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The Effect of Computer-Assisted Nutrition Education on Nutrition Knowledge, Nutrition Status, Dietary Compliance, and Quality of Life of Hemodialysis Patients

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THE EFFECT OF COMPUTER-ASSISTED NUTRITION EDUCATION ON NUTRITION KNOWLEDGE, NUTRITION STATUS, DIETARY COMPLIANCE, AND QUALITY OF LIFE OF HEMODIALYSIS PATIENTS

by

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Julianne Stewart

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ABSTRACT

The Effect of Computer-Assisted Nutrition Education on Nutrition Knowledge, Nutrition Status, Dietary Compliance, and Quality of Life of Hemodialysis Patients

by

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This study was conducted to assess the effect of nutrition education utilizing computerized dietary analysis on nutrition knowledge, dietary compliance, nutrition status, and quality of life in hemodialysis patients. Twenty patients of the Bonneville Dialysis Center in Ogden, Utah voluntarily agreed to participate in this six-month study. All participants completed quality of life assessments, the Beck Depression Inventory© (BDI), and a nutrition knowledge assessment pre- and post-study. Patients in the treatment group (n=12) completed monthly 3-day food records which were analyzed by Computrition® nutrient analysis software. Results were discussed with the patients during one-on-one education sessions. Control patients (n=8) completed 3-day food records pre- and post-study. Monitoring parameters included: nutrition-related laboratory data, kinetic modeling data, weights, and percent body fat, using Futrex® near infrared interactance. Dietary components followed were: protein, calories, sodium, potassium, calcium, and phosphorus. Multivariant analysis of variance was used for statistical comparisons.

Weight and percent body fat were relatively stable throughout the study period for both groups. The treatment group's nutrition knowledge improved as measured by pre- and post-study test scores. Nutrient intakes showed no significant changes except for calorie

intake, which decreased in the treatment group. The treatment group's intake of other analyzed nutrients showed declining trends, which were not statistically significant.

Serum albumin and total protein increased in both groups. Average serum cholesterol levels decreased in the treatment group. Serum potassium levels did not change significantly. Serum phosphorus increased in the treatment group. However, this did not appear to be caused by increased dietary phosphorus intake. Kinetic modeling data showed a significant increase in protein catabolic rate of experimental subjects. Protein catabolic rates (PCR) are an indicator of dietary protein intakes in maintenance hemodialysis patients.

The treatment group showed improvement in the alertness behavior area of the Sickness Impact Profile© (SIP). The control group declined in the recreation and pastimes area of the SIP. No significant changes were observed in the BDI.

These results indicate that computerized dietary analysis is an effective instruction tool, is helpful in improving dietary protein intake as measured by PCR, and may contribute to improved quality of life of hemodialysis patients.

(194 pages)

CHAPTER I

INTRODUCTION

Background Information

The normal functions of the kidney can be grouped into three areas 1) excretory function, 2) homeostatic/metabolic function, and 3) endocrine activity. The kidneys expel excess water, solutes, and metabolic waste products. They help maintain normal acid-base electrolyte, and fluid balance. The kidneys also secrete renin, erythropoietin, prostaglandins, and vitamin D (Shronts, 1989). In addition, they are involved with the metabolism of other hormones such as insulin, glucagon, and parathyroid hormone (Kopple, 1988). Treatment for renal failure attempts to mimic the kidney's normal function. Nutritional management is a mainstay of the treatment regimen.

In recent years, much progress has been made in the treatment of renal disease (Jameson and Wiegmann, 1990). The first successful hemodialysis in humans was reported by Kolff in 1944. In 1960, indwelling plastic vascular cannulas were introduced. Prior to this time, dialysis was preformed using glass or metal cannulas that were inserted into an artery or a vein. The surgical method of creating an arteriovenous fistula that could withstand repeated needle puncture was introduced in 1966. Over the last 20 years, more significant advances have occurred, such as the development of high-flux dialysis and improved medications. Improvements in dialysis techniques and organ transplant procedures have extended the lives of many patients. However, none of the current treatment methods are entirely satisfactory. Renal failure has many side effects which affect other organ systems of the body. Antirejection medications also have undesirable side effects. Life may be prolonged, but the quality of life is not optimal. The overall management of the disease is geared toward prolonging the patient's life and improving his/her quality of life (Zeman, 1991).

Chronic renal failure (CRF) occurs when there is an irreversible loss of kidney function that occurs over an extended period of time. All functions of the kidney are lost -- excretory capacity as well as endocrine and metabolic functions. There are many causes of CRF. Zeman (1991) classified them as follows: 1) diseases in which kidney involvement is predominant, i.e. glomerulonephritis, interstitial nephritis, or polycystic disease; 2) urinary tract obstruction that may lead to renal failure, i.e. malignancy or prostatic enlargement; 3) conditions that often cause renal failure, i.e. malignant hypertension, potassium deficiency, or heavy metal poisoning; and 4) systemic diseases in which renal failure sometimes occurs, i.e. diabetes, atherosclerosis, or gout.

Renal disease is classified according to glomerular filtration rate (GFR). The normal GFR is approximately 125 ml/min. The progression of renal failure can be divided into four stages: decreased renal reserve, renal insufficiency, renal failure, and uremia (Zeman, 1991). Because of the large reserve capacity of the kidney, at least 55% of the normal renal function is lost before blood urea nitrogen increases. In the phase of decreased renal reserve the GFR is greater than 55 ml/min, but less than the normal rate. In renal insufficiency, the GFR is between 30 and 55 ml/min and up to 80% of the nephron function may be lost. Mild azotemia is seen in this stage. In renal failure the GFR is between 12.5 and 30 ml/min, and loss of nephron function may reach 90%. Signs of this stage include moderate to severe azotemia and anemia, electrolyte and acid-base balance impairment, and decreased concentrating ability. In the final stage of uremia, 90 to 100% of renal function is lost, and the GFR is less than 12.5 ml/min. Individuals in this stage are oliguric or anuric and have uremic symptoms involving other organ systems (Zeman, 1991).

The time for initiation of dialysis is highly dependent on the patient's individual symptoms. Patients show a wide variety of symptoms for a given level of serum abnormalities (Jameson and Wiegmann, 1990). In patients with CRF, dialysis is usually

initiated when the GFR is between 5 and 10 ml/min (Zeman, 1991).

During recent years, the number of patients receiving dialysis treatments has grown at a remarkable rate. In 1988, there were 147,000 patients with end-stage renal disease in the United States, and the number is rising by nearly 10% per year. Of these patients, 110,000 received dialysis treatments and 37,000 underwent kidney transplantations (U.S. Renal Data System 1990 Annual Data Report). This growth is primarily due to technological advances and the increased availability of dialysis (Jameson and Wiegmann, 1990). Also, the lives of patients with diseases such as diabetes, which is one of the main causes of renal failure, are being extended. Hence, diabetic patients who would not have lived long enough to develop long-term complications are now developing renal failure and other chronic complications of diabetes.

The mechanisms involved in the progression of renal disease are not fully understood. There are at least two reasons why these mechanisms are not elucidated. First, because the glomerulus and interstitium have a rather limited number of responses to injury, the kidney responds to a variety of insults in a similar manner. When the "end-stage kidney" is examined, it is usually impossible to determine the cause of the sclerosis or to determine whether the original insult is continuous. Second, the damaged kidney seems to continue to deteriorate. In animal models it is clear that renal insufficiency can progress after the original insult to the kidney has ended. Hence, the kidney itself may contribute to its own deterioration as a result of its response to injury (Klahr et al., 1988).

Klahr et al. (1988, p.1657-1658) described the "end-stage kidney" as follows:

> The end-stage kidney is usually reduced in mass. The glomeruli have a loss of capillaries, localized areas of cell proliferation, and progressive scarring that eventually causes the capillary bed to collapse. Tubules, particularly those attached to scarred glomeruli, are atrophied and often surrounded by inflammatory cells. There is diffuse fibrosis characterized by increased deposition of collagen and mesenchymal matrix, increased lipid deposition, and increased numbers of fibroblasts. On electron micrographs, the tubular and glomerular basement membranes are often thickened in the early stages of the disease and are condensed into amorphorous material

in the later stages.

Several potential risk factors have been identified which may contribute to the progression of CRF. Such factors include: systemic hypertension, proteinuria, hyperlipidemia, high dietary protein intake, and other conditions that lead to glomerular hypertrophy (Klahr et al., 1988).

Once renal failure has progressed to the point of requiring dialysis to maintain life, proper nutrition is a vital component of the patient's treatment. At this time, a major goal of nutritional management is to compensate for the kidneys' loss of function in maintaining the constancy of the body's internal environment. Intake of food and fluids normally makes a substantial contribution to the variability of the internal environment. Hence, a major role of nutritional management is to reduce the intake of substances that the kidney must excrete and to provide replacements for those materials lost in abnormal quantities. While some nutrients are being restricted, the patient must still be provided a diet to maintain optimum nutritional status. This can be very challenging because many patients suffer from the symptoms of uremia. Early-morning nausea is frequently seen, as well as anorexia and aversion to meats. Weakness, fatigue, memory loss, motor neuropathy, prolonged bleeding times, and personality changes are other common symptoms. Patients with uremia may also develop a sallow skin color, a urine-like odor to the breath, and urea crystal deposits on the skin (Zeman, 1991; Jameson and Wiegmann, 1990). In addition, patients undergoing treatment may suffer from anxiety, depression, and frustration resulting from rigid, complicated treatment regimens and diets (Gardner, 1981).

Many complications are observed in the long-term dialysis patient. Such complications are not simply the result of the dialysis treatment itself. Rather, they reflect the ongoing process of the underlying disease, along with treatment side effects and a state of uremia that is permanently undertreated. Examples include renal osteodystrophy, which is caused by hyperparathyroidism and vitamin D deficiency, and anemia with combined

etiologies of erythropoietin deficiency, hyperparathyroidism, vitamin deficiency, aluminum toxicity, chronic dialysis-related blood losses, hemolysis, excessive blood sampling, and gastrointestinal bleeding. Complex nutritional problems occur as a result of anorexia or an inadequate diet as well as dialysis losses of water-soluble vitamins and amino acids. Often dietary management is complicated by the presence of delayed gastric emptying, especially in diabetic patients. Hiccups, ulcers, and gastroesophageal reflux are also seen. Hyperlipidemia is a common complication, and many abnormalities are seen in the cardiovascular system. These include an increased incidence of hypertension, angina, myocardial infarctions, and strokes. Excessive fluid intakes and weight gains between dialysis treatments contribute to volume expansion and hypertension, which cause deleterious long-term effects on the cardiovascular system (Jameson and Wiegmann, 1990).

Malnutrition is common in patients with CRF. The causes of malnutrition are much more complex than merely inadequate nutrient intakes. Metabolic abnormalities specific to renal disease also contribute to malnutrition. Such factors include interactions of nitrogenous wastes and potential metabolic toxins with hormones or within metabolic pathways (Guarnieri et al., 1989).

Because of the kidney's unique role in nutrient metabolism and the process of disease progression, patients with renal failure are especially susceptible to malnutrition. Dialysis patients display protein-calorie malnutrition, vitamin and mineral deficits, loss of appetite, nausea and vomiting, and altered nutrient metabolism (Moore and Acchiardo, 1991). This presents a real challenge for nutrition professionals working with dialysis patients.

Dietary compliance is generally considered to be poor (Blackburn, 1977; De-Nour and Czaczkes, 1972; Ferraro et al., 1986; Gardner, 1981; Hartman and Becker, 1978; Manley and Sweeney, 1986; Wolcott et al., 1986). Eating correctly often presents a very

difficult challenge for patients and their families and may result in unnecessary over-restriction of some nutrients and, ultimately, failure to eat (Gardner, 1981).

Computerized diet analysis has been shown to be an effective educational tool that can improve patients' nutrition knowledge and compliance to dietary counseling (Dennison et al., 1991; Gagliardi and Marx, 1989; Moses et al., 1989; Walt and Forgione, 1989). With the increased availability of computers in the dialysis setting, nutrient analysis computer software can be more feasibly utilized. Access to the nutrient content of foods through nutrient analysis computer software may be a means to help patients increase dietary flexibility and meet their nutritional goals with as few limitations as possible.

