropriate, the serum potassium can be lowered by the administration of a cation-exchange resin containing sodium. The sodium ions are partially released in the intestinal tract and are replaced by potassium ions so that excess potassium is excreted in the feces. With this therapy, frequent monitoring of all electrolytes is necessary since both serum calcium and magnesium may also become deficient (34).

Hypokalemia may be seen in any stage of renal failure. It can occur in renal potassium wasting or in over-correction of elevated serum potassium along with loss of gastrointestinal fluids.

The fluid intake allowed in uremia is determined principally by the amount of urine the kidneys can excrete plus insensible losses through the skin and lungs. Edema, leading to congestive failure, can result from fluid overload (54). Body weight, fluid intake and fluid output should be recorded daily. The anephric patient is allowed only the minimum amount of liquid needed to take his oral medications. Dehydration is usually the result of loss from vomiting or diarrhea.

Adjustments in the electrolyte content of the dialysate can usually correct abnormal serum sodium and/or potassium levels in the maintenance hemodialysis patient. Nearly 100 percent of fluid overload can be removed in a single dialysis treatment (53).

Calcium, phosphorus, vitamin D and iron. Management of calcium metabolism in chronic renal failure is difficult since random measurement of calcium and phosphorus does not depict the underlying pathophysiology. The objective of therapy is to maintain as near normal levels of calcium and phosphorus as possible, thereby preserving the skeleton and preventing soft tissue calcification. The calcium content of the diet pattern is markedly low, particularly in those patients who are not allowed to drink milk because of severe fluid restrictions. One to three gms of calcium carbonate may be supplied daily in powdered or tablet form. Calcium carbonate also has the advantage of buffering hydrogen ions and reducing acidosis (35).

In long standing renal disease, there is apparently an acquired resistance to vitamin D which may be the etiological factor in "renal rickets." This interpretation is suggested by the finding that uremic patients lose excessive quantities of calcium in feces and that the defect in calcium absorption can be reversed by the administration of large quantities of vitamin D (7). The retention of calcium that occurs with administration of vitamin D leads to remineralization of bone, relieves bone pain and prevents the development of further skeletal deformities. The effect of a specific administration of vitamin D in any given patient is unpredictable. For this reason, considerable care must be taken to avoid hypercalcemia with its bone complications and soft-tissue calcium deposits. With vitamin D therapy, the serum calcium concentration should be measured frequently, and if it rises above



10 mg per 100 ml, treatment should be discontinued.

Hypercalcemia is usually the result of a primary disturbance in calcium metabolism. It can occur as a consequence of secondary parathyroid hyperplasia (68). Calcium supplements are omitted if the product of calcium and phosphorus (both expressed as mg per 100 ml serum) is greater than 70 (35).

Serum phosphorus concentration is frequently elevated in spite of decreased renal tubular absorption. This elevation may be the earliest change in chronic renal failure causing hypocalcemia (68). Decreased tubular excretion, lean tissue breakdown following poor or no food intake or the phosphorus content of the diet itself can result in elevated serum phosphorus. Parathyroid hormone secretion increases restoring tubular secretion of phosphorus toward normal as long as creatinine clearance exceeds 20-30 ml per min. With lower creatinine clearance, glomerular filtration is inadequate to handle an increased phosphate load. Serum phosphorus is further augmented by excessive bone resorption under action of the parathyroid hormone. A daily intake of an aluminum carbonate type antacid is prescribed if the serum calcium-phosphorus product approaches 70. This antacid has the property of binding some of the dietary phosphorus in the small intestine so that it is excreted in the feces (34).

As renal disease progresses, erythropoiesis becomes defective, since secretion of the hormone, erythropoetin, is inhibited in the damaged kidney (68). The hematocrit (packed cell volume) level of the uremic patient is normally about half the healthy adult's

value of  $46.5 \pm 7.7\%$  for males and  $42.4 \pm 8\%$  for females. Uremic patients seem to tolerate the lower hematocrit very well (54).

The hemoglobin concentration ranges from 6 to 10 g per 100 ml, but this is not generally associated with iron deficiency. The magnitude of hemoglobin concentration represents a rough correlation with the degree of azotemia (34). Since oral iron supplements are poorly absorbed in the patient with renal failure, whole or packed cell blood transfusions are used when hemoglobin level falls below 6 g per 100 ml. Some reports suggest good response with parenteral iron (68).

Uric acid. The uric acid content in the blood is abnormally high in all patients with severely damaged kidneys, since excess amounts cannot be filtered out into the urine. "Gouty" symptoms are relieved by the daily administration of a structural analogue of the natural purine base, hypoxanthine. This medication acts on purine catabolism without disrupting the biosynthesis of vital purines. It inhibits the production of uric acid by blocking the biochemical reaction immediately preceding uric acid formation, thus lowering both serum and urinary acid levels (54).

Administration of vitamin supplements. The B-complex vitamins and ascorbic acid are generally administered since the nutrient content of even an optimum intake of the diet prescription is often deficient in these vitamins (68). Prolonged cooking times and the leaching effect of large volumes of water which are

used to reduce naturally occurring sodium and potassium reduce the vitamin contents to well below accepted daily requirements (67). Furthermore, evidence suggests that these vitamins are removed from the blood by the dialysate.<sup>7</sup>

Alpha Keto-analogues. Walser and associates (69) have recently reported the oral administration of the alpha keto-analogues of valine, leucine, isoleucine, methionine and phenylalanine along with the remaining essential amino acids to chronic uremia patients. The patients also ingested their low protein, adequate calorie diet. Results of the experiment appear to establish that ingestion of these keto-analogues can diminish the rate at which urea appears in the urine and in the body fluids. If this type agent can promote nitrogen anabolism by directing ammonia derived from intestinal ureolysis to protein synthesis, clinical improvement of these patients is probably assured. Further study is indicated.

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<sup>7</sup>McKenzie, J. C. and J. E. Ford 1969 Vitamin nutrition of patients on regular hemodialysis treatment. Nutr. Soc. Proc. 28: 1 A (abstr.)

## CHAPTER III

### PROCEDURE

#### Introduction

An assessment of adherence to the initial therapeutic diet instruction was made by ascertaining both informational and clinical profiles of patients currently undergoing maintenance hemodialysis twice a week for six to seven hours in The University of Tennessee Artificial Kidney Center, Memphis. A comparison to these values was made one month after administering an audio-tutorial diet reinforcement program which was developed for the purpose of enhancing adherence to the diet prescription. The principles of developing an audio-tutorial program as described by Postlethwait (23), Dwyer (33) and the committee of Graphics Intent Group of the Association for Educational Communications and Technology (31) were used as guidelines in devising this program. The program was presented while each patient was receiving treatment on the artificial kidney machine.

The pre-tests and post-tests were identical and were designed to establish evidence of behavioral changes in the patients involved in the study (10, 23, 24). The behavioral objectives were: (a) to name examples of protein, sodium, potassium, fluid and extra-calorie food sources in the diet prescription; (b) to recall the reason for the importance of ingesting the prescribed amount of protein and adequate kilocalories; (c) to recall the effects of

excessive intakes of sodium, fluids and potassium; and (d) to demonstrate the ability to improve dietary intake, thus attaining a more desirable level of blood urea nitrogen, total serum protein and albumin, and serum sodium and potassium.

### Selection of Subjects

The subjects to participate in the study were randomly selected by assigning a number to each patient currently undergoing maintenance hemodialysis in the Center; then 16 numbers were drawn for use in the study. Eight of these were male and eight were female, with one white and seven black in each sex. Duration of hemodialysis treatment for these patients ranged from 3-15 months at the time pre-testing was done. Except where otherwise indicated, the pre-test values served as the control for each subject.

### Identification of the Variables

In the population sample used for this study, variables included: (a) sex; (b) race; (c) age; (d) educational level; (e) money spent for food per week per subject; and (f) number of months the diet had been prescribed at pre-testing and the length of time the patient had been receiving dialysis treatment.

### Initial Diet Instruction

Each patient had received a one-to-one instruction for his prescribed diet from a professional dietitian during his first hospitalization for chronic uremia, followed by an instruction which was adjusted to his needs when hemodialysis was instituted.

The basic information was in booklet form and each patient had been given a copy to use at home.

#### The Diet Prescription for the Hemodialysis Patient

The diet prescription for patients participating in this study varied with individual needs. Protein allowances ranged from 50-60 g per day, sodium and potassium restrictions ranged from 1-2 g per day, total daily fluid allowances ranged from 800 ml to ad libitum and daily kilocalorie levels from 1800 to 2000. The diet prescription (Rx) for each patient is listed in Appendix A, Table 4.