Problem Statement

Dietary noncompliance is a prevalent problem among the dialysis population. Fluids and some nutrients such as sodium, potassium, and phosphorus must be limited while energy and other nutrients, such as protein and calcium, must be maintained at adequate levels. These specific requirements result in a very complicated diet which is difficult for many patients to understand and follow. Dietary compliance often is an overwhelming challenge for patients and their families. Because of the rigid, complicated, and unpalatable nature of the diet, dietary limitations can cause significant psychological stress. Physical and emotional symptoms such as anxiety and failure to eat are seen. This condition has been termed "hyperdietism" (Gardner, 1981).

Malnutrition is commonly seen as a result of poor nutrient intakes and other metabolic abnormalities. Poor nutritional status impairs wound healing and rehabilitation and increases susceptibility to infection. The dialysis process itself is catabolic, and many patients experience anorexia and gastrointestional problems which further contribute to malnutrition. Improving dietary compliance would contribute to improving the nutritional status of dialysis patients and contribute to an improved sense of well being. Access to the

nutrient content of foods via nutrient analysis computer software should enhance dietary flexibility and aid patients in improving and maintaining good nutritional status.

The quality of life of hemodialysis patients is comparatively poor when compared to patients with kidney transplants and the general population (Evans et al., 1985b). Nutritional factors affect many dimensions of quality of life, including perceived physical, psychological, and interpersonal well-being (Padilla, 1990). Improving nutritional status may enhance the quality of life of dialysis patients. Improving quality of life is an important goal in patient care.

Purpose of the Study

The purpose of this study was to determine the effect of using nutrient analysis computer printouts as an educational tool on dietary compliance, quality of life, nutrition knowledge, and nutrition status of hemodialysis patients.

Objectives

1. To optimize the use of the Computrition nutrition analysis system in preventing and controlling "hyperdietism":
   A. implement patient participation in a computer-assisted dietary analysis learning program
   B. develop patient education materials based on need identified through patient survey.
2. To maintain or improve the nutritional status of study participants.
3. To determine the change in quality of life of study participants.
4. To determine the change in nutritional knowledge of study participants.
5. To determine the change in dietary compliance of study participants.

Methodology

Subjects

The study sample included 20 chronic hemodialysis patients being treated at the Bonneville Dialysis Center in Ogden, Utah. The treatment group included 12 patients (6 men and 6 women) age 32-75 years (mean=55.2 years) who had been receiving hemodialysis treatments for 8-81 months (mean=38.0 months). The control group included 8 patients (3 men and 5 women) age 33-72 years (mean=57.9 years) who had been receiving hemodialysis treatments for 6-234 months (mean=56.8 months).

Development of Education Materials

From the results of a nutrition-related interest survey, a patient education manual, "Bonneville Dialysis Center Nutrition Guide: Eating Well on Dialysis," was developed. This manual served as an education/reference guide for patients. Patients in the treatment group were given a copy of the manual at the beginning of the study period.

Recruitment

All chronic hemodialysis patients of the Bonneville Dialysis Center were individually contacted, informed of the study, and made aware of what would be expected of study participants. Patients willing to participate in the six-month study were asked to sign an informed consent and to complete questionnaires dealing with general nutrition information, nutrition knowledge, dietary compliance, and quality of life.

Biochemical Data

Biochemical data were obtained from the patient's medical record. Laboratory data collected and analyzed for this study included: hemoglobin, hematocrit, sodium, potassium, calcium, phosphorus, blood urea nitrogen (BUN), creatinine, cholesterol, total protein, albumin, and alkaline phosphatase. Kinetic modeling was done quarterly on most

patients as part of their regular treatment. Protein catabolic rate and Kt/V were collected and analyzed for the months that kinetic modeling was done. All laboratory data were collected for the three months prior to the initiation of the study to serve as a base line. Laboratory data were then collected on a monthly basis during the six-month study period.

Anthropometric Data

Study participants were weighed before and after dialysis treatments. The dry weight (post-treatment weights) and weight changes between treatments were recorded and analyzed monthly.

Percent body fat was determined using the Futrex®-5000 infrared body fat analyzer. This procedure was performed monthly after dialysis on the patient's non-access arm.

Dietary Intake Form

Study participants were instructed on keeping accurate food records and were asked to keep monthly three-day food records. Specific instructions were given on recording the type of food eaten, how the food was prepared, and the amount eaten. Participants were told to weigh meats and cheeses and measure all other food after cooking. Food models were used to instruct patients on estimating portion sizes. Written instructions and example of how to record dietary intake were provided. All study participants supplied this information for the first and last months of the six-month study period. Only those participants in the treatment group supplied this information monthly for each of the six months.

Nutrient Analysis

Dietary intakes recorded on the three-day food records were analyzed on Computrition individual intake nutrient analysis computer software (Dietary Intake Analysis®, Computrition, Inc.). Nutrients which were tracked and analyzed in this study included: calories, protein, sodium, potassium, calcium, and phosphorus.

Quality of Life Instruments

All subjects completed three quality of life instruments pre- and post-study. These included the Beck Depression Inventory©, Sickness Impact Profile©, and a nutrition-related quality of life assessment. They were instruments designed to assess degree of depression, sickness-related dysfunction, and effects of nutrition on quality of life, respectively.

Education Sessions

Patients in the treatment group met with the researcher on a weekly basis for an education session. Family members were frequently involved. The session during the week after patients had recorded their food intake was spent reviewing the Computrition printouts. The patient education booklet was also used as a teaching tool. The education sessions were designed to center on the patient's individual needs at that time and to address particular questions or items of concern. Thus, the education that each patient received was not identical.

Statistical Analysis

Statistical analyses were done using the Statistical Package for the Social Sciences (SPSS). Multivariant analysis of variance (MANOVA) was used to determine change over time and differences between groups. T-test analyses were used to determine existing differences between groups at the beginning of the study period.

Limitations

1. Data were collected on a sample of only 20 subjects who participated on a volunteer basis, all from a single dialysis treatment center. Thus, the study sample may not accurately represent the true population of hemodialysis patients.
2. Three-day dietary records may not be representative of the subjects' normal dietary

intake. Variable uremic symptoms may have prevented the subjects from eating their usual diet.

3. Nutrient analysis using any data base is only an approximation of actual nutrient intake. There are two main reasons for this. First, food records are not completely accurate and are occasionally missing necessary details for accurate analysis. Second, the nutrient values contained in data bases are subject to analysis limitations and inconsistencies between research laboratories. Although the Computrition data base contains 20,259 foods, some foods were not listed in the data base and were assumed to be equivalent to other similar foods that were in the data base.

CHAPTER II

LITERATURE REVIEW

Compliance

End-stage renal disease can result in severe lifestyle restrictions. Chronic dialysis patients are required to preform daily behaviors which are often restrictive and unpleasant. Although treatment times have decreased, hemodialysis patients are still required to spend approximately three hours a day, three times a week for dialysis treatments. Transportation and waiting time increases the total time to four to six hours. In short, hemodialysis patients spend three days each week involved in treatment. Other medical tests and procedures are common and may fill up the remaining free time. Patients commonly report feeling "washed out" after dialysis and report feeling tired and lethargic (i.e. uremic) prior to the treatment. An overview of the hemodialysis patient's week shows a "see-saw" effect of feeling poorly, dialyzing, and feeling tired afterwards , followed by a good day, and then the cycle begins again.

Patients are expected to adhere to strict dietary regimens. The typical diet is one which is low in sodium and potassium, and moderate to high in protein. Fluid intake must be severely restricted, especially if the patient is anuric. Most dialysis patients take many medications including phosphate binders with each meal, as well as vitamins, iron, and antihypertensives.

The treatment is unusual because it offers no cure, but simply maintains life. There are many examples of physical complications of chronic renal failure and the resulting dialysis treatments, which occur in most hemodialysis patients. They include the following, depending of the individual's medical situation: peripheral neuropathy, blood glucose aberration, lethargy, sleep reversal, irritability, confusion, headaches, nausea, blood pressure abnormalities, bone disease, metabolic encephalopathy, dementia, anemia,

pericardial disease, and cardiomegaly. The above complications are magnified if certain other diseases exist along with the renal disease (Nehemkis and Gerber, 1986).

Compliance is defined as the extent to which a person's behavior (in terms of taking a medication, following a diet, or adopting lifestyle changes) coincides with medical or health advice (Haynes, 1979). Achieving dietary compliance among patients is an art and science which has challenged health care professionals over the years. Compliance with dietary, fluid, and medication regimes is a critically significant factor in the continued well-being and slowing of disease processes in hemodialysis patients. Yet, compliance within the dialysis population is generally considered poor. Various studies have reported between 20-81% of chronic hemodialysis patients as being noncompliant (Blackburn, 1977; De-Nour and Czaczkes, 1972; Ferraro et al., 1986; Gardner, 1981; Hartman and Becker, 1978; Manley and Sweeney, 1986; Wolcott et al., 1986). Also, compliance decreases as the length of time on dialysis increases (Blackburn, 1977). Miller et al. (1980) reported that compliance rates with renal diets are poorer than those associated with gluten-free, low-phenylalanine, and modified fat diets, yet are substantially better than dietary compliance rates for insulin-dependent diabetics.

Reports on compliance vary based on different objective and subjective data examined. For example, objective measures of compliance such as blood chemistries yield higher noncompliance rates than do patient self-report measures. Common objective indicators used in measuring compliance include serum potassium and phosphorus levels and between-dialysis weight gains (Cummings et al., 1982; Hoover, 1989; Manley and Sweeney, 1986; Wolcott et al., 1986).

Methods to identify a potentially noncompliant patient and ways to improve patient compliance are topics which have been addressed extensively in the literature. Health care providers cannot take compliance for granted. Difficulty in distinguishing compliant from noncompliant patients presents a serious obstacle to patient care. In summarizing published

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research, Matthews and Hingson (1977) concluded that noncompliance can pose a problem regardless of the severity of the patient's illness. Noncompliance tends to be greater when the disorder is asymptomatic, but numerous studies have shown that in general, the severity of the illness is unrelated to compliance. More severe problems often require more complex, difficult regimens. Patients with severe disorders may find it difficult to comply because of limitations imposed on them because of their illness, and may also become discouraged from previous attempts which resulted in failure. Just the fact that a patient's illness is severe, painful, or even life-threatening, does not ensure a high level of compliance (Matthews and Hingson, 1977). Also, compliance seems to undergo a marked deterioration as the duration of the therapy extends (Sacket and Snow, 1979). Low compliance among hemodialysis patients may be partly explained by the long-term nature of the treatment.

A patient's demographic characteristics do not consistently predict compliance. Studies which report no relation between patient compliance and characteristics such as social class, age, sex, education, occupation, income, and marital status, greatly outnumber those that do show a relationship (Matthews and Hingson, 1977). Though this does not mean that such characteristics will never predict compliance, it does mean that noncompliance can be a problem with any patient population, regardless of social class, age, or ethnic background.

Blackburn (1977) concluded that the problem confronting the medical team caring for dialysis patients seems to be one of motivation. The complications which result from noncompliance over a period of time are slow and unobservable to the patient. Thus, the possibility of developing renal osteodystrophy or advanced cardiovascular disease may be denied by the patient, even as it is taking place. More research needs to be done on effective ways to motivate patients to comply with the dialysis regimen.

Health behavior change can be viewed as a two-step process. First, the patient

but were no more compliant than control groups (Matthews and Hingson, 1977). Better predictors of compliance include the nature of the regime, patient beliefs about their illness and treatment, and interactions between patients and their health care providers. Intelligence seems to have little influence on dietary compliance with dietary aspects, but it does affect other aspects, such as rehabilitation. However, it has been shown that there is a strong relationship between patients' understanding of restrictions and their compliance (De-Nour and Czaczkes, 1972). While knowledge of the medical condition does not increase compliance rates, knowledge of the regimen does (Gerber, 1986). Without proper instruction and understanding, compliance cannot be expected.

One of the most frequently observed problems in health care in general is a lack of knowledge on the patient's or significant other's part (Boyd., 1983). Thus, patient education involving the patient and "significant others" should be given high priority by professionals working with hemodialysis patients. Patients must be fully informed about their illness and what is expected, and the use of social supports should be maximized. Most importantly, instructions must be simplified and tailored to the patient's individual needs. Patients cannot be expected to comply without having a good understanding of what is expected of them.

Intervention aimed at improving compliance in hemodialysis patients should focus on decreasing environmental barriers that interfere with the patient's ability to comply. Examples of environmental barriers include eating away from home or shopping for appropriate foods. Practical suggestions might include planning menus in advance, discussing appropriate food choices for eating at restaurants, identifying environmental cues associated with fluid consumption, and discussing ways to react to the cues, such as eating sour hard candies to stimulate saliva production (Cummings et al., 1982). Prevention strategies need to be discussed to prevent problems before they arise and thus maximize long-term adherence and minimize inappropriate bad habits.

Miller et al. (1980) suggested that intervention strategies to improve dietary compliance should focus on the portion of the patient population that is at the greatest clinical risk (the poorest compliers). As previously mentioned, particular strategies used to improve compliance should always be focused on the patient's individual needs. Patients will be more likely to comply if they perceive the information being given as useful and important to them in everyday living. The patient's level of priority for dietary compliance will change with the occurrence and intensity of other life stressors and needs to be addressed accordingly (Snetselaar, 1991). Different aspects of compliance are almost totally unrelated, so each behavior must be dealt with individually and on a consistent, on-going basis. Education and re-education are very important.

Although much emphasis has been placed on the need for effective patient education, little in published literature relates education to successful health outcomes (Goddard and Powers, 1982). Even if patients are provided with information, they may not have a great enough understanding to adequately apply the information due to possible emotional and attitudinal factors. Haynes (1979) reported that education methods including programmed instruction, lectures and demonstrations, and personal instruction and counseling substantially increased patients' knowledge about their condition, but failed to improve compliance or therapeutic outcomes.

Although general medical knowledge does not appear to be associated with greater compliance, Turk et al. (1986) concluded that a different kind of knowledge did appear to be related -- namely, the extent to which a patient knows what behavior the regime requires, and how and when to preform the behavior. This again emphasizes the importance of educating patients on how to deal with specific day-to-day situations. A number of studies have indicated that this kind of information relates positively with compliance (Becker et al., 1972; Hulka et al., 1976).

In a study which compared patient education needs as assessed by nurses and by

patients, it was found that nurses rated the education needs of hemodialysis patients significantly higher overall than did the patients themselves. The greatest difference was found in the diet and fluid category (Goddard and Powers, 1982). When information is presented without first determining which education needs are of greatest concern to the patient, the communication process is bound to be less effective. Perhaps increasing patient knowledge and interest in their diet is the first step in improving dietary compliance.

Patients should be encouraged to actively participate in learning. This can help promote confidence and a sense of responsibility, especially if the patient receives positive reinforcement during the learning process. In assessing the patient's degree of compliance, it may be more important to identify "why" the patient did not learn instead of "what" was not learned. Patients with passive personalities, low motivation, a poor body image, and a fear or denial of their disease frequently have difficulty complying with a regimen for their disease (Gains, 1979). Thus, assessing patient readiness is an important step in the education process.

Education can be improved by supplementing oral instruction with written materials. Written materials can be referred to frequently by the patient, and the information is repeated when the written materials are read. Information which is repeated will be retained and recalled more readily than nonrepeated information (Green, 1979). Printed dietary education materials are useful to supplement, simplify, and reinforce principles of the complex renal diet.

It seems that the greater the complexity of the diet, the poorer the compliance with the diet (Blackburn, 1977; Gardner, 1981). A partial solution to this problem may be to highly individualize the diet for each patient, based on current biochemical data, clinical symptoms, and the physical and motivational assessment of the patient. This may be preferable to the general "renal" diet which automatically restricts sodium, potassium, phosphorus, and fluids. As the patient's individual needs change, diet instructions can be

tailored to meet those needs. Perhaps a patient new to dialysis will not need to restrict potassium intake as much at first, but later as serum potassium levels increase, dietary potassium will need to be watched more closely.

Gardner (1981, p.57) contributed dietary noncompliance in part to "hyperdietism," which is defined as "a physical and emotional state resulting from a rigid, complicated, and unpalatable diet." Typical symptoms include: anxiety, depression, frustration, confusion, hostility, and frequently, failure to eat. Food seems to become an obsession with many patients, and dietary limitations can create considerable psychological stress.

Due to advances in technology, the life of a patient with end-stage renal disease can now be extended. There seems to be an ever-greater emphasis on the patient's quality of life. Compliance with dietary restrictions is probably the most difficult aspect of the whole medical regimen because it affects long-standing personal habits and preferences. Thus, the resulting hyperdietism can have a negative impact of the quality of life of renal patients.

Because of the many restrictions which are imposed on these patients, food is one of the few remaining pleasures in their lives. Although food must also be restricted, Gardner (1981) concluded that by preventing and controlling hyperdietism, food may be one thing the patient can enjoy with as few limitations as possible. This, in turn, should improve quality of life.

Ways to help patients feel more relaxed about their diet, yet still be reasonably compliant, are summarized as follows: 1) restrict only the nutritional elements necessary for the individual patient at a particular time, 2) keep diet instructions simple, 3) develop and maintain a good relationship with the patient, and 4) be flexible (Gardner, 1981). When these guidelines are used, eating can become more enjoyable for the patient and have a positive impact on their quality of life.

Quality of Life

Quality of life (QOL) is a multidimensional concept that includes physical, emotional, and social components associated with a disease or its treatment. The major aspects of QOL include: 1) physical functioning, i.e. mobility, activities of daily living 2) psychological functioning, i.e. anxiety, depression 3) social functioning, i.e. participation in work, recreation, and other social activities 4) cognitive functioning, i.e. judgement, alertness, memory, and 5) general well-being, i.e. life satisfaction, general health perceptions (Revicki, 1990).

Physical well-being relates to general functioning and includes aspects such as feeling happy and strong, and sleeping and eating well. Psychologic well-being includes enjoying life, feeling happy, being able to concentrate and communicate, having a positive attitude, and feeling able to adapt and adjust to consequences of disease and its treatment. Nutritional factors can play a role in all dimensions of QOL because they contribute to perceived physical, psychological, and interpersonal well-being (Padilla, 1990).

For hemodialysis patients, the restricted intake of certain foods and fluid not only makes meals less pleasant, but also greatly detracts from QOL. The psychological stress caused by limiting the tension-reducing outlet of eating is great. Dietary restrictions pose a problem for patients, often to the extent that elaborate dreams of food and eating have been reported. Further preoccupation is indicated by the frequency of which eating and drinking is initiated as a topic of conversation among patients (Blackburn, 1977).

In a study to determine the role of nutritional well-being in the QOL of cancer patients, nutritional variables included appetite, eating sufficiently, distress from nausea and vomiting, and worry over weight (Padilla, 1990). It was discovered that general physical well-being was poorer than nutritional well-being and that nutritional well-being factors were less correlated with perceived physical well-being than with psychologic well-being. This suggests the importance of improving nutritional well-being to increase

important outcomes such as adjusting to treatment; having fun; feeling useful, happy, and satisfied; being able to concentrate; and ultimately having a generally good QOL (Padilla, 1990).

For patients with chronic diseases, it is only possible to improve physical and mental functioning by reducing symptoms, illness severity, and disease progression (Revicki, 1989). Improving daily functioning and well-being is an increasingly important goal in treating patients with chronic diseases (Stewart et al., 1989). Both the course of the disease and the medical treatment, including nutritional intervention, are important factors in perceived QOL. Hence, nutritional well-being can have a strong positive impact on perceived QOL (Padilla, 1990).

Studies involving 30-, 50-, and 70-year olds from the general population showed "health" to be regarded as important or very important by 95 to 98% of the subjects. Health and personal safety were the second most important contributors to overall QOL, lagging slightly behind only material comforts (Flanagan, 1982). Hence, maintaining or improving health can positively affect overall QOL. Improvement in QOL usually results from reducing the illness severity and slowing the disease progression.

QOL is becoming an increasingly important issue in the health-care field. QOL has always been a concern for medical professionals, but it has recently received heightened attention with the increasing cost of health care. Advances in technology have made prolonging life a reality, so attention has now shifted from quantity to quality of life (Revicki, 1989). Patients as well as health care providers are concerned not only with the length of life, but also with the positive attributes that give meaning to the various domains of life (Burckhardt et al., 1989). With limited resource allocation, the ultimate goal is to maximize the number of patients treated at the lowest cost, while providing the highest QOL affordable (Evans, 1990a).

The reasons for interest in QOL have changed over the years. Initially,

psychological studies were used to assess patient suitability for dialysis. More recent studies have focused on QOL as a treatment outcome (Evans, 1990b; Evans et al., 1985b; Hart and Evans, 1987).

As dialysis has become more widely available and kidney transplantation more efficacious, research has been conducted to assess the effect of different treatment modalities on QOL. When subjective indicators of QOL are measured, it has been found that renal patients adapt well to their life circumstances, despite their condition compared with the general population (Cassileth et al., 1984; Evans et al., 1985a, 1985b).

Evans et al. (1985b) conducted a multi-center trial involving 859 patients undergoing dialysis or transplantation. The goal of the study was to determine whether objective and subjective measures of QOL were influenced by case mix (some patients were older and sicker than others) or treatment modality. With case mix differences controlled, transplant recipients consistently showed a higher subjective and objective QOL than patients undergoing any form of dialysis. Patients receiving home hemodialysis were closest to the transplant recipients, followed by continuous ambulatory peritoneal dialysis (CAPD) and in-center hemodialysis. The latter two groups were similar to each other and reported a lower QOL than either the transplant or home hemodialysis group. Results from this study showed that, with the exception of transplant recipients, patients with ESRD have a poorer objective QOL. Despite favorable subjective assessments, dialysis patients did not work or function at the same level as people in the general population.

The Sickness Impact Profile© (SIP) was used to compare the perceived sickness-related behavioral dysfunction of the 859 ESRD patients mentioned above. The SIP is a standardized instrument which divides sickness-related dysfunction into 12 categories (Bergner et al., 1976a, 1976b; Carter et al., 1976; Hart and Evans, 1987; Pollard et al., 1976). Transplant recipients were least functionally limited followed by home dialysis, CAPD, and in-center dialysis patients. The SIP categories which showed the largest

overall differences were sleep and rest, work, recreation and pastimes, and home management (Hart and Evans, 1987). Seedat et al. (1987) also confirmed that successful transplantation resulted in the best QOL for ESRD patients. However, it is recognized that all ESRD patients are not suitable transplant candidates, and many will remain on dialysis for extended lengths of time before a suitable donor organ is located. Improving QOL for these patients while they are on dialysis is vitally important for their overall well-being.

Jones (1990) reported that functional status as measured by the Karnofsky Performance Status Scale was found to be a significant risk factor for hospitalization and death in chronic hemodialysis patients. It was found that patients with lower functional ability utilized more resources during treatments than did the more functional patients and would therefore appear to be at greater risk for negative outcomes. The results of this study also suggested that it might be advantageous from both a cost and QOL perspective to maintain or improve the functional status of patients. Exercise and fitness programs were suggested as one way to improve functional status (Jones, 1990). Improved nutritional status may also contribute to improved functional status.

There are many perspectives from which to assess QOL. These include: psychiatric, psychological, social psychological, social work/nursing, and rehabilitation medicine (Evans, 1990b). To date, researchers in the field have not reached a consensus as to best define QOL. Whereas biochemical parameters are easily quantified, measuring QOL is much more difficult, and research has lagged in development of reliable measurement tools (Churchill et al., 1987; Chubon, 1986). Calman (1984, p.124) identified several problems associated with defining QOL. They are described as follows:

> The quality of life can only be described and measured in individual terms, and depends on present lifestyle, past experience, hopes for the future, dreams and ambitions. Quality of life must include all areas of life experiences and take into account the impact of illness and treatment. A good quality of life can be said to be present when the hopes of an individual are matched and full-filled by experience. The opposite is also true: a poor quality of life occurs when the hopes do not meet with the experience. Quality of life changes with time and

> under normal circumstances can vary considerably. The priorities and goals of an individual must be realistic and would therefore be expected to change with time and be modified by age and experience.