#### Testing

Prior to viewing the program, each patient in the study received identical testing to determine entry behavior for informational and performance levels as well as a questionnaire to provide domestic and socioeconomic background information. The forms for recording these data are found in Appendix B. All questions were oral and answers were recorded by the author to avoid embarrassing the illiterate patients. Identical tests were repeated in post-testing, omitting the domestic and socioeconomic information section.

Data obtained from subjects. The nutrition history included: (a) domestic, socioeconomic and cultural factors which generally predispose adherence to a therapeutic diet; (b) patient's comprehension of his diet; and (c) a computerized analysis of the patient's 24-hour recall and fluid intake.

The domestic, socioeconomic and cultural factors which were considered appropriate were: (a) number of months the diet had been prescribed and the length of time patient had been receiving hemodialysis therapy; (b) ethnic background; (c) education; (d) money available for purchasing food; (e) use of food stamps; (f) other sources of food; (g) cooking facilities; (h) patient's ability to care for self; (i) who prepared patient's food; and (j) difficulties encountered in obtaining or preparing foods for the therapeutic diet. This information was recorded only as part of the pre-test.

Eleven questions based on the behavioral objectives were asked in order to ascertain the patient's ability to recall critical points in his diet prescription. These questions are included in the forms found in Appendix B. Each question was given a numerical value to establish a grade percentage for information recall.

The 24-hour recall of food and fluid intake for each patient was analyzed in The University of Tennessee, Memphis, Biometric Computer Center,<sup>8</sup> where the nutrient values in the data bank are from the United States Department of Agriculture (U.S.D.A.) Handbook No. 8 (70). These values included water, kilocalories, protein, fat, carbohydrate, calcium, phosphorus, iron, sodium, potassium, vitamin A, thiamin, riboflavin, niacin and ascorbic acid.

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<sup>8</sup>IBM System/360, Model K, 128K, International Business Machine Corporation, Data Processing Division, White Plains, New York.

Although the diet prescription for hemodialysis patients usually includes a potassium restriction, potassium intakes were excluded since the subjects were instructed to prepare all vegetables in a manner which would leach out much of the natural potassium content, thus resulting in an inestimable difference from the U.S.D.A. food composition tables. Each subject's total pre-test intake of water, kilocalories, protein and sodium was compared with his diet prescription and given a percentage score. This was repeated for the post-testing.

In order to assess the pre-test physical profile of each patient, these characteristics were recorded: (a) gain or loss of weight, based on pre-dialysis weight at time of present and last treatments; (b) patient's complaints; (c) mental lucidity; (d) general appearance, and (e) emergency hospitalization since last treatment. Identical characteristics were observed at the time the post-test was administered.

Greater than a one pound per day weight gain between treatments (based on pre-dialysis weights) indicates excessive fluid and/or sodium intakes. Complaints include the symptoms due to high blood pressure, bone pain and infections. The state of mental lucidity affects the quality of informational testing since these patients are frequently so ill that interpersonal communication is very poor, thus testing was withheld until the patient was responsive. General appearance would merely indicate the level of physical well-being. Any emergency hospitalization would imply failure to comply with therapeutic measures, a need for adjusting



the prescribed diet or medication or a severe superimposed illness.

### Statistical Method

The null hypothesis stated that pre-test values ( $x$ ) will equal post-test values ( $y$ ) at the termination of the study ( $H_0 : x=y$ ). The alternate hypothesis for information recall was  $H_1 : x < y$ . Since the instruction program was not expected to have a negative effect, a one-tailed "t" distribution was indicated. However, it was recognized that instruction could have a negative effect on diet adherence for various reasons. Therefore, a two-tailed "t" test was used to compute the dietary adherence measurements. A level of significance of five percent was used in evaluating the statistics (71).

The effect of education level was evaluated by dividing the subjects into two groups. The eight patients who had less than 10th grade education were placed in Group A and the eight patients who had at least 10th grade education were placed in Group B. The mean pre- and post-test scores for these groups and for the total number of subjects were compared with unpaired, pooled variance "t" tests. This included information scores and percent of diet prescription calculated from the recording of the 24-hour recall of food intake for kilocalories, protein, sodium and water. As previously stated, potassium intake was deleted since the patients were instructed to prepare vegetables in a manner which would lower the natural potassium content, thus calculated values could vary appreciably from actual intake (62). Pre- and post-test mean

weight change between dialyses for each group and for the total number of subjects was also compared.

In order to determine other variables which might affect behavioral change, these correlations were made: (a) the mean of school grades completed for all subjects was compared with mean pre-test and change in information scores, mean pre-test and change in sodium scores, and the mean changes in kilocalories, protein and water scores; (b) the mean of kilocalorie score change was compared with the mean of change in protein, sodium and water scores; (c) the mean of water score change was compared with the mean of change in sodium and protein scores; (d) the mean pre- and post-test water scores were compared with the mean pre- and post-test sodium scores; (e) the mean of pre-test water scores was compared with the mean number of months the subjects had been on the diet prescription; (f) the mean amount of money spent per week per patient was compared with the mean number of months subjects had been on the diet prescription, mean pre-dialysis weight change since last treatment and mean pre-test information; and (g) the mean age for all subjects was compared with both mean pre-dialysis weight change and with each pre-test dietary intake mean score.

A "t" test comparison was also made between male and female subjects for mean pre-test and change in information scores, mean pre-test and mean change in sodium, water, kilocalorie and protein scores. The mean amount of money spent per person per week, mean pre-dialysis weight change between dialysis treatments and the change in mean pre- and post-test pre-dialysis weight were also

compared between the sexes.

A bilateral nephrectomy was performed on 12 of the 16 patients during the testing period. This was not anticipated at the inception of the study, therefore an improvement in the biochemical values could not be predicted since a major surgical procedure has been shown to adversely change many of these values. For example, hyperkalemia, increased BUN, decreased serum albumin and dehydration are observed. Routine post-surgery dietary procedures require intravenous feedings followed by surgical liquids for two or three days, therefore caloric intake and protein intake are minimal. This results in both weight loss and endogenous protein catabolism (34), thus the pre-test and post-test biochemical determinations were not compared statistically.

#### Development of the Audio-Tutorial Diet Instruction Program

Selection of the subject matter. Information relevant to reinforcing the initial, one-to-one diet instruction encompassed both the rationale for and the means of restricting protein, sodium, fluid and potassium intakes, as well as the significance and modes of enhancing total caloric intake. The informational content was governed by the "entry" behavior (23) and the behavioral objectives (10).

Outline of informational content. The material was divided into four main classifications: (a) protein; (b) sodium and fluid; (c) potassium; and (d) kilocalories. Subheadings in each category

included information which covered the purpose of either the restriction or the need for emphasis, foods included in the category, foods to avoid, methods of increasing or decreasing the individual nutrients and a built-in pictorial self-test to involve the viewer in a brief activity and to provide immediate feedback (23). The pictorial self-tests used for each segment are found in Appendix C.

Development of the narrative or script. The narrative was developed from the outline using simple terminology based on elementary school (third grade) vocabulary (72). Cartoon-type characters, with dialogue, were incorporated to avoid a totally didactic mode of presentation. Each segment was designed to be concluded in less than 15 minutes, recognizing the short attention span exhibited by poorly educated individuals (18).

Professional colleagues, nonprofessional staff members and literate patients who were not included in the study were asked to evaluate each script for unity, clarity, adequacy and length. Constructive criticisms and suggestions led to many revisions.

Selection of the medium. A video-tape cassette play-back unit with a 17-inch color television monitor<sup>9</sup> was purchased by The University of Tennessee Artificial Kidney Center. This equipment

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<sup>9</sup>SONY V-P 1000 V-Matic video cassette player and SONY KV-1710 color television monitor. The SONY Corporation of America, New York.

does not require the services of a trained projectionist. Since the University Audio-Visual Communications (AVC) Department provided the technical assistance and the necessary equipment to produce video-tapes, this medium was selected. The flexibility of television was another factor which favored its use over other media. The equipment was attached to a portable cart to enable placing it in a comfortable viewing position for each patient. The play-back unit was equipped with a review-selector to allow multiple repetitions of any portion of each segment.

The story board. Upon completion of the tentative scripts, the services of the AVC artist were obtained for the purpose of devising a story board to illustrate the entire segment in each classification. Each important point to be emphasized was written on a separate 4" by 6" index card. These were placed in sequence with the script and the artist sketched appropriate graphics on each card. Actual foods, food models and live demonstrations were also included as examples of certain details. The technical advice of the AVC Producer-Director and other staff members was utilized in finalizing the format of each segment. Necessity of changing the graphics during the video-taping required minor revision of the script sequence.