Unfortunately, most of the QOL studies do not meet the objectives outlined above. Many QOL studies emphasize outcomes and fail to consider the process by which the outcomes were reached. Thus, it is difficult to fully appreciate the process by which intervention by care givers affects outcomes (Evans, 1990a).

Many standardized instruments have been developed to measure QOL. Most of these were not originally developed to be used as QOL indicators per se. For example, indexes such as the Nottingham Health Profile and the SIP were initially developed as health status measures, and not until later on, as QOL became a more popular research area, did the developers of the instruments refer to them as QOL assessment indicators (Evans, 1990b).

Critics have debated whether observed differences between treatment modalities are really due to the treatment itself or to patient selection factors. For example, transplant recipients are generally younger and healthier and would therefore have a higher QOL than other ESRD patients. While such arguments seem likely, the evidence suggests that differences in QOL across treatment modalities do exist, even after social and demographic factors and health status of the patient are controlled (Evans, 1990b). Transplantation is clearly the modality of choice, but failed transplantation experiences and complications associated with long-term immunosuppressive therapy may eventually compromise the QOL of many patients (Evans, 1990b).

The Food and Drug Administration (FDA) has approved the use of recombinant human erythropoietin (EPO) for use by dialysis patients. EPO stimulates production of red blood cells and greatly enhances the QOL of most hemodialysis patients (Evans, 1990a). Patients report higher energy levels, are more active, and are in better health than before treatment. Their physical and emotional well-being and life satisfaction also improve.

Both objective and subjective QOL parameters showed improvement after EPO treatment in clinical trials involving more than 300 patients. Researchers concluded that in addition to improvement in hematological parameters, EPO greatly improves QOL of anemic patients on maintenance hemodialysis (Evans et al., 1990). Nutritional well-being may also be enhanced by EPO therapy. If patients feel better, they will be better able to meet their nutritional needs, which will also contribute to increased energy and accomplishment of their goals.

Computer Use in Patient Education

Increased accessibility of computer technology along with increased consumer interest in health and nutrition has resulted in widespread use of computerized nutrient analysis programs. Such programs have been used by nutrition professionals as well as by the general public (Byrd-Bredbenner et al., 1988).

Dialysis patients have benefitted from computer printouts showing their blood chemistry values. Aspects of patient care which are dependent on patient compliance can be reinforced with computer printouts. For example, proper management of calcium and phosphate levels requires patient compliance with taking medications properly. Patients can be motivated by seeing their laboratory reports with a written interpretation so they can actually see the results of their efforts (Heneghan and Oh, 1990).

Computerized nutrient analysis printouts may also be effective in enhancing patient compliance and motivation. Gagliardi and Marx (1989) conducted a study to determine the effects of individualized nutrient analysis computer printouts from a weekly diet recall on compliance to selecting and eating foods to increase iron stores in iron-deficient subjects. Subjects were randomly assigned to a treatment or control group. Both groups met weekly with a nutritionist and submitted daily diet recalls. Those in the experimental group received individual diet counseling plus weekly nutrient analysis printouts. A significant

difference was found in mean iron intakes between the two groups, with those in the experimental group consuming an average of 4.3 mg/day more iron than those in the control group. These researchers concluded that the use of computerized diet analyses is an effective educational tool that can improve patient compliance to dietary counseling (Gagliardi and Marx, 1989).

Computerized nutrient analysis has also been used in nutrition education for cardiovascular health (Walt and Forgione, 1989). Positive trends were noted in changes in saturated fat and sodium intakes among study participants receiving computerized nutrient analysis printouts. The results of this study showed that computerized nutrient analysis printouts, used with education and counseling in an innovative approach to health education, can show problem areas in an individual's diet (Walt and Forgione, 1989).

Computerized nutrient analysis has been shown to be a positive element in nutrition education for senior citizens as well (Dennison et al., 1991). In this study, experimental subjects either received nutrient analysis printouts of three-day food records along with a nutrition program or received the nutrition program without computer interaction. Compared to controls, both experimental groups significantly lowered saturated fat intake. Possible benefits of incorporating computers into nutrition education include enhanced teaching effectiveness and personalized immediate feedback for the patient.

Computer-assisted instruction has received attention as a positive asset to education (Gaston, 1988; Kulik et al., 1980). When compared to standard lecture format instruction, Gaston (1988) found that computer-assisted instruction resulted in no significant differences in knowledge retention or student attitudes. Attitudes toward computer-assisted instruction were positive, and this teaching method seemed to be as effective as lecture for learning knowledge and retention.

In a related study, Moses et al. (1989) found that computer-based nutrition education programs may be more effective than traditional methods for increasing

knowledge of food sources of specific nutrients and incorporation of the appropriate foods into the diet. Pregnant adolescents receiving computer-based nutrition education showed significantly greater knowledge of food sources of specific nutrients than did controls.

Based on the results of these studies involving specific patient populations, it seems likely that all patient populations on special diets, including dialysis patients, could benefit from computerized dietary analyses. It may prove to be especially beneficial for patients on restricted diets in helping to prevent and control hyperdietism.

CHAPTER III

METHODOLOGY

Subject Description

The study sample consisted of 20 chronic hemodialysis patients being treated at the Bonneville Dialysis Center in Ogden, Utah. During the recruitment phase approximately 50 patients were being treated at this center. Patients who were willing to participate were assigned to a treatment or control group based on their scheduled dialysis appointment days. Those who dialyzed on Monday, Wednesday, and Friday were assigned to the treatment group, and those who dialyzed on Tuesday, Thursday, and Saturday were assigned to the control group. The treatment group included 12 subjects (6 men and 6 women) age 32-75 years (mean=55.2 years), who had been receiving hemodialysis treatments for 8-81 months (mean=38.0, median=45 months). The cause of renal failure in subjects in the treatment group was due to diabetic nephropathy (n=4), glomerulonephritis (n=4), interstitial nephritis (n=2), or unknown causes (n=2).

The control group included 8 subjects (3 men and 5 women) age 33-72 years (mean=57.9 years), who had been receiving hemodialysis treatments for 6-234 months (mean=56.8, median=21 months). The cause of renal failure in subjects in the control group was due to diabetic nephropathy (n=1), glomerulonephritis (n=4), interstitial nephritis (n=1), granulomatosis (n=1), or unknown causes (n=1).

Five subjects who participated in the study were not included in the study sample. Reasons for exclusion included: three subjects received kidney transplants before the study was completed, one subject voluntarily withdrew in the third month of the study, and one subject was refusing dialysis treatments for periods of a week at a time.

Research Design

This study was designed to determine the effects of individualized nutrition education utilizing computerized dietary analysis on nutritional status, quality of life, and nutrition knowledge. The issue of dietary compliance was also addressed.

Procedures and Materials

A summary of the data collection timetable is presented in Table 1.

All chronic hemodialysis patients of the Bonneville Dialysis Center were individually contacted in March 1991, informed of the study and of what would be

Table 1. Data collection timetable.

Data Collection Period	Data Collected	Data Source
Initial contact	-Previous 3 months biochemical data	Medical record
	-Previous 3 months weight data	Medical record
	-Quality of life, BECK depression, and nutrition knowledge scores	Questionnaires
	-General nutrition information	Questionnaire
	-Nutrient intakes	Three-day dietary records
Monthly during 6 month study period	-Biochemical data	Medical record
	-weight data	Medical record
	-percent body fat	Futrex®-5000
	-Nutrient intakes	Three-day dietary records
Study completion	-Quality of life, BECK depression, and nutrition knowledge score	Questionnaires
	-Nutrient intakes	Three-day dietary records
	-Post-study data	Questionnaire

expected of study participants. Patients willing to participate in the six-month study were asked to complete the following forms. The researcher interviewed blind patients and those who were unable to write to obtain the information.

1. Written Consent. Patients wishing to participate were required to sign a written consent (Appendix A) which explained the purpose of the study and what would be required of participants. The consent form explained that all information and laboratory data would be kept confidential, that participation was voluntary, and that participants could withdraw from the study at any time. The telephone numbers of the researchers were provided in case the subjects had any questions.

2. General Nutrition Information. At the initial meeting with the researcher, subjects were asked to respond to questions dealing with nutritional issues (Appendix B). The questionnaire took approximately 10 minutes and was designed to obtain descriptive data including age, height, dry weight, weight changes, employment, initiation of dialysis treatments, diet prescription, dietary supplements, and medications. Subjective information such as appetite, perceived importance of dietary compliance, and activity level was also included. This information was used to help meet the individual needs of the patient.

3. Nutrition Knowledge Quiz. At both the beginning and the end of the study, participants completed a nutrition knowledge quiz (Appendix C). The quiz contained 17 questions and took approximately 10 minutes to complete. Questions included selecting foods high in calcium, phosphorus, sodium, protein, and calories. Strategies for fluid control and eating out were also addressed. The format of the questions was matching, true/false, and short answer.

4. Sickness Impact Profile. Subjects were required to complete the Sickness Impact Profile © (SIP) (Bergner, 1977) both pre- and post-study. This took approximately 20 minutes to complete. The SIP is a very comprehensive health status

measure. It is a standardized questionnaire that measures sickness-related dysfunction (Evans, 1990b). The portion of the SIP used in this study consisted of 93 questions which are scaled and weighted and grouped into seven categories. The seven categories were: ambulation, mobility, body care and movement, alertness behavior, home management, recreation and pastimes, and social interaction. Three of these categories, ambulation, mobility, and body care and movement, comprised a physical dysfunction dimension. Subjects were instructed to place a mark by the statements which applied to them and to indicate by marking the appropriate line that they had read all the statements in the section. Scores were calculated by adding the scale values for each item checked within the category and dividing by the maximum possible score for the category. This value was then multiplied by 100 to obtain the category score. A score for each of the individual categories and the physical dimension was calculated. Scores could range from zero to 100, where a high score indicated poor functional status, and a low score indicated good functional status. The higher the score, the more patients perceive themselves as being functionally limited.

5. Beck Depression Inventory. Subjects were required to complete the Beck Depression Inventory © (BDI) (Beck, 1978) both pre- and post-study. The BDI is a 21-item instrument designed to assess the severity of depression in adolescents and adults. It contains questions dealing with mood, pessimism, sense of failure, dissatisfaction, guilt, punishment, self dislike, self accusations, suicidal thoughts, crying, irritability, social withdrawal, indecisiveness, body image, work difficulty, sleep patterns, fatigue, appetite, weight loss, somatic preoccupations, and loss of libido. The BDI took approximately 5 minutes to complete. The BDI was scored by summing the ratings given by the subject for each of the 21 items. Each item was rated on a 4-point scale ranging from 0 to 3. The maximum possible total score was 63. If more than one statement was chosen, the statement with the highest rating was used to calculate the score. Scores from 0 to 9 were

considered within the normal range; scores of 10 to 18 indicated mild to moderate depression; scores of 19 to 29 indicated moderate to severe depression; and scores of 30 to 63 indicated extremely severe depression. The staff social worker was notified of subjects who scored greater than 18 on the BDI.

6. Nutrition-Related Quality of Life Indicator. This instrument was developed by the researchers to assess quality of life as related to diet and nutrition. Subjects were required to complete this questionnaire pre- and post-study. It took approximately 2 minutes to complete. This questionnaire consisted of 11 questions to which subjects responded by placing a slash on a Likert scale (Appendix D). The questions were designed to assess: how much patients worry about their diet, how well they understand their diet, if they felt their diet was restricted, their level of strength, if they look forward to meal times, how often they eat away from home, if they were compliant to all components of their diet, how they perceived their overall quality of life, and what affect diet had on their perceived overall quality of life. Responses were scored by assigning a measured numerical value to the position of the mark on the Likert scale.