The entire program, complete with story boards for each segment, was again shown to the group who had read the original script. A few minor revisions were made based on their suggestions and comments.

Production of the video tapes. Taping sessions were scheduled contingent upon availability of both the studio and the production staff. Two color television cameramen, a floor manager, a video engineer, an audio engineer, two production assistants, the staff members whose voices were used for the cartoon characters and the Director-Producer were needed each time a taping session was scheduled. A minimum of three hours was required for each taping. Only one segment was completed at each session.

Prior to the first taping session, members of the production team met to select the introduction and closing background music. Only 100 percent instrumental recordings were reviewed in seeking a light and lively semi-classical or popular tune. Since the tapes were for educational non-commercial use, it was not necessary to restrict the selection to non-royalty recordings. At this same meeting a color slide picturing the Artificial Kidney Center was selected to use in the opening and closing shots. Also, it was determined that the narrator should wear a colored laboratory coat as a white uniform produced excessive glare with color equipment.

A floor "flow-plan" was developed by the Producer-Director to enable the production team to review the production pattern and to clarify any questions concerning continuity in the script being taped. Each member of the team had been given a copy of the final script appropriately labeled with cues for the dialogue, graphics and demonstrations. In addition, the cameramen were provided with "shot" sheets to assist them in focusing their cameras properly.

When all members of the team were in place, both a video check for color and lighting and an audio check for sound modification were completed. A trial run of the entire production was made to make certain each team member understood his responsibility and to finalize the continuity.

Testing the program. Prior to presenting it to the subjects involved in this study, the entire program, including the self-tests, was shown to a total of 35 people in groups of various size. These included both professional and nonprofessional staff members, students (five of these were age 10) and patients not participating in the study. Suggestions for improvement were recorded for later revision of the cassettes. In general, the comments indicated that the program had good potential.

#### Presentation of the Audio-Tutorial Program to the Subjects in the Study

The four video-tape cassettes were presented in sequence to each patient while he was in bed receiving the dialysis therapy. One group of the patients came to the Center on Mondays and Thursdays and the remainder came on Tuesdays and Fridays. Only one cassette was scheduled to be shown to each patient on any given day to allow sufficient time for repetition, should a patient request this.

A single ear-phone was used both to prevent disturbing adjacent patients and to assure the participant's being able to

hear the audio portion. If a patient seemed particularly disturbed or ill, the program was withheld until his next treatment. Since these patients are in the habit of sleeping most of the time while on the kidney machine, the Center staff assisted in keeping them awake throughout the segment.

Each patient was provided with a pencil with the appropriate pictorial self-test paper and with verbal instructions for marking the paper. The test for each segment consisted of black and white line drawings which were a reproduction of the drawings shown on the television screen. The food labels and questions printed on the examples found in Appendix C correspond to the verbal instructions in the tape and did not appear on the test used by the patients. The patient was asked to repeat the segment if he missed any questions. The self-test was not graded, but was included as an additional reinforcement tool as well as a method for immediate feed-back.



## CHAPTER IV

### RESULTS AND DISCUSSION

Data recorded for each of the 16 experimental subjects used in this study included sex, age, race, grades completed in school, months on diet prescription at pre-testing, money spent for food per person per week and pre- and post-test pre-dialysis weight changes between treatments. These data are listed in Appendix D, Table 5. Pre-test and post-test information recall scores and percentages of diet prescription consumed, based on 24-hour recall of food intake, are listed in Appendix E, Table 6.

The paired comparisons of pre-test to post-test mean information recall scores for Group A, the subjects with less than 10th grade education, and Group B, the better educated subjects, resulted in Student "t" values which were very highly significant at the 0.001 probability level as indicated in Table 1. This demonstrates that the audio-tutorial program developed was an effective instructional device for hemodialysis patients regardless of educational background. The mean pre-test information recall score for Group A was only 32.4% compared to 49.9% for Group B. As would be expected, the less educated subjects effected a greater improvement (37% change) in information recall than the better educated subjects (24.5% change) following the instructional program. The mean change in information score for all subjects was also very highly significant ( $P < 0.001$ ).

Pre-test and post-test mean values and paired "t" values for

TABLE 1

Mean pre-test and post-test information recall scores and dietary adherence percentages<sup>a</sup> for experimental subjects and results of paired "t" comparisons

Group <sup>b</sup>	Pre-test	Post-test	Change	Paired "t"
A information	32.4%	69.4%	37.0%	7.05***
B information	49.9%	74.4%	24.5%	6.31***
Total information	41.1%	71.9%	30.8%	8.80***
A kilocalories	56.6%	56.6%	0.0%	0.00
B kilocalories	52.2%	67.0%	14.8%	2.68*
Total kilocalories	54.5%	61.8%	7.4%	1.57
A protein	72.9%	75.2%	2.3%	0.17
B protein	82.1%	93.0%	10.9%	1.02
Total protein	77.5%	84.1%	6.6%	0.76
A sodium	61.0%	38.8%	-22.2%	-2.58*
B sodium	37.5%	56.1%	18.6%	2.16
Total sodium	49.8%	47.4%	- 2.4%	-0.27
A water	104.6% <sup>c</sup>	76.5% <sup>d</sup>	-32.9%	-3.26*
B water	97.7% <sup>c</sup>	89.6%	- 8.1%	-0.53
Total water	101.2% <sup>e</sup>	83.0% <sup>f</sup>	-20.5%	-2.16*
A weight change <sup>g</sup>	2.6 lb.	3.0 lb.	0.4 lb.	0.20
B weight change	2.6 lb.	4.1 lb.	1.5 lb.	1.58
Total weight change	2.6 lb.	3.6 lb.	1.0 lb.	0.93

<sup>a</sup>Percent of diet prescription ingested.

<sup>b</sup>Each group consisted of eight patients.

<sup>c</sup>Only seven patients used since one had water ad libitum.

<sup>d</sup>Eight patients used since the subject with ad libitum fluids was changed to restricted fluids.

<sup>e</sup>Only fourteen patients used as two had water ad libitum.

<sup>f</sup>Only fifteen patients used as one had water ad libitum.

<sup>g</sup>Mean weight change between dialysis treatments.

\*,\*\*\* denote significance at the .05 and .001 probability levels, respectively.

the variables which were used to measure dietary adherence (behavior) are also listed in Table 1. The kilocalorie, protein sodium and water mean scores listed are based on the percentage of each individual's diet prescription which was recorded for pre-test and post-test 24-hour recall of food ingested.

The less educated (Group A) mean pre-test kilocalorie score was slightly higher than the score for Group B, but the mean for both groups was only 54.4% of the diet prescription. Group A showed no improvement in the mean value; however, certain individuals in this group improved kilocalorie intake appreciably, as can be noted in Appendix D, Table 5. Improvement in kilocalorie mean score occurred for Group B which was significant at the 0.05 probability level. Some improvement, though not significant, was observed in the mean score for all subjects.

Group A, the less educated subjects, showed only a slight improvement in mean protein scores, changing from 72.9% to 75.2% of the prescribed allowance. The mean pre-test protein score for Group B was 82.1%, improving to 93.0% after the instructional program. The change was not statistically significant, but could be the result of their better application of the dietary principles which were emphasized in the program.

The mean pre-test sodium score for the less educated subjects was nearly twice as high as for the better educated, that is, 61% in Group A and 37.5% in Group B. A statistically significant decrease in the mean sodium score ( $P < 0.05$ ) was observed in Group A, indicating a positive effort to follow the instructions in the

program which especially emphasized sodium restriction. The post-test increase noted in Group B (18.6%) may reflect a more accurate recall of food intake for the post-test or a positive effort to meet the dietary prescription.

A statistically significant decrease in mean water intake score ( $P < 0.05$ ) occurred in Group A whose pre-test mean water intake score was 104.6%. Group B had a pre-test mean score of 97.7% which decreased to 89.6% on the post-test score. The change in the combined groups was also significant ( $P < 0.05$ ). Although the pre-test value was nearer to the prescription, this could be interpreted as a positive behavioral change in fluid consumption, since a minimum intake was desirable. Errors in estimating the amounts of water reported in the 24-hour recall of food and fluid intakes may have increased as a result of knowledge of the "right" answer.