7. Biochemical Data. Monthly biochemical data were obtained from the patient's medical record. All patients routinely had a monthly complete blood count (CBC) and total chemistry panel (SMA) done as part of their regular treatment at the dialysis center. Blood work was analyzed at a nearby laboratory, and the results were returned to the dialysis center the following week. CBC data collected and analyzed for this study included hemoglobin and hematocrit. SMA data collected and analyzed for this study included: sodium, potassium, calcium, phosphorus, glucose (in diabetic patients), blood urea nitrogen (BUN), creatinine, cholesterol, total protein, albumin, and alkaline phosphatase. Kinetic modeling was done quarterly on most patients as part of their regular treatment. Protein catabolic rate and Kt/V were collected and analyzed for the months that kinetic modeling was done. All laboratory data were collected for the three months prior to the

initiation of the study (January-March 1991) to serve as a base line. Laboratory data were then collected on a monthly basis during the six-month study period (April-September, 1991) (Appendix E).

8. Anthropometric Data. Subjects were weighed before and after dialysis treatments on a digital platform scale which measured to one-tenth of a kilogram accuracy. Each of the subjects was weighed wearing indoor clothing with shoes. No adjustments were made for the weight of the clothing or shoes. The weight of wheelchair-bound patients was determined by difference after subtracting the weight of the wheelchair. Weight change between dialysis treatments was determined by subtracting the last post-treatment weight from the next pre-treatment weight. The dry weight and weight change recorded at approximately the twentieth day of the month were collected and analyzed for this study. Dry weights (post-treatment weights) and weight changes between treatments were recorded for the three months prior to the study to serve as a baseline. This information was collected monthly during the six-month study (Appendix F).

Percent body fat was determined using the Futrex®-5000 infrared body fat analyzer. The Futrex is a light-weight portable device which measures percent body fat using infrared interactance. It is a noninvasive technique wherein a light wand is placed on the midline of the bicep belly, and a low energy beam of near-infrared light is sent into the subject's bicep. The wave length shift of the reflected beam determines percentage of body fat to one-tenth of a percentage accuracy. Prior to taking the actual measurements, the subject's gender, height, dry weight, age, frame size, and activity level are entered in the device to be used in the body fat calculations. The entire procedure takes less than one minute to complete. This procedure was preformed on the day of dialysis, usually after treatment, on the patient's non-access arm. Two readings were taken on each subject. If the readings were not within 0.5 percentage of each other, the measurements were repeated. The readings were taken after dialysis on all study participants on approximately

the twentieth day of each month during the six-month study period (Appendix F).

9. Dietary Intake Form. Subjects were asked to record three days of dietary intake during the week following the initial contact and during the third week of each month of the study. They were to choose three typical days to record. Specific instructions were given on recording the time eaten, the type of food eaten, how the food was prepared, and the amount eaten. Subjects were told to weigh meats and cheeses and measure all other food after cooking. They were instructed to keep a written record of all foods and the quantity eaten for three consecutive days, including one weekend day. Food models were used to instruct subjects on estimating portion sizes. Written instructions and an example of how to record dietary intake were provided (Appendix G). All study participants supplied this information for the first and last months of the six-month study period. Only those participants in the treatment group supplied this information for each of the six months.

10. Nutrient Analysis. Dietary intakes recorded on the three-day food records were analyzed on Computrition individual intake nutrient analysis computer software. This program uses nutrient values from USDA Handbook 8 and data provided by manufacturers. The data base contains 20,259 foods. Intake data are compared with standards for the individual's age and sex. The National Research Council standards are used for comparison. The unique features of this system and data base follow.

1) The nutrient composition data of the foods are up-to-date values. The data base is updated four times a year, so it reflects the most current foods on the market.

2) The primary source of the data is reliable.

3) Values can be entered either in the raw or cooked form.

4) Amounts can be entered in either weight or volume units.

5) Many commercial name brand foods are included in the data base, including foods from many fast food chains.

6) Combination foods are included as well as single item foods.

7) Zero values indicate that there is no nutrient content, while an asterisk (*) indicates that the nutrient content is not available in the data base.

8) Analyses are printed in an easy to read format which lists the nutrient content of each food as well as the daily totals and a histogram comparing the nutrient levels to the recommended daily allowances (RDAs) for the individual.

9) For nutrients which fall below the RDA, a summary is provided which states the importance of the nutrient and lists foods which are high in that nutrient. For certain nutrients (calories, fat, cholesterol, and sodium) which exceed the RDA or recommended intake levels, a summary is provided which explains why too much of that nutrient is undesirable and lists the foods that were consumed which are high in that nutrient.

The data base does have some limitations, mainly in the limited nutrient availability of some commercial brands of foods.

The 20 dietary components analyzed by Computrition are:

Calories	Vitamin A
Protein	Thiamine
Fat	Riboflavin
Carbohydrate	Vitamin C
Fiber	Potassium
Cholesterol	Zinc
Iron	Niacin
Sodium	Vitamin B_6
Calcium	Vitamin B_{12}
Phosphorus	Folacin

Subjects were provided with a printout that included the analysis of all 20 nutrients

(Appendix H). Nutrients which were tracked and analyzed in this study included: protein, sodium, potassium, calcium, phosphorus, plus calories. The nutrient intake for each of the three days was computed individually, and the average of the three days was calculated to represent the intake of each nutrient for the month.

11. Supplementation Analysis. The Bonneville Dialysis Center supplied all patients with vitamin/mineral supplements and phosphate-binding medications. A protein powder supplement was given to patients who were consuming inadequate dietary protein. Liquid nutritional supplements were also provided to those patients who were not eating well. The nutrient contribution of the nutritional supplements was added to the dietary totals provided by the Computrition analysis. The nutrient content of the supplements is listed below:

Vitamin/Iron Supplement		Folacin Supplement		Protein Supplement (2 Tbs)	
Vitamin C	500 mg	Folic Acid	800μg	Protein	17 gm
Thiamin	6 mg			Sodium	130 mg
Riboflavin	6 mg			Potassium	55 mg
Niacin	30 mg			Calories	70
Vitamin B_6	5 mg				
Vitamin B_{12}	25 μg				
Pantothenic Acid	10 mg				
Iron Sulfate	105 mg				

12. Development of Education Materials. Several months prior to the beginning of the study, all patients at the Bonneville Dialysis Center were asked to complete a survey (Appendix I). Patients selected from a list of nutrition/diet-related topics and numerically ranked the topics in order of greatest interest. The results of this survey were used by the researcher to develop a patient education manual, "Bonneville Dialysis Center Nutrition

Guide: Eating Well on Dialysis." This 86-page manual contains chapters on: controlling fluid intake, sodium and potassium, phosphorus and calcium, how to get enough protein, eating well and boosting calories in renal diets, using the renal exchange system, menu planning and renal diets, using convenience foods, dining out on a renal diet, and holiday recipes for renal diets (Appendix J). Subjects in the treatment group were given a copy of this manual at the beginning of the study period. Subjects in the control group were promised and given a copy of the booklet at the end of the study period.

13. Education Sessions. The researcher met individually with each subject in the treatment group on a weekly basis for education sessions. Sessions usually lasted 15-30 minutes. The session during the week after subjects had recorded their food intake was spent reviewing the Computrition printouts. Special emphasis was placed on getting adequate protein and limiting sodium, potassium, and phosphorus. The individual's needs at that time, as reflected by current laboratory data and patient interest, were considered as part of the discussion. The patient education booklet was also used as a teaching tool. Other sessions during the month were used to discuss selected topics from the patient education booklet. For example, one month was spent emphasizing the need for adequate protein intake. Food models were used to represent portion sizes so patients would know the quantity they would need to eat to meet their individual needs. Topics of discussion during July and August centered on the potassium content of fresh fruits and vegetables that were in season. Again, food models were used to teach portion sizes, and it was pointed out that small amounts of "forbidden" foods could be included in the diet without exceeding their daily potassium limit. Strategies for controlling fluid intake during the hot summer months were also discussed.

The education sessions were designed to center on the subject's individual needs at that time and to address particular questions or items of concern. Thus, the education that each subject received was not identical.

14. Post-Study Questionnaire. At the completion of the study, subjects in the treatment group completed a questionnaire dealing with their perceptions of the study project (Appendix K). The questionnaire contained five multiple choice questions and took approximately one minute to complete. The questions assessed how the subjects perceived any changes in their diet and nutrition knowledge that were made during the six-month study period, if they felt nutrient analysis computer printouts were useful and assisted them in making dietary changes, and if the printed patient education materials were used.

Statistical Analysis

The SPSS (Statistical Package for the Social Sciences) was used for statistical analysis. Frequency distributions were completed to determine means and standard deviations of lab values, anthropometric values, dietary nutrient intakes, BDI scores, SIP scores, nutrition knowledge scores, and nutrition-related quality of life scores. Analysis was completed on all test subjects grouped together and separately for both the treatment and control groups.

T-test analyses were used to identify any existing differences between groups at the initiation of the study. Multivariant analysis of variance (MANOVA) was used to determine statistical significance. The following questions were tested: 1) Was there a change in the variables over time? 2) Did the treatment and control groups differ from each other over time? If the Mauchly-Spericity test was significant, the degrees of freedom were multiplied by the Huynh-Feldt epsilon before the F-value was computed. An F-value of $p<0.05$ was set as the probability criterion for statistically significant results.

CHAPTER IV

RESULTS AND DISCUSSION

Purpose

Hemodialysis patients are expected to comply with a very demanding treatment regimen. In-center hemodialysis requires a significant time commitment, with treatment times averaging three hours, three days a week. The time involved is only one part of the patient's total commitment. Patients are required to take many medications and follow a complicated, restricted diet. The renal diet is restricted in sodium, potassium, and fluid intake, and is moderate to high in protein. About 30% of the dialysis population has diabetes and must follow a diabetic diet in addition to the renal diet.

Dietary compliance poses a significant problem to many dialysis patients. Some patients may feel that the diet is so complicated and overwhelming that they abandon the diet completely. Many patients may also experience "hyperdietism" which is manifested by frustration, anxiety, and frequent failure to eat (Gardner, 1981). Nutrient analysis computer software has been beneficial in improving dietary compliance in other patient populations (Dennison et al., 1991; Gagliardi and Marx, 1989; Moses et al., 1989; Walt and Forgione, 1989). No studies have been reported where nutrient analysis computer printouts have been used as an education tool for dialysis patients. Allowing patients to see the actual nutrient content of individual foods in their diet could help patients meet their dietary goals and also help prevent unnecessary over-restriction, which could lead to hyperdietism.

The quality of life of dialysis patients is an issue which has been addressed recently. In-center hemodialysis patients have a poorer quality of life when compared to patients on other forms of dialysis, transplant recipients, and the general population (Evans et al., 1985b). Nutritional factors can affect general well-being and quality of life of

chronically ill patients (Padilla, 1990).

The purpose of this study was to determine what influence computer-assisted nutrition education, using dietary nutrient analysis computer printouts, would have on nutrition knowledge, dietary compliance, nutrition status, and quality of life of hemodialysis patients. Biochemical, anthropometric, and dietary information was used to assess nutritional status and dietary compliance. Quality of life and nutrition knowledge were measured with questionnaires and standardized instruments.

Subject Description

All hemodialysis patients of the Bonneville Dialysis Center in Ogden, Utah, were informed of the study in March, 1991 and asked to participate. Participation was on a volunteer basis. Subjects were assigned to a treatment or a control group based on their scheduled dialysis appointment days.

During the recruitment phase of the study, approximately 50 patients were being treated at the Bonneville Dialysis Center. The initial study population consisted of 25 patients. Data from five subjects who participated in the study were not included in the final analysis. These data were excluded because three subjects received kidney transplants before the completion of the study, one subject became ill and voluntarily withdrew in the third month of the study, and one subject refused dialysis treatments for extended periods of time, and it was felt that the data on this subject would not give an accurate representation. The final study sample consisted of 20 subjects. Eight patients were assigned to the control group. This group was 62.5% female and 37.5% male, with an age range of 33-72 years (mean = 57.9 years). These subjects had been receiving hemodialysis treatments for 6-234 months (mean=56.8, median=21 months). Twelve patients were assigned to the treatment group. This group was 50% female and 50% male, with an age range of 32-75 years (mean = 55.2 years). These subjects had been receiving hemodialysis

treatments for 8-81 months (mean = 38.0, median=45 months).

Nutrition Knowledge Data

Nutrition knowledge of subjects in the treatment group showed significant improvement as measured by pre- and post-study test scores. Control subjects did not show any significant change in pre- and post-study test scores (Table 2). Mean pre-test scores of the two study groups were not significantly different (p=0.086).

Subjects in the treatment group showed improvement in identifying foods high in calcium, phosphorus, sodium, potassium, protein, and calories. Mean pre-study test scores were notably higher than the mean pre-study test scores for the control group. The control group stayed at roughly the same level while the treatment group significantly improved. The mean post-study test score for the treatment group (82.3%) was still far from a perfect score of 100%. This shows that the quiz was difficult enough to measure a range of individual variability and that the correct answers could not be "guessed."

Nutrient Intakes

Dietary records can provide valuable information concerning nutrient intake and dietary compliance (Blumenkrantz et al., 1980). Self-reporting of food intakes has been shown to be a valid tool in assessing dietary intakes of individuals (Stunkard and Waxman, 1981). However, due to the subjective nature of this method of reporting, results must be interpreted with caution. Portion size errors are a critical concern (Schoenfeld et al., 1983). Food models and measuring devices help improve accuracy (Smathers et al., 1992).

Table 2. Nutrition knowledge scores of study participants (%) (mean ± SD).

	Treatment	Control
Pre-study	75.2 ± 7.9	66.5 ±13.6
Post-study	82.3 ±7.2	68.5 ±15.2
p value	0.038	0.579

Subjects recorded dietary intakes for three consecutive days. Foods such as meats and cheeses were recorded in ounces. Other foods and liquids were recorded in cups, tablespoons, etc., as appropriate. Nutrient analysis was done with Computrition dietary analysis computer software. A summary of the subjects' intake of energy, protein, sodium, potassium, calcium, and phosphorus is provided in Table 3. T-test analyses showed no significant differences between groups, with regard to mean nutrient intakes, at the beginning of the study ($p \geq 0.05$).

Energy

Hemodialysis patients need adequate calories to meet daily requirements, to spare protein for tissue protein synthesis, and to prevent catabolism of lean tissue for energy. Generally, 35-50 Kcals/kg ideal body weight (IBW) per day is recommended for hemodialysis patients to maintain nitrogen balance and meet metabolic needs (Harvey et al., 1980; Kluthe et al., 1978; Monteon et al., 1986; Slomowitz et al., 1989; Zeman 1991). Renal failure itself does not seem to influence energy expenditure, as long as sepsis is not present. Energy expenditure in maintenance hemodialysis patients is not different from that of normal individuals. Therefore, low energy intakes are inappropriate (Monteon et al., 1986; Schneeweiss et al., 1990).

Most of the subjects consumed fewer calories than recommended in the first and sixth month of the study (Tables 4 and 5). Average energy intakes for the control group were 24.4 and 26.0 Kcal/kg/day for the first and sixth months, respectively. Comparable values in the treatment group were 25.2 and 20.5 Kcal/kg/day. These values were based on actual weights unless the subject's weight was $\geq$ 120% IBW. For subjects over 20% of their IBW, calculations were based on an adjusted weight which was figured as follows: Adjusted weight = (actual weight - ideal weight)/4 + ideal weight. This calculation is based on the assumption that 25% of fat tissue is metabolically active. Ideal body weights were calculated as follows: men-- 106 lb. for first 5 feet, plus 6 lb. for each inch over 5 feet.

Table 3. Dietary intake summary (mean ± standard deviation). [T=treatment, (n=12); C=control, (n=8)] note: months 2-5 had missing data, p-values reflect only cases with no missing data (n=7).

MONTH	1		2	3	4	5	6		p-value	
	(T)	(C)	(T)	(T)	(T)	(T)	(T)	(C)	(T)	(C)
Kcals	1501±379	1446±373	1470±390	1620±511	1382±404	1369±367	1246±268	1586±379	0.016	0.323
protein (g)	62.3±18.9	59.2±29.5	55.4±14.9	59.3±13.5	50.7±15.1	47.7±8.4	56.1±19.2	69.4±18.1	0.138	0.405
Na (mg)	1817±623	1946±1099	1980±561	1759±644	1750±323	1603±518	1455±430	1895±868	0.068	0.814
K (mg)	1724±536	1995±869	1571±292	1733±407	1484±440	1372±212	1646±512	2034±705	0.479	0.927
Ca (mg)	522±271	565±294	625±298	699±343	565±169	515±164	502±198	748±340	0.657	0.137
P (mg)	894±301	831±389	788±296	884±374	730±195	645±141	750±240	1036±326	0.100	0.211

Table 4. Summary of energy and protein intakes of control subjects.

			Month 1			Month 6	
ID#	Height (in)	Weight (kg)	Kcals/kg	Protein g/kg	Weight (kg)	Kcals/kg	Protein g/kg
01	61	62.0*	24.3	0.75	62.0*	23.6	1.02
02	62	50.5	32.1	1.75	52.0	31.1	1.33
03	68	106.0*	17.9	0.73	106.5*	17.2	0.75
04	72	121.0*	12.0	0.39	108.0*	23.9	1.10
06	72	85.5	21.5	0.86	86.5	18.7	0.89
07	60	44.0	26.7	0.67	45.0	29.1	0.98
08	67	53.0^	40.0	2.12	53.5^	41.2	1.35
09	68	55.5^	20.8	0.75	58.0	23.4	1.52
mean±SD			24.4±8.7	1.00±0.60		26.0±7.7	1.12±0.26

* weight ≥120% ideal body weight.
^ weight <90% ideal body weight.

Table 5. Summary of energy and protein intakes of treatment subjects.

			Month 1			Month 6	
ID#	Height (in)	Weight (kg)	Kcals/kg	Protein g/kg	Weight (kg)	Kcals/kg	Protein g/kg
10	72	70.0^	18.9	1.05	79.0	20.4	1.07
11	60	48.5	26.4	1.14	49.1	20.1	1.15
12	62	49.0	44.2	1.43	50.0	29.3	0.98
13	66	83.5*	28.0	1.36	80.5*	19.9	1.35
14	60	75.0*	21.8	0.61	71.0*	20.7	0.78
15	66	79.5*	18.5	0.79	77.0*	24.1	1.10
16	69	69.5	25.6	1.21	63.5^	18.9	1.06
17	62	54.5	28.7	1.00	52.5	26.7	0.93
18	64	57.0	20.7	0.58	58.0	15.3	0.61
19	72	63.0^	31.8	1.25	69.5^	22.1	0.82
20	65	81.5*	17.1	0.85	80.0*	13.3	0.56
21	72	66.5^	20.6	1.08	68.5^	14.9	0.50
mean±SD			25.2±7.6	1.03±0.28		20.5±4.7	0.91±0.26

* weight ≥120% ideal body weight.
^ weight <90% ideal body weight.

women-- 100 lb. for the first 5 feet, plus 5 lb. for each inch over 5 feet (Hamwi method) (Shronts, 1989). These findings are slightly higher than those reported by Moore and Acchiardo (1991) where patients prescribed 35 Kcal/kg per day reported intakes of only 18 Kcal/kg per day. The National Cooperative Dialysis Study showed similar findings where hemodialysis patients reported calorie intakes 34% below the prescribed level with an average energy intake of 1542 Kcals (Schoenfeld et al., 1983). Thunberg et al. (1981) reported that 50% of maintenance hemodialysis patients consumed 15% fewer calories and/or less protein than was prescribed. Other investigators have also reported poor energy intakes of hemodialysis patients (Jacob et al., 1992; Kopple et al., 1989; Monteon et al., 1986).

Obese patients require less energy per kilogram (Slomowitz et al., 1989). All obese subjects in the treatment group lost weight during the six-month study period, while only one obese control subject lost weight during this time (Tables 4 and 5). The treatment group's energy intake fell from a mean of 1501±379 to 1246±268 Kcals ($p=0.016$) (Figure 1). However, protein and calcium intakes remained relatively stable. This may be explained by patients reducing the amount of "empty-calorie" foods in their diet and focusing on more "nutrient dense" foods. Control subjects' intake remained fairly stable (Figure 1).

Protein

Hemodialysis is a catabolic process. Amino acids, peptides, and some proteins are lost with each dialysis treatment. Protein losses, in the form of amino acids, are estimated to be 10 to 13 grams per hemodialysis treatment. Because of these losses, protein requirements are generally 1.0 to 1.5 gm of protein/kg per day, primarily of high biological value (Kluthe et al., 1978; Sanders et al., 1990; Shronts, 1989). The protein intake of study subjects did not show a significant change during the six-month study (Figure 2).

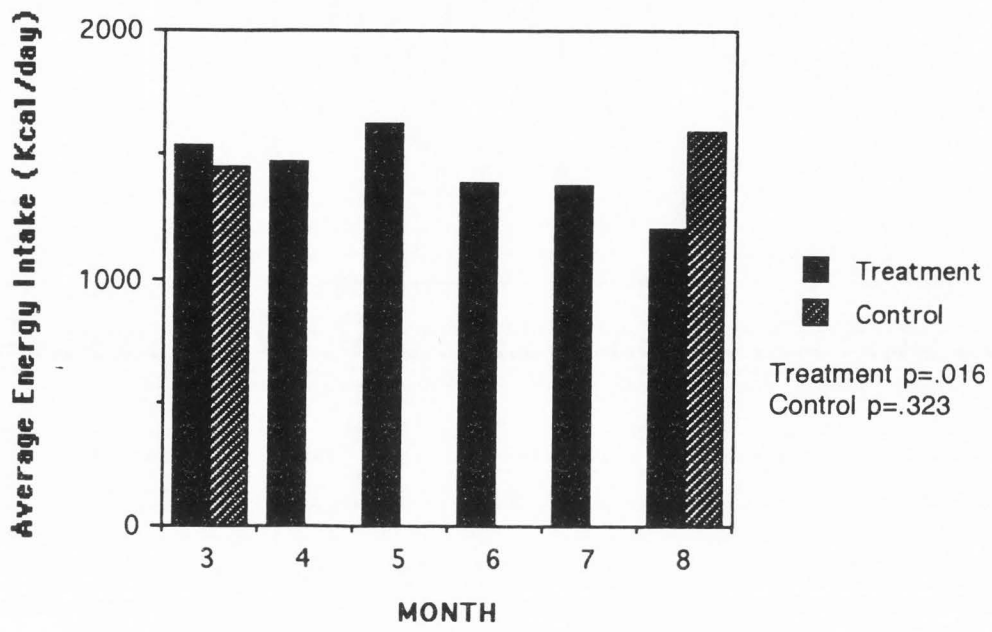

Figure 1. Average energy intakes of study participants by month.