The mean pre-dialysis weight change between treatments, measured at pre-testing and post-testing for both groups showed non-significant increases, although the increase for Group B was higher than Group A. This could be related to the higher protein and kilocalorie intakes for Group B following the instruction program, resulting in an increase in dry weight which, in turn, may reflect a degree of effectiveness of the audio-tutorial program. Another explanation might be an increase in weight due to the increase in the mean sodium intake shown for Group B, causing greater water retention. There was no consistency in the results with water, sodium and weight changes. This could be construed as a discrepancy

in the actual amount of fluid and sodium recalled by the Group B patients, or that the information learned from the program influenced the patients' awareness as to the answers they were expected to give in the post-test 24-hour recall. Had it been possible to utilize the serum and whole blood biochemical determinations, a more valid interpretation of the behavioral changes reflected in the 24-hour recall of food intake possibly could have been observed.

Correlations were made between school grades completed and pre-test information scores, information score change, changes in scores of adherence to the diet prescription and other selected variables. The correlation coefficients are shown in Table 2.

The highly significant correlation ( $P < 0.01$ ) of grades completed with pre-test mean information scores indicates that the better educated subjects had greater understanding of both the rationale for and the restrictions of their individual diet prescriptions prior to the audio-tutorial instruction. However, they learned significantly from the instruction, so all subjects were at approximately the same stage of understanding after the program was presented, thus resulting in a significant negative correlation ( $r = -.49$ ). This was also reflected by the group means shown in Table 1, page 45.

The negative correlation of school grades with the pre-test mean sodium score (nonsignificant  $r = -.47$ ) supports the dietary recall data which indicated that the better educated individuals consumed less sodium before the instruction was given. School

TABLE 2

Significant and related correlations between experimental variables measured in 16 subjects

Variables correlated	Correlation coefficient
School grades completed, pre-test information	+.62**
School grades completed, information change	-.49*
School grades completed, pre-test sodium scores <sup>a</sup>	-.47
School grades completed, sodium change	+.54*
School grades completed, kilocalorie change	+.37
School grades completed, protein change	+.41
School grades completed, water change	+.37
Kilocalorie change, protein change	+.43
Kilocalorie change, sodium change	+.56*
Kilocalorie change, water change	+.49*
Water change, sodium change	+.29
Water change, protein change	+.06
Pre-test water, pre-test sodium scores	+.07
Post-test water, post-test sodium scores	+.40
Pre-test water, months on diet prescription	-.44
Money spent per person per week, months on diet	+.44
Money spent per person per week, pre-dialysis weight change <sup>b</sup>	-.71**
Money spent per person per week, pre-test information	+.42
Age, pre-dialysis weight change <sup>b</sup>	+.45
Age, pre-test protein scores	+.61*

<sup>a</sup>Based on percent of diet prescription ingested at 24-hour recall.

<sup>b</sup>Weight change between treatments.

\*,\*\* denote significance at the .05 and .01 probability levels, respectively.

grades were significantly correlated ( $r = +.54$ ) with the change in sodium scores which could be related to a better understanding of the sodium content of foods after viewing the program. High, but nonsignificant, positive correlations between school grades completed and change in kilocalorie, protein and water scores were observed. These correlations may indicate that the better educated subjects could apply the information learned more effectively than the less educated group.

Protein, sodium and water score changes were all positively associated with kilocalorie changes (two significant correlations, one approached significance). If the subjects' 24-hour recall were reasonably accurate, this would be expected.

Water score change was not closely correlated to sodium and protein changes. While the positive correlation ( $r = +.40$ ) between the post-test water score and the post-test sodium score approached significance, the pre-test water and pre-test sodium scores showed less correlation ( $r = +.07$ ).

The pre-test water score was negatively correlated ( $r = -.44$ ) with the number of months the subjects had been on the diet, but this correlation was nonsignificant. This relationship may be because the Center staff constantly charged the patients with the need for decreasing their fluid intake or, after the patients consumed too much water, they did not accurately recall the total amount of fluids ingested for the pre-test 24-hour recall.

The amount of money spent per person per week was shown to have a positive, though nonsignificant, correlation with the number

of months the patient had been on his diet prescription at the time pre-testing was administered. This could possibly reflect that the patients learned how much food they could ingest without experiencing unpleasant symptoms, that they could eat more than allowed since the artificial kidney machine would remove the excessive amounts of blood urea nitrogen, sodium, potassium and fluids, or that financial assistance had increased the available food money.

A very significant negative correlation ( $r = -.71$ ) of money spent for food per person per week with pre-dialysis weight change was observed. A smaller ingestion of liquids and a greater intake of the more expensive solid foods might have caused this rather surprising result. Although the correlation between money spent and pre-test information was nonsignificant, it was positive and suggests that the greater understanding of the diet prior to the audio-tutorial instruction was in the better educated group, where more money might have been available for food.

The positive, but nonsignificant, correlation of age with the pre-dialysis weight change may be construed as an indication that the older patients were not as accurate as the younger patients with measuring their fluid and sodium intakes, thus causing greater water retention. Age and pre-test protein scores showed a positive, significant correlation ( $r = +.61$ ). One interpretation may be that the older patients had more money to spend on protein-rich foods.



Male and female subjects were compared using unpaired, pooled variance "t" tests to ascertain whether sex was related to pre-test information recall scores, information score change, pre-test dietary adherence scores and changes in dietary adherence following instruction, as well as money spent for food per person per week and pre-dialysis weights and weight changes. These values are listed in Table 3.

The "t" values for both pre-test mean information scores and mean change in information were nonsignificant. The comparison of mean pre-test sodium scores for males and females was nonsignificant, but the mean change in sodium score was greater for males than for females. Highly significant "t" values (3.54 for pre-test water score and 3.68 for pre-test kilocalorie score) indicate a relationship between these scores and sex, with females conforming better to water prescriptions, but not as well to their kilocalorie prescriptions, having taken less than the prescribed amounts in each case. The better conforming sex (female with water and male with kilocalories) showed practically no change following instruction, but the lesser conforming sex apparently applied the knowledge learned in both instances. Males decreased water intake significantly more than females and females increased kilocalorie intake significantly more following the instruction. Females consumed less of their protein prescription at pre-test than males and showed a greater change than men following instruction. One explanation might be that females usually prepare their own food and learned from the program which foods were more

TABLE 3

Mean pre-test information recall scores, dietary adherence percentages, changes in each following instruction, amounts spent for food and results of "t" test comparisons between male and female subjects

Variable	Male	Female	"t" value
Pre-test information score	38.25%	44.00%	-0.56
Information score change	34.10%	35.00%	-0.09
Pre-test sodium score	50.60%	49.10%	0.12
Sodium change	- 9.40%	16.80%	-0.56
Pre-test water score	125.30%	81.75%	3.54**
Water change	-50.20%	1.75%	-3.94**
Pre-test kilocalorie score	66.40%	42.50%	3.68**
Kilocalorie change	- 2.00%	16.40%	-2.22*
Pre-test protein	87.40%	67.60%	1.74
Protein change	- 2.50%	15.75%	-1.08
Money spent per person	\$9.92	\$11.36	-0.80
Pre-dialysis weight	2.45 lb.	2.76 lb.	-0.27
Weight change	1.40 lb.	0.52 lb.	

\*,\*\* denote significance at the .05 and .01 probability levels, respectively.

important to ingest, then applied this knowledge. The difference in amount of money spent per person per week for food was non-significant between the sexes. The comparison of pre-dialysis weight for males and females, as well as the pre-dialysis weight change after administration of the instruction, was nonsignificant.

Improvement in scores for information recall in all the subjects indicates that the audio-tutorial instructional method offered an effective means of teaching the subjects, including those with a limited educational background. Eliminating printed words and using graphics and other illustrative material with simple narration appealed to the educationally disadvantaged, yet did not appear to patronize the better educated subjects.

Although the 24-hour recall of food intake has limited reliability, any errors were possibly comparable in both the pre-test and the post-test information. Again, the surgery which was experienced by the twelve patients might have been responsible for an appreciable variable in the intake of these patients, thus increasing the experimental error. Important biological and physiological sequelae may become apparent in those individuals whose intakes improved. For example, decreased BUN, increased serum albumin, stable blood pressure due to prevention of fluid retention caused by excessive fluid and sodium intakes and an increased feeling of well being could result.

The video-tapes stimulated an excellent response in the subjects on this study since they asked many more questions concerning their respective diet prescriptions than was noted prior to

the study. If this interest is maintained, continuing improvement in both understanding and practice could result.

Upon completion of the test period, patients were asked to make comments and suggestions toward improving the program. The most frequent comment was that the use of a double earphone would have eliminated the extraneous, yet unavoidable noise in the Center which was somewhat distracting while viewing the program. Several patients suggested the inclusion of more graphics, since they particularly enjoyed the cartoon characters. None of the subjects acknowledged any problem with understanding the vocabulary or content. The length of each tape was considered appropriate by all participants. Most of the patients believed that they were better prepared to adhere to their diet prescription after participating in the study.

## CHAPTER V

### CONCLUSION

From the results of this study it was evident that even though the better educated hemodialysis patients knew more about their diet prior to the audio-tutorial instruction, as indicated by a highly significant correlation between grades completed and pre-test information scores, both those subjects with less and those with more than a 10th grade education acquired a significant amount of knowledge. The degree of improvement manifested by the mean scores of the less educated subjects revealed a greater inculcation of knowledge than those with at least 10th grade education, and the post-test mean scores were very similar. Thus, the instructional portion of the stated objectives was achieved by all subjects through use of the experimental program, regardless of their educational background.

Lack of precision in the dietary recall method contributed to unaccountable errors in estimation of amounts of food ingested by the experimental subjects. Thus, statistics which were computed for the study were not totally representative of dietary adherence. However, following administration of the audio-tutorial program, some positive behavioral changes in dietary adherence were revealed. Significant changes in percentages of adherence to the diet prescription by the subjects were observed for kilocalories, sodium and water.

The better educated group of subjects showed a significant increase in mean kilocalorie intake, even though the mean kilocalorie intake for all subjects remained lower than desirable (61.8% of the diet prescription) at post-testing and no change was shown in the less educated subjects. A greater ability to apply knowledge learned from the program may account for the improvement effected by the better educated group.

A significant decrease in the mean sodium score was observed in the less educated group and the increase in sodium score for the better educated group approached significance. The post-test mean score for the entire group of subjects was less than half (47.4%) the diet prescription for sodium. Thus, both groups showed an understanding of the importance of restricting sodium intake, but need additional reinforcement to achieve the prescribed level.

The mean water consumption score (101.2%) was the only dietary variable measured which closely approximated the prescribed amount in all subjects before the instruction program was administered. A significant decrease in water consumption occurred in the less educated group. This, in addition to the decrease in sodium for the less educated group, corresponds with their greater gain in the understanding of its importance. Constant reinforcement from the Center staff to decrease sodium and water intakes also increased awareness among both groups. These changes suggest that diet prescriptions to achieve more desirable biochemical profiles

are realistic and improved behavior should follow clarified objectives.

While there was no significant change in protein consumption for either group of subjects, the mean protein score at pre-test was 77.5% and increased to 84.1% after viewing the instruction program. This does represent a positive behavioral change which is especially critical to the hemodialysis patient's well being.

It was concluded that: (a) the audio-tutorial program was a successful technique for teaching information to the group receiving hemodialysis therapy, regardless of educational background; and (b) further reinforcement measures are required to achieve sufficient application of the information learned in order to attain a desirable adherence to the diet prescription.

LITERATURE CITED



## LITERATURE CITED

1. Bennett, I. L., Jr. 1968 The provision of health services; a challenge for the future. *Ann. Intern. Med.* 69: 980.
2. Freeman, R. M., and G. M. Bulecheck 1968 Programmed instruction: an approach to dietary management of dialysis patients. *Amer. J. Clin. Nutr.* 21: 613.
3. Young, M. A. C., P. H. Buckley, H. Wechsler and H. W. Demone 1969 A demonstration of automated instruction for diabetic self care. *Amer. J. Pub. Health* 59: 110.
4. Burton, B. 1969 Diet therapy in uremia. *J. Amer. Diet. Ass.* 54: 475.
5. Stucky, V. T. 1963 Tape recordings, booklets teach diets. *Hosp.* 42: 78.
6. \_\_\_\_\_ 1968 Patients can see hospital events on closed circuit T.V. *Southern Hosp.* 15: 7.
7. David, D. S., A. L. Rubin, E. Hochgelerent and K. H. Stenzel 1972 Dietary management in renal failure. *Lancet* 1: 34.
- ✓ 8. Johnson, H. M. 1969 The educational need of economically deprived children. *Audio-Visual Instruct.* 14: 82.
- ✓ 9. Parker, J. E. 1969 Visual literacy for minority groups. *Audio-Visual Instruct.* 14: 67.
10. Mager, R. F. 1962 *Preparing Instructional Objectives.* Learon Publishers, Belmont, California. p. 3.
- ✓ 11. Bloom, B. S., M. D. Engelhart, E. J. Furst, W. H. Hill and D. R. Krathwohl 1956 *Taxonomy of Educational Objectives. Handbook I: Cognitive Domain.* David McKay Co., Inc., New York. p. 10.
- ✓ 12. Bohlen, J. M., and G. M. Beale 1955 How farm people accept new ideas. *Agric. Ext. Ser. Spec. Report. No. 15,* North Central Regional Pub. No. 1, Iowa State College, Ames, Iowa.
13. Craig, D. G. 1971 Guiding the change process in people. *J. Amer. Diet. Ass.* 58: 22.
- ✓ 14. Olds, J. 1956 *The Growth and Structure of Motives.* The Free Press. Goencoe, Illinois. p. 87.

- ✓15. Maslow, A. H. 1954 Motivation and Personality. Harper Brothers, New York. p. 63.
- ✓16. Franks, C. 1969 Behavior Therapy: Appraisal and Status. McGraw-Hill, New York. pp. 38, 73.
- ✓17. Bigge, M. L. 1964 Learning Theories for Teachers. Harper and Row, Publishers, New York. p. 300.
- ✓18. Lange, P. C. 1972 What's the score on programmed instruction? Today's Ed. 61: 59.
- ✓19. Flanagan, J. C. 1971 In: Developmental Efforts in Individualized Learning, R. A. Weisberger (ed.), F. E. Peacock Publishers, Inc., Ithaca, Illinois. p. 4.
- ✓20. Kapfer, P. G., and G. Swenson 1968 Individualized instruction for self-paced learning. The Clearing House 42: 405.
- ✓21. Moore, A. N., and H. W. Klachko 1967 Problems in producing programs for auto-instruction. J. Amer. Diet. Ass. 51: 420.
22. American Heart Association 1969 Programmed Instruction for Fat-Controlled Diet. New York.
- ✓23. Postlethwait, S. N. 1971 In: Developmental Efforts in Individualized Learning, R. A. Weisberger (ed.), F. E. Peacock Publishers, Inc., Ithaca, Illinois. p. 314.
- ✓24. Johnson, R. B., and S. Johnson 1971 Assuring Learning with Self-Instructional Packages, or Up the Up Stair-Case. Self-Instructional Packages, Inc., Chapel Hill, North Carolina. p. 7.
25. Lacey, R. A. 1972 Seeing with Feeling - Film in the Classroom. W. B. Saunders, Philadelphia. p. 1.
- ✓26. McKown, H. C., and A. B. Roberts 1940 Audio-Visual Aids to Instruction. McGraw-Hill Book Company, New York. p. 35.
- ✓27. Sherron, R. H. 1971 Curriculum research for the disadvantaged adult. Audio-Visual Instruct. 16: 41.
- ✓28. Ehrle, E. B. 1970 Avoiding the audio-tutorial mistake. Bio-Sci. 20: 103.
- ✓29. Leiberman, J. 1967 Toward Improved Learning. Reprints compiled by Public Health Service Audio-Visual Facility, U. S. Dept. of Health, Education and Welfare, Bureau of Disease Prevention and Environmental Control, Atlanta, Georgia. p. ix (Foward).