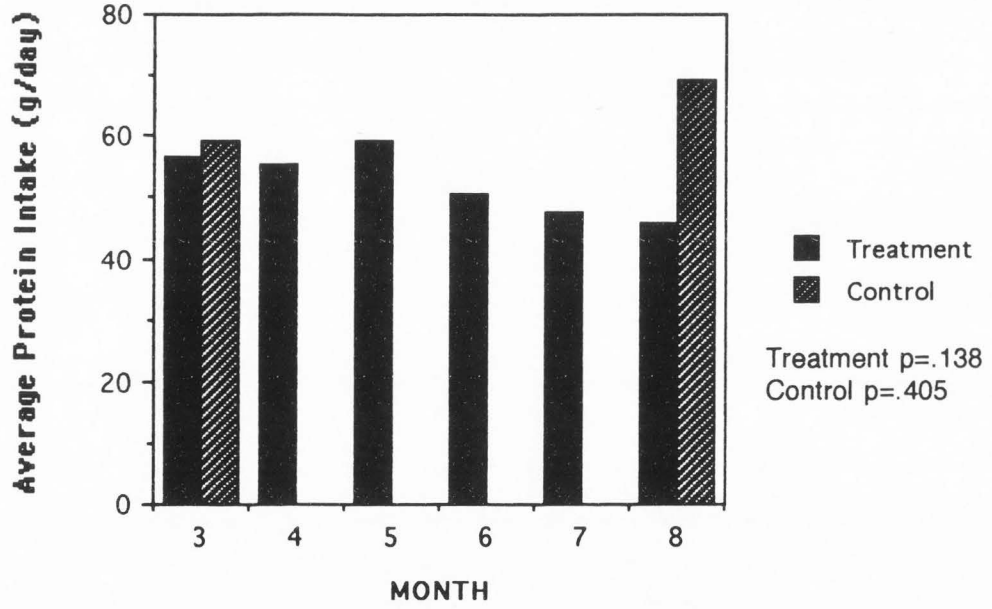

Figure 2. Average dietary protein intakes of study participants by month.

However, average protein intakes were close to the lower end of the recommended level for both study groups. Mean intakes for the control group were 1.00 and 1.12 gm /kg/day for the first and sixth months of the study, respectively. Comparable values for the treatment group were 1.03 and 0.91 gm protein/kg/day (Tables 4 and 5). These findings are slightly higher than those reported by Moore and Acchiardo (1991), who found that when prescribed a diet containing 1.0 gm of protein/kg per day, patients reported intakes of only 0.75 gm of protein /kg per day.

The importance of maintaining adequate protein intake was emphasized during the education sessions with the subjects in the treatment group. Food models were used to demonstrate portion sizes. Subjects who consistently had poor protein intakes were provided with a protein powder that could be incorporated into other foods.

While dietary intake records did not show an increase in the treatment groups' protein intake (Figure 2), serum albumin levels did show an upward trend. This will be discussed further in the biochemical section. This finding may indicate that the three-day food records did not provide an accurate representation of daily protein intake for the entire month.

Sodium

Sodium and fluid restrictions are necessary in renal failure to prevent accumulation of these materials between dialysis treatments. Excess sodium is usually excreted by the kidney. When the kidneys are not functioning properly, excess sodium attracts and carries fluid with it. This condition leads to hypertension, edema, and possibly congestive heart failure (Sanders et al., 1990; Zeman, 1991). Sodium intake is restricted to the amount that limits water weight gain to approximately 0.5 kg/day. Consuming large amounts of sodium causes patients to become thirsty and drink more fluids, which contributes to the above problems. Renal patients are usually restricted to a sodium intake between 2 and 4 gm per day. Sodium restrictions for subjects in this study were within this range. Subjects

who had greater sodium urinary losses could tolerate a higher sodium intake. Average sodium intakes were always lower than 2 grams (Table 3). Schoenfeld et al. (1983) reported mean dietary sodium intakes of 2097 mg per day.

The treatment group showed a downward trend in sodium intake. Average sodium intakes fell from 1817 mg/day (month 1) to 1455 mg/day (month 6) (Figure 3). This would partly explain the downward trend in intertreatment weight gains observed in this group, which will be discussed further in the anthropometry section.

The nutrient analysis computer printouts were useful in helping subjects identify foods that were high in sodium. Many subjects were surprised to learn the high sodium content of foods such as milk and cheese.

Potassium

Potassium is a principal intracellular electrolyte which must be maintained close to the normal level at all times. Normally 80-90% of the body's potassium is excreted by the kidneys (Sanders et al., 1990). Therefore, when the kidneys fail, dietary potassium intake must be kept at a lower level to prevent hyperkalemia. Excess potassium is removed by the dialysis process, so if a subject were to eat a high potassium food, it was recommended to do so 6 to 8 hours before dialysis. This length of time allows the potassium to be metabolized so it can abe adequately removed by dialysis.

Dietary potassium is usually restricted to 1600 to 3000 mg/day (Zeman, 1991). Patients with some urine output can tolerate more potassium than those who are anuric. Subjects in this study were restricted to 2000 to 3000 mg potassium per day. No significant changes in dietary potassium intakes were observed in either group (Figure 4). Mean dietary potassium intakes ranged from 1372 to 2034 mg per day (Table 3). Schoenfeld et al. (1983) reported a similar mean dietary potassium intake of 1611 mg per day.

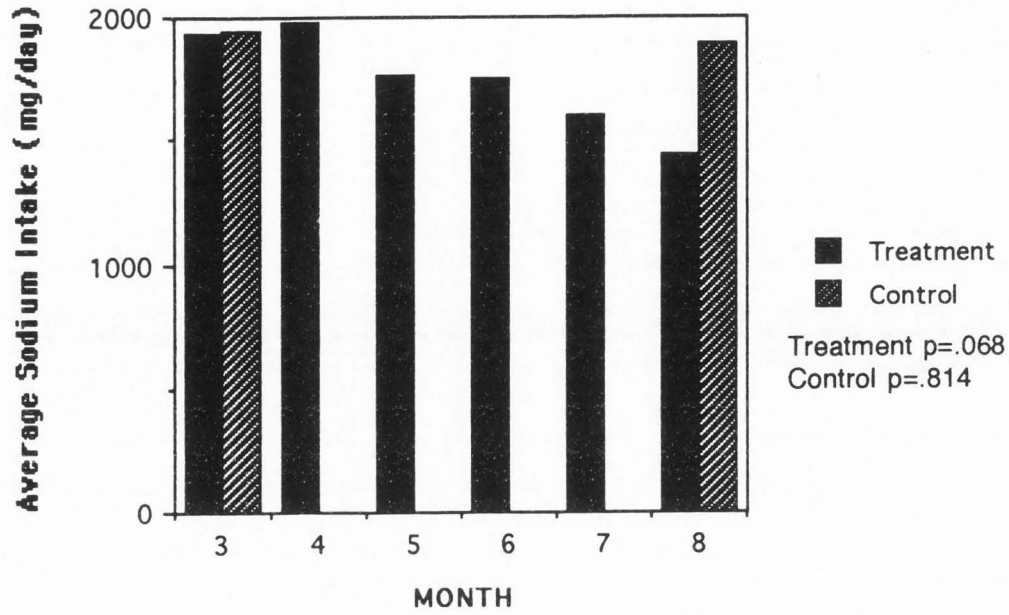

Figure 3. Average dietary sodium intakes of study participants by month.

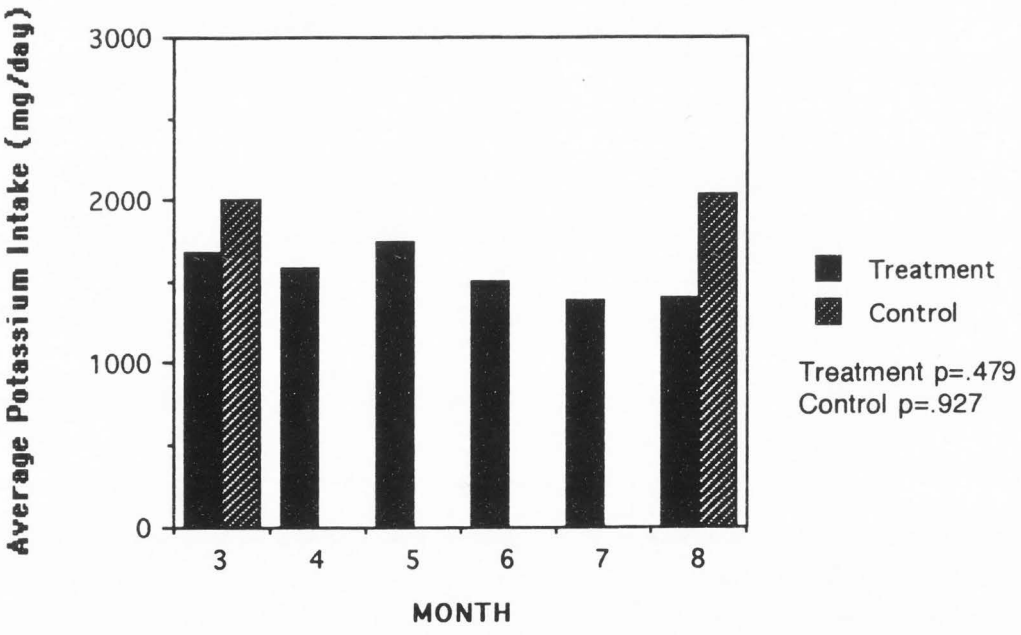

Figure 4. Average dietary potassium intakes of study participants by month.

Calcium

Calcium balance is maintained by the gastrointestinal tract by gut absorption of calcium and by the kidneys through urinary calcium excretion. Hormones, such as parathyroid hormone, vitamin 1,25-$(OH)_2D_3$ (calcitrol), calcitonin, cortisol, and growth hormone are also involved in calcium balance (Sanders et al., 1990). Because of increased phosphorus levels in renal failure, serum calcium is lower than normal and parathyroid hormone levels remain chronically elevated. Decreased calcium absorption from the intestine also contributes to the deficit in serum calcium. Calcitrol, the active form of vitamin D which stimulates gastrointestinal calcium absorption, is mainly produced by the kidneys. Intestinal calcium absorption is decreased when renal hydroxylation of the 25-hydroxycholecalciferol form of vitamin D to the 1,25 (active) form is depressed. Patients with renal failure are prone to renal osteodystrophy because of alterations in vitamin D metabolism, reduced calcium absorption, elevated parathyroid hormone levels, and acidosis (Zeman, 1991).

Recommendations for oral calcium intake for dialysis patients range from 1,000 mg/day to 1,800 mg/day (Sanders et al., 1990; Zeman, 1991). Phosphate binders, which are calcium based, comprise a large proportion of renal patients' total calcium intake. For example, calcium carbonate, the predominant phosphate binder used by subjects in this study, contains 1,000 mg of calcium per 2,500 mg of calcium carbonate.

Average dietary calcium intakes ranged from 502 to 699 mg/day for the treatment group. Control subjects had similar calcium intakes (Table 3). Schoenfeld et al. (1983) reported mean dietary calcium intakes of 435 mg per day. No significant changes in dietary calcium intake were observed in either group (Figure 5). Phosphate binder and supplement use was not monitored in this study. Therefore, the values listed in Table 3 represent only a fraction of the subjects' total calcium intake.

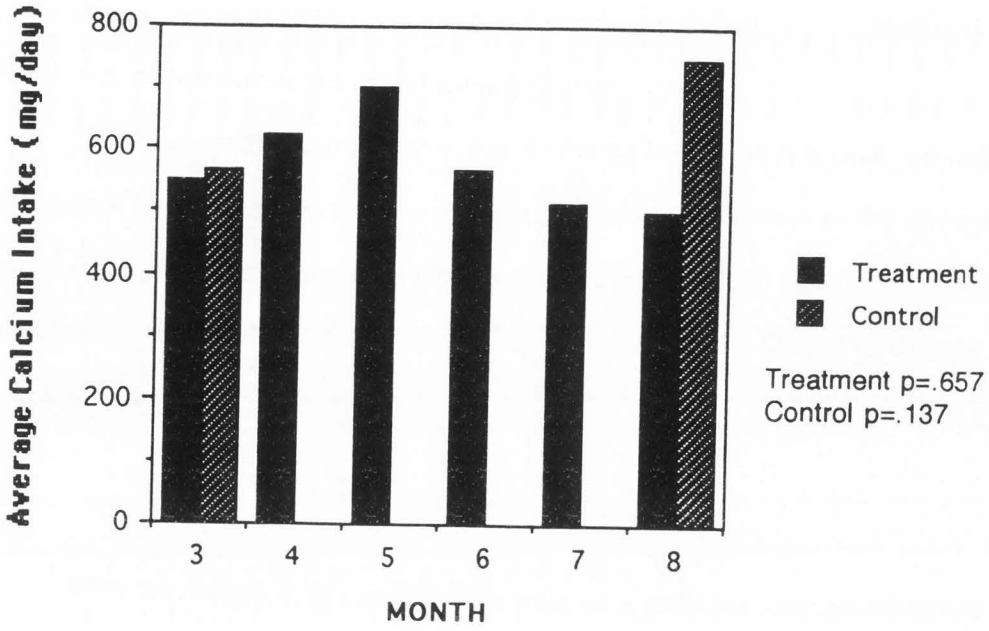

Figure 5. Average dietary calcium intakes of study participants by month.