- ✓ 30. Brown, J. W., R. B. Lewis and F. F. Harclerod 1973 A-V Instructional Technology Media and Methods. McGraw-Hill Book Company, New York. p. 2.
- ✓ 31. \_\_\_\_\_ 1971 Guidelines for preparing a presentation. Committee of Graphics Intent Group, Association for Educational Communicators and Technology. Audio-Visual Instruct. 16: 42.
32. Pender, J. L. 1966 Dietitian teaches patient via closed circuit TV. Hosp. Topics 44: 46.
- ✓ 33. Dwyer, F. W. 1972 A guide for Improving Visualized Instruction. Learning Services, Pennsylvania State University. p. 6.
34. Wang, F. 1971 Conservative management of chronic renal failure. Med. Clin. of N. Amer. 55: 137.
35. Anderson, C. F., R. A. Nelson, J. D. Margie, W. J. Johnson and J. C. Hunt 1973 Nutritional therapy for adults with renal disease. J. Amer. Med. Ass. 223: 68.
36. Maddock, R. K., Jr., H. A. Bloomer and S. W. de St. Joer 1968 Low protein diet in the management of renal factors. Ann. Intern. Med. 69: 1003.
37. Brown, W.D. 1967 Present knowledge of protein nutrition. In: Present Knowledge in Nutrition, The Nutrition Foundation, Inc., New York. p. 6.
38. Munro, H. N. 1964 In: Mammalian Protein Metabolism, Vol. I, H. N. Munro and J.B. Allison (eds.), Academic Press, New York. p. 401.
39. Recommended Daily Allowances 1968 Report of the Food and Nutrition Board, National Academy of Sciences. Washington, D. C.
40. Irwin, M. I., and M. Hegsted 1971 A conspectus of research on protein requirements in man. J. Nutr. 101: 385.
41. Food and Agriculture Organization 1965 Protein Requirements. Report of a joint FAO/WHO Expert Group. FAO Nutrition Meeting, Report Series No: 37. Food and Agriculture Organization of the United Nations, Rome, Italy.
42. Osborne, T.B., and L. B. Mendel 1917 The use of soybeans as food. J. Biol. Chem. 32: 369.

43. Mitchell, H. H. 1923 A method of determining the biological value of protein. *J. Biol. Chem.* 58: 873.
44. Platt, B. S., D. S. Miller and P. R. Payne 1961 Protein value of foods. In *Recent Advances in Human Nutrition*, J. R. Brock (ed.), Churchill, London. p. 360.
45. Hegsted, D. M. 1964 Proteins, In: *Nutrition, A Comprehensive Treatise*, Vol. I, Macronutrients and Nutrient Elements, G. H. Beaton and E. W. McHenry (eds.), Academic Press, New York. p. 115.
46. Scrimshaw, N. S., R. F. Goldman and J. Mayer 1966 Minimum dietary essential amino acid-to-total nitrogen ratio for whole egg protein fed to young men. *J. Nutr.* 89: 9.
47. Hegsted, D. M. 1968 Minimum protein requirements in man. *Amer. J. Clin. Nutr.* 21: 352.
48. Krebs, H. A. 1964 The metabolic fate of amino acids. In: *Mammalian Protein Metabolism*, Vol. I, H. N. Munro and J. B. Allison (eds.), Academic Press, New York. p. 150.
49. Najarian, J. S., and H. Harper 1956 A clinical study of the effect of arginine on blood ammonia. *Amer. J. Med.* 21: 832.
50. Giordano, C. 1963 Use of exogenous and endogenous urea for protein synthesis in normal and uremic subjects. *J. Lab. Clin. Med.* 62: 231.
51. Giovannetti, S., and Q. Maggiore 1964 A low-nitrogen diet with proteins of high biological value for severe chronic uremia. *Lancet* 1: 1000.
52. Berlyne, G. M., A. B. Shaw and S. Nilwarangkur 1965 Dietary treatment of chronic renal failure. *Nephron* 2: 129.
53. Rose, W. C., R. L. Wixon, H. B. Lockhart and G. F. Lambert 1955 The amino acid requirements of man. *J. Biol. Chem.* 217: 987.
54. Dunea, G. 1971 Peritoneal dialysis and hemodialysis. *Med. Clin. of N. Amer.* 55: 155.
55. Ginn, H. E., A. Frost and W. W. Lacy 1968 Nitrogen balance in hemodialysis patients. *Amer. J. Clin. Nutr.* 21: 385.
56. Kopple, J. D., J. H. Shinaberger, J. W. Coburn, M. K. Sorenson and M. E. Rubini 1969 Evaluating modified protein diets for uremia. *J. Amer. Diet. Ass.* 54: 481.

57. Cullen, A. B. 1968 Dietary management of chronic uremia and patient adherence to dietary restrictions. Amer. J. Clin. Nutr, 21: 626.
58. Stein, P. G., and N. J. Winn 1972 Diet controlled in sodium, potassium, protein and fluid; use of points in calculation. J. Amer. Diet. Ass. 61: 538.
59. Rosenstock, I. M. 1969 Psychological forces, motivation and nutrition education. Amer. J. Pub. Health 59: 1992.
60. Sorenson, M. K., and J. D. Kopple 1968 Assessment of adherence to protein-restricted diets during conservative management of uremia. Amer. J. Clin. Nutr. 21: 63.
61. Robinson, L. G., and A. H. Paulbitski 1972 Diet therapy and educational program for patients with chronic renal failure. J. Amer. Diet. Ass. 61: 531.
62. Tsaltas, T. T. 1969 Dietetic management in uremia. Amer. J. Clin. Nutr. 22: 490.
63. Sorensen, M. K. 1970 A yeast-leavened, low protein, low electrolyte bread. J. Amer. Diet. Ass. 56: 521.
64. Krawitt, L. P., and E. K. Weinberger 1971 Practical Low Protein Cooking. Charles C. Thomas Publishing Co., Springfield, Illinois.
65. Card, B. K. 1973 Dietetic food store for patients on hemodialysis. J. Amer. Diet. Ass. 62: 425.
66. Reichsman, F., and N. B. Levy 1972 Problems in adaptation to maintenance hemodialysis. Arch. Intern. Med. 30: 859.
67. Halper, I. S. 1971 Psychiatric observations in chronic hemodialysis program. Med. Clin. N. Amer. 55: 177.
68. Schwartz, W. B., and J. P. Kassirer 1968 Medical management of chronic renal failure. Amer. J. Med. 44: 792.
69. Walser, M., A. W. Coulter, S. Dighe and F. R. Crantz 1973 The effect of keto-analogues of essential amino acids in severe chronic uremia. J. Clin. Invest. 52: 678.
70. Composition of Foods 1963 Agriculture Handbook No. 8, Agriculture Research, U. S. Department of Agriculture, Washington, D.C.

71. Remington, R. D. and M. A. Schork 1970 Statistics with Application to the Biological and Health Sciences. Prentice-Hall, Inc., Englewood Cliffs, New Jersey. p. 195.
72. Bailey, M., M. Barnes and E. M. Horrocks 1963 Our English Language, Grade 3. The American Book Company, New York. p. 2.

APPENDIXES

## APPENDIX A

TABLE 4

Diet prescription, pre-test and post-test intakes from 24-hour recall of food intake for experimental subjects

Patient code Number		Water, ml			Kcal			Protein, g			Sodium, mg		
		Rx	pre	post	Rx	pre	Post	Rx	pre	post	Rx	pre	post
1	A <sup>a</sup>	800	528	502	2000	885	1147	50	13.1	44.0	1000	1244	521
2	B <sup>b</sup>	1000	845	1060	2000	954	1215	50	53.4	49.7	2000	877	780
3	B	800	790	841	1800	1031	1105	50	45.1	45.2	2000	570	1067
4	A	800	985	390	1800	1389	1201	50	45.2	33.5	2000	1528	888
5	A	800	1954	959	2000	949	1664	60	54.3	65.2	2000	805	1088
6	B	1000	726	1101	1800	526	1194	50	46.3	32.1	1000	452	1006
7	B	800	1336	671	2000	1350	1451	60	55.3	73.0	2000	843	1100
8	A	800	898	649	2000	1445	990	60	62.7	33.3	2000	714	807
9	B	ad lib	1137	1061	1800	1592	1374	60	50.0	68.4	2000	661	1253
10	A	800	1169	670	2000	1231	1259	60	53.4	57.3	2000	1480	550
11	B	800	800	481	1800	909	1239	50	39.5	28.0	2000	819	1131
12	A	800	567	497	1800	604	617	60	20.0	42.7	2000	880	591
13	A	800	633	507	2000	813	952	60	34.8	40.8	2000	1059	673
14	A	800	998	722	1800	1365	940	60	54.4	28.0	2000	1017	556
15	B	800	496	568	1800	689	983	50	29.6	44.1	2000	781	348
16	B	800	784	726	1800	709	1352	50	27.1	55.7	2000	544	1288

<sup>a</sup>"A" represents subjects who have had less than 10th grade education.

<sup>b</sup>"B" represents subjects who have had at least 10th grade education.



APPENDIX B

PRE-TEST AND POST-TEST FORMS FOR AUDIO-TUTORIAL

DIET INSTRUCTION PROGRAM

Patient Identification      Patient No. \_\_\_\_\_ Group No. \_\_\_\_\_

Diet Rx: Pro. \_\_\_\_\_g: Na \_\_\_\_\_g: K \_\_\_\_\_g

Calories \_\_\_\_\_

Total Fluids \_\_\_\_\_cc.

Date started hemodialysis \_\_\_\_\_

Date started present diet Rx \_\_\_\_\_

Diagnosis \_\_\_\_\_

Nephrectomy \_\_\_\_\_

Significant medications \_\_\_\_\_

BIOCHEMICAL DETERMINATIONS

Hematologic Profile		Baseline (pre-test)	One Month (post-test)
Serum:	Total Protein, g %		
	Sodium, mg/l		
	Potassium, mg/l		
	Albumin, g %		
Whole Blood:	Urea Nitrogen, mg %		
	Creatinine, mg %		
	Hematocrit, %		

CLINICAL PROFILE

	Baseline (pre-test)	One Month (post-test)
Weight		
Weight change since last treatment		
Complaints		
Lucidity		
General Appearance		
Ambulatory to Center		
Hospitalization between dialysis treatments		

DOMESTIC & SOCIOECONOMIC FACTORS

Ethnic background \_\_\_\_\_ Education (last grade completed) \_\_\_\_\_  
 Occupation \_\_\_\_\_ Number of persons living in home \_\_\_\_\_  
 Weekly amount spent on food: \$5-\$10; \$10-\$15; \$15-\$20; \$20-\$25;  
 other \_\_\_\_\_ Purchase food stamps \_\_\_\_\_ Vegetable garden \_\_\_\_\_  
 Chickens (& eggs) \_\_\_\_\_ Other sources of food \_\_\_\_\_  
 Cooking facilities: stove (kind) \_\_\_\_\_ refrigerator \_\_\_\_\_  
 deepfreeze \_\_\_\_\_ standard measuring cup \_\_\_\_\_ & spoons \_\_\_\_\_  
 household or diet scales \_\_\_\_\_ Who does the cooking? self \_\_\_\_\_  
 spouse \_\_\_\_\_ relative \_\_\_\_\_ other \_\_\_\_\_. How often  
 does patient eat out? \_\_\_\_\_.  
 Recreation \_\_\_\_\_ & frequency \_\_\_\_\_.  
 Cigarettes per day \_\_\_\_\_ Alcoholic beverages: kind \_\_\_\_\_  
 amount \_\_\_\_\_. Which foods does patient miss the most on this  
 diet \_\_\_\_\_  
 Which is difficult on this diet? Having to eat a certain amount of  
 meat and eggs each day \_\_\_\_\_; doing without cornbread, light bread,  
 biscuits \_\_\_\_\_; doing without salty foods \_\_\_\_\_; measuring  
 all foods \_\_\_\_\_; limiting the amount of water or other beverages.

## PATIENT'S COMPREHENSION OF DIET

	Possible Score	Pre-test Score	Post-test Score	Score
1. Name of protein foods.	10			
2. What does protein do for your body?	9			
3. Which protein foods should you eat every day?	9			
4. What does too much salt do for you?	9			
5. Why aren't ham, bacon or potato chips on your diet?	9			
6. Which foods on your diet have water in them?	9			
7. What should you measure if your fluids are limited?	9			
8. Name some foods which are high in potassium.	9			
9. How can you lower potassium in fresh vegetables?	9			
10. Why should you eat wheat starch bread?	9			
11. Why do you need the right amount of calories every day?	9			
<b>TOTAL SCORE</b>	<b>100</b>			

## 24-HOUR RECALL OF DIET INTAKE

	Pre-test	Post-test
Appetite		
Breakfast		
Morning snack		
Lunch		
Afternoon snack		
Dinner		
Bedtime snack		

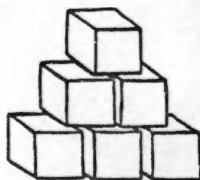
## COMPUTERIZED ANALYSIS OF 24-HOUR RECAL

	Water,cc	Kilo- Calories	Protein, g	Sodium, mg	Potassium,mg
Pre-test					
Post-test					
% diet Rx					

APPENDIX C  
SELF TESTS

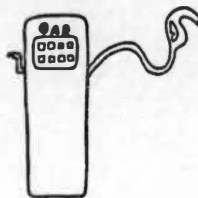
TAPE I: PROTEIN

1



"PROVIDE BUILDING BLOCKS FOR MUSCLES AND OTHER TISSUES?"<sup>1</sup>

"PROVIDE FUEL OR ENERGY?"



Q. "WHAT IS THE MOST IMPORTANT THING THAT FIRST CLASS PROTEINS DO FOR YOU?"

2

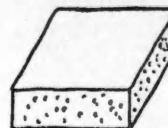


"BAKED CHICKEN?"



"GREEN BEANS?"

"CORNBREAD?"



"EGG?"

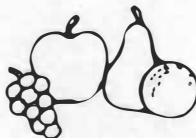


Q. "MARK TWO FIRST CLASS PROTEIN FOODS."

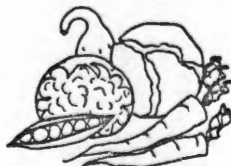
3



"CEREALS?"



"FRUITS?"



"VEGETABLES?"



"CHEESE?"

Q. "MARK THREE FOODS WHICH CONTAIN SECOND CLASS PROTEIN."

4



"EGGS?"



"MEAT?"



"PEAS?"



"CEREALS?"

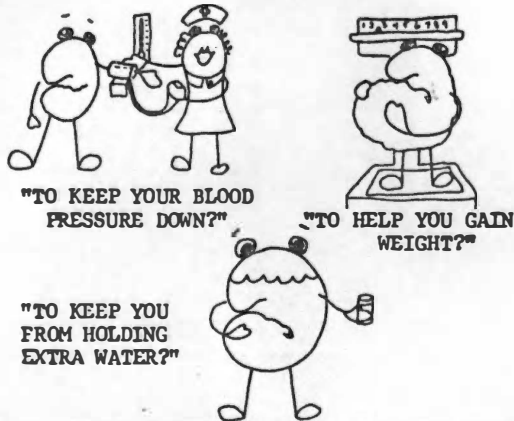


"FRUIT?"

Q. "MARK TWO FIRST CLASS PROTEIN FOODS YOU SHOULD EAT EVERY DAY."

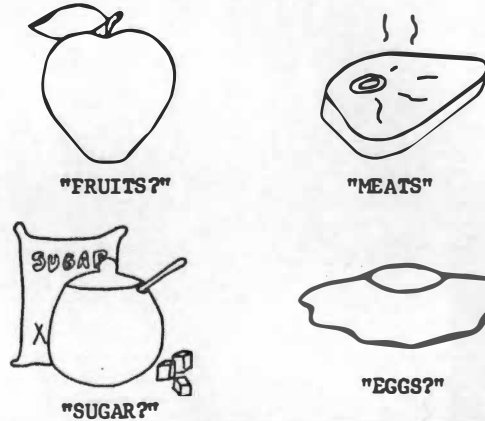
<sup>1</sup>Labels and questions are printed here for purposes of this paper only.

1



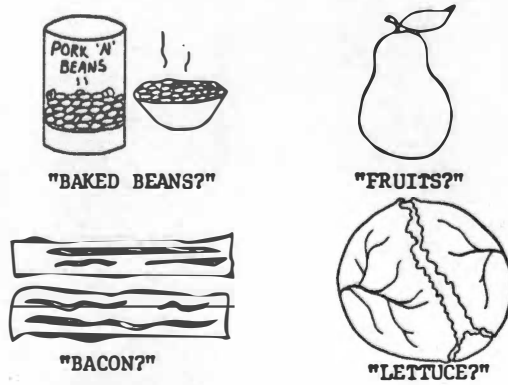
Q. "WHY IS SODIUM MEASURED IN YOUR DIET? MARK TWO ANSWERS."

2



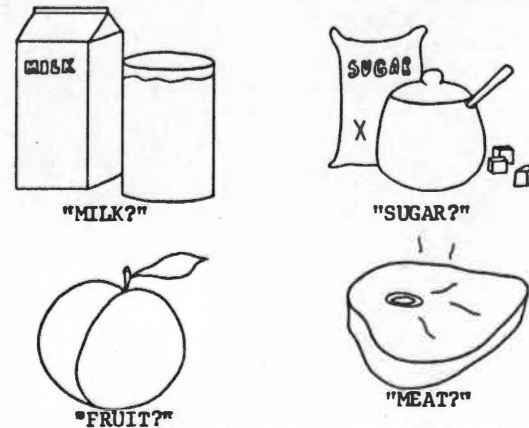
Q. "WHICH FOODS CONTAIN HIDDEN SODIUM? MARK THREE ANSWERS."

3



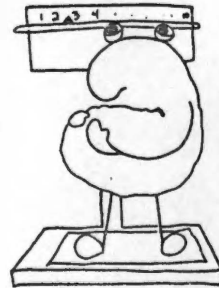
Q. "WHICH FOODS ARE NOT ON YOUR DIET LIST BECAUSE THEY CONTAIN TOO MUCH SODIUM? MARK TWO?"

4



Q. "WHICH FOODS CONTAIN WATER THAT MUST BE COUNTED IN YOUR TOTAL FLUIDS? MARK THREE?"

1



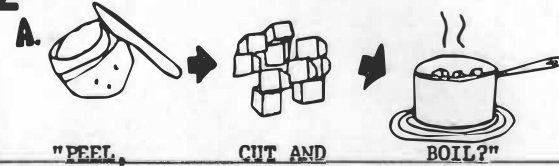
"TO HELP YOU GAIN WEIGHT?"



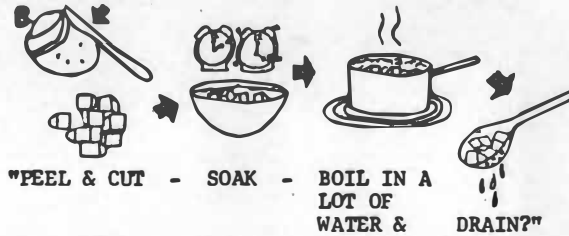
"TO BALANCE THE AMOUNT OF POTASSIUM YOUR KIDNEYS CAN HANDLE ALONG WITH YOUR MEDICINE AND DIALYSIS TREATMENT?"

Q. "WHY DO WE MEASURE K IN YOUR DIET?"

2



"PEEL, CUT AND BOIL?"



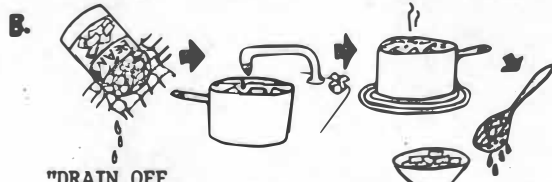
"PEEL & CUT - SOAK - BOIL IN A LOT OF WATER & DRAIN?"

Q. HOW CAN YOU LOWER K IN POTATOES?"

3



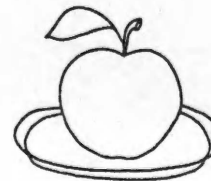
"HEAT IN WATER THEY WERE PACKED IN?"



"DRAIN OFF PACKING WATER, RINSE, HEAT IN FRESH WATER"

Q. "HOW CAN YOU LOWER K IN CANNED VEGETABLES?"

4

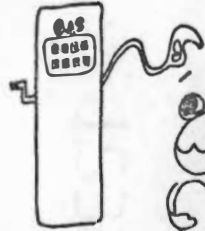


"RAW FRUITS & VEGETABLES?"



"CANNED FRUITS & VEGETABLES?"

Q. "WHICH FOODS HAVE THE MOST K IN THEM?"



"FOR FUEL OR ENERGY?"



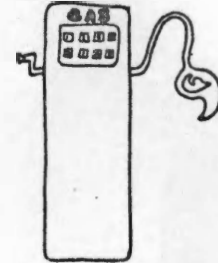
"TO PROTECT YOUR MUSCEL CELLS FROM BEING USED FOR ENERGY?"

"TO GIVE YOU EXTRA WATER?"

Q. "WHY DO YOU NEED THE RIGHT AMOUNT OF CALORIES EVERY DAY? MARK TWO."

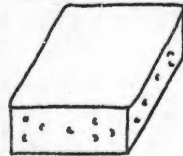


"JUST BECAUSE THEY TASTE GOOD?"



"TO GIVE YOU EXTRA CALORIES?"

Q. "WHY SHOULD YOU EAT THE WHEAT STARCH BREAD AND DESSERTS EVERY DAY?"



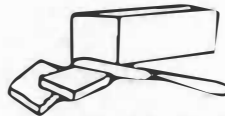
"CORNBREAD?"



"JELLY?"



"COOKING OIL?"



"BUTTER, MARGARINE?"



"SWEET POTATO?"

Q. "WHICH FOODS GIVE YOU EXTRA CALORIES WITHOUT ADDING EXTRA PRO., NA, K, OR FLUIDS?"



## APPENDIX D

TABLE 5

Patient identification, months on diet prescription, money spent for food per person per week and pre- and post-test pre-dialysis weight changes between treatments

Patient code Number	Sex, age, race	Grades Completed in school	Months on diet at pre-test	Food money spent per week	Pre-dialysis weight changes in pounds	
					pre	post
1	A <sup>a</sup> F 24 N	8	11	\$15.00	+3.0	+3.0
2	B <sup>b</sup> F 41 N	12	9	10.00	+5.5	+3.8
3	B F 52 N	12	6	10.00	+2.0	+5.5
4	A M 48 N	2	12	6.00 <sup>c</sup>	+1.8	+1.0
5	A M 44 N	9	7	10.00	+1.8	+4.0
6	B F 57 N	10	15	15.00	0.0	+1.8
7	B M 34 N	12	3	8.00	+4.0	+1.0
8	A M 43 N	4	12	12.50	+2.0	-0.3
9	B M 23 W	15	3	12.50	+3.5	+4.8
10	A M 38 N	5	3	8.55	+6.5	+5.0
11	B F 46 N	12	12	15.00	+0.5	+3.0
12	A F 27 N	7	12	4.50	+6.0	-3.8
13	A M 41 N	6	5	8.00	+1.5	+9.3
14	A M 39 N	9	2	3.00 <sup>c</sup>	-1.5	+6.0
15	B F 35 W	10	4	10.00	+2.8	+8.0
16	B F 31 N	12	10	3.00 <sup>c</sup>	+2.3	+5.0

<sup>a</sup>"A" represents subjects who have had less than 10th grade education.

<sup>b</sup>"B" represents subjects who have had at least 10th grade education.

<sup>c</sup> Food stamps or other sources of food were used.

## APPENDIX E

TABLE 6

Information recall test scores and percentages of diet prescriptions (Rx) consumed

Patient code Number	Information recall scores		Percent of Diet Rx consumed, 24-hour recall							
	pre	post	Water		Kcal		Protein		Sodium	
			pre	post	pre	post	pre	post	pre	post
1 A <sup>a</sup>	64	87	66	63	44	57	26	88	124	52
2 B <sup>b</sup>	34	47	85	106	48	61	107	99	44	39
3 B	47	72	99	105	57	61	90	90	29	53
4 A	16	67	123	49	77	67	90	67	76	44
5 A	24	62	100 <sup>c</sup>	120	47	83	91	109	40	54
6 B	26	69	73	110	29	66	93	64	45	101
7 B	55	80	167	84	68	73	92	122	42	55
8 A	42	50	112	81	72	50	105	56	36	40
9 B	78	91	100 <sup>c</sup>	100 <sup>c</sup>	88	76	83	114	33	63
10 A	21	71	146	84	62	63	89	96	74	28
11 B	60	81	100	60	51	69	79	56	41	57
12 A	22	64	71	62	34	34	33	71	44	30
13 A	53	89	79	63	41	48	58	68	53	34
14 A	17	65	125	90	76	52	91	47	51	28
15 B	32	70	62	71	38	55	59	88	39	17
16 B	67	85	98	91	39	75	54	111	27	64

<sup>a</sup>"A" represents subjects who have had less than 10th grade education.

<sup>b</sup>"B" represents subjects who have had at least 10th grade education.

<sup>c</sup> Fluid intake was ad libitum.

## VITA

Virginia King Lawson was born in Pineville, Missouri, October 10, 1918. She completed both elementary and preparatory schools in Kansas City, Missouri. After receiving a Bachelor of Science degree in Dietetics and Institutional Management from Kansas State University, Manhattan, in 1939, the student entered and completed a 12-month dietetic internship at Vanderbilt University in Nashville, Tennessee. This was followed by employment from 1940-43, as Staff Dietitian at Baptist Memorial Hospital in Memphis, Tennessee. Marriage and the subsequent family of four children interrupted her career until 1958, when she returned to an active professional life. She has been employed in the position of Chief Research Dietitian for The University of Tennessee Clinical Research Center, Memphis, since 1964. In 1971, the student entered The University of Tennessee, Graduate School, Knoxville, to pursue an advanced degree in nutrition. A Master of Science degree in Nutrition was obtained in December, 1973.