Phosphorus

Phosphate is normally excreted primarily in the urine. As renal failure progresses, phosphate retention increases. An elevated serum phosphorus level is associated with a fall in serum calcium, which induces hyperparathyroidism. Calcium and phosphorus can then be easily mobilized from the bones and may increase the deposition of calcium phosphate in the soft tissues. Serum phosphorus levels may be able to be controlled by reducing phosphorus intake to 600 to 1,200 mg/day (Sanders et al., 1990). However, foods which are high in protein and calcium are also high in phosphorus. Therefore, it is not feasible to keep dietary phosphorus low and still be consuming a high protein diet. Chronic dialysis patients are prescribed phosphate-binding medications to be taken with meals. Calcium carbonate and calcium acetate are two commonly used phosphate binders. Aluminum-based binders are now discouraged due to the potential of aluminum toxicity, possibly contributing to "dialysis dementia." Phosphate binding medications work by binding

phosphate in the gastrointestinal tract and preventing its absorption. Side effects of these medications include constipation and nausea (Zeman, 1991).

No significant changes were observed during the six-month study period in either study group (Figure 6). The average phosphorus intake was always in the recommended range of 600 to 1,200 mg/day, with intakes ranging from 645 10 1036 mg/day (Table 3). These findings are similar to those reported by Schoenfeld et al. (1983) of a mean intake of 879 mg per day.

Dietary Compliance

With the exception of energy, there were no significant changes observed in the treatment group's intake of the analyzed nutrients. In the treatment group, energy intakes

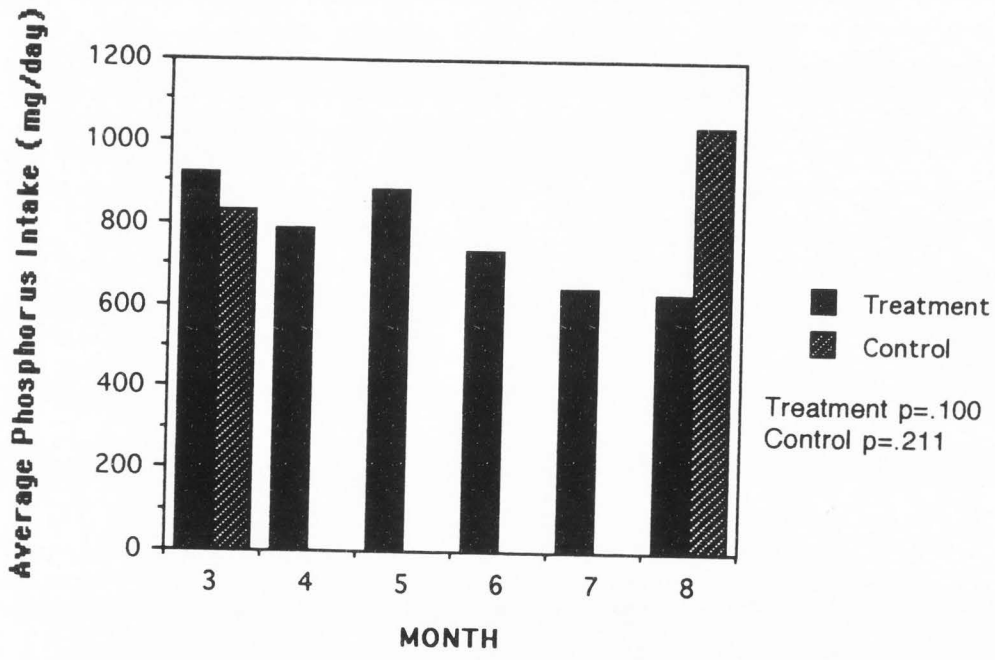

Figure 6. Average dietary phosphorus intakes of study participants by month.

fell from a mean of 1501 Kcal/day (month 1) to 1246 Kcal/day (month 6). This corresponds to average intakes of 25.2 Kcal/kg/day and 20.5 Kcal/kg/day, respectively (Tables 4 and 5). Based on minimal energy needs of 35 Kcal/kg/day, the average intake of these patients fell from 72% to 59% of estimated needs. The average energy intake for the control group showed a slight increase from 70% to 74% of estimated needs.

The decrease in energy intake and declining trends of other nutrients in the treatment group were likely related to patient fatigue in completing food records. Similar trends could have been expected in the control group if they had kept food records for each of the six months.

It should be noted that average intakes of sodium, potassium, and phosphorus were always within the recommended levels. Average protein intakes were slightly below recommended levels, yet higher than protein intakes reported elsewhere (Moore and Acchiarado, 1991). There were no significant differences between the two groups for dietary intakes of any nutrient except calories (kcals, p=.020; protein, p=.149; sodium, p=.242; potassium, p=.766; calcium, p=.089; phosphorus, p=.072).

Attaining and maintaining good nutrition status of hemodialysis patients are being recognized as an extremely important goal and has been identified as a factor contributing to decreasing mortality rates. "Current approaches to treatment of chronic renal failure effect the importance of diet in the rate of progression to end- stage renal disease and focus more than ever before on the individuals' nutritional requirements" (Moore and Acciarado, 1991, p.34).

Biochemical Data

Malnutrition commonly occurs in patients with renal failure. Causes of malnutrition include inadequate nutrient intakes, loss of nutrients into the dialysate, concurrent illnesses, uremic toxins, and endocrine abnormalities such as insulin resistance,

hyperglucagonemia, and hyperparathyroidism. Monthly biochemical data reflecting visceral protein status, metabolic bone status, electrolyte status and hematological status provide a good indicator of the patients' nutritional status. A summary of biochemical data collected in this study is provided in Tables 6 and 7.

Serum Proteins

Serum protein levels are very useful in assessing nutritional status. Serum albumin is the most abundant plasma protein and has a major influence on colloid osmotic pressure of the plasma. Many factors contribute to low albumin levels seen in pathological conditions. These include decreased synthesis and increased catabolism, low dietary protein intake, reduced intestinal absorption, protein-losing enteropathies, and hemodilution (Guarnieri et al., 1989).

Serum albumin significantly increasd in both study groups (Treatment, p=.008; control, p=.005) (Figure 7). There were no significant differences observed between the two study groups (p=0.135), but the treatment group's monthly average remained slightly higher than the control group's average level. The mean albumin levels of the two groups were not significantly different from each other during the three months preceding the study ($p \geq 0.05$). Both groups maintained average albumin levels within the normal range during the six-month study period, with means of 3.9-4.0 g/dl in the treatment group and 3.7-3.9 g/dl in the control group. These levels are similar to findings reported by Thunberg et al. (1981) where most albumin levels of hemodialysis patients were in the low normal range. Albumin levels were also found to be within the normal range in the National Cooperative Dialysis Study Population (Schoenfeld et al., 1983). Guarnieri et al. (1989) reported that serum albumin levels are often low in hemodialysis patients. There is general agreement that, in both acute and chronic renal failure, protein catabolism is increased (Wassner et al., 1986). Because of its long half-life of approximately 21 days, albumin is generally considered to be a reliable indicator of nutritional status in patients with renal failure, and

Table 6. Biochemical data for treatment group (mean ± standard deviation) (n=12).

	Pre-Study			Study						p-value
MONTH	1	2	3	1	2	3	4	5	6	
albumin (g/dl)	3.3±.6	3.4±.4	3.8±.2	4.0±.4	4.0±.3	4.0±.2	4.0±.3	3.9±.3	4.0±.4	0.008
total protein (g/dl)	6.3±.8	6.5±.6	6.2±.5	6.5±.6	7.0±.6	6.5±.6	6.8±.7	6.9±.6	7.0±.3	0.030
cholesterol (mg/dl)	170±30	161±31	158±42	172±42	164±38	161±38	161±41	140±35	128±38	0.040
BUN (mg/dl)	55.0±14	62±13	74±24	86±38	68±14	76±12	76±14	66±17	77±18	0.093
creatinine (mg/dl)	8.2±1.4	8.6±1.3	10.9±3.8	10.9±2.5	10.8±3.5	11.5±3.0	12.0±3.3	10.5±3.5	11.6±3.6	0.006
sodium (mmol/l)	138.0±6	135±2	134±6	137±4	137±7	137±3	135±4	137±2	138±4	0.061
potassium (mmol/l)	4.8±.8	4.8±.8	5.4±1.3	5.4±1.3	5.1±.9	5.2±.7	5.3±1.0	5.0±.9	5.7±1.2	0.208
calcium (mg/dl)	9.6±1.2	10.0±1.4	9.8±1.1	10.3±1.4	9.9±1.5	10.0±1.2	9.3±1.4	9.5±1.2	9.3±1.5	0.503
phosphorus (mg/dl)	5.8±1.4	6.5±1.7	7.4±1.1	6.4±1.6	8.0±3.0	7.7±2.0	6.5±1.4	6.0±2.5	7.3±1.9	0.005
alk phos (IU/l)	74±28	79±51	93±70	101±74	114±99	102±90	140±178	102±72	99±48	0.286
hematocrit (%)	28.2±4.5	27.9±3.7	28.6±3.4	29.0±3.5	29.9±3.6	28.4±3.4	28.0±4.7	28.6±5.2	27.9±4.1	0.707
hemoglobin (g/dl)	9.4±1.5	9.2±1.2	9.6±1.3	9.7±1.0	10.4±1.3	9.6±1.2	9.5±1.7	9.1±1.4	9.4±1.3	0.210
prot. catabolic rate	0.85±.21			0.93±.32				1.20±.36		0.030
KT/V	1.20±.41			1.19±.35				1.11±.33		0.770

Table 7. Biochemical data for control group (mean ± standard deviation) (n=8).

MONTH	Pre-Study 1	Pre-Study 2	Pre-Study 3	Study 1	Study 2	Study 3	Study 4	Study 5	Study 6	p-value
albumin(g/dl)	3.6±.2	3.6±.1	4.0±.3	3.9±.4	3.9±.4	3.9±.3	3.8±.2	3.8±.3	3.7±.2	0.005
total protein (g/dl)	6.9±.2	7.1±.3	6.7±.4	6.8±.8	7.0±.6	6.7±.4	6.7±.4	7.4±.5	6.9±.3	0.003
cholesterol (mg/dl)	201±86	189±108	202±71	194±73	211±110	179±64	199±88	205±65	184±62	0.608
BUN (mg/dl)	57±19	56±30	67±28	71±29	56±27	77±29	63±21	58±30	59±26	0.001
creatinine (mg/dl)	8.8±1.9	8.9±1.4	11.6±1.7	12.1±2.4	10.7±1.0	11.6±1.7	12.2±2.2	10.5±1.9	11.2±1.0	0.000
sodium (mmol/l)	135±4	131±6	137±2	136±4	137±4	136±4	138±4	134±3	137±2	0.012
potassium (mmol/l)	4.4±.5	4.4±.5	4.6±.6	4.6±.4	4.4±.6	5.0±.6	4.9±.3	4.7±.6	4.8±.4	0.097
calcium (mg/dl)	9.2±.4	9.3±.2	8.9±.6	9.7±1.4	9.1±.2	8.9±.5	8.8±.5	9.4±.4	8.7±.4	0.165
phosphorus (mg/dl)	5.1±1.6	5.8±1.3	6.1±1.9	6.1±2.3	5.6±2.1	5.8±1.8	5.1±1.6	4.8±1.3	5.5±2.0	0.513
alk phos (IU/l)	80±26	94±39	93±27	87±35	87±41	132±96	124±87	110±81	100±64	0.281
hematocrit (%)	29.6±3.9	29.7±3.7	28.9±3.2	27.5±2.1	30.1±3.7	29.9±3.6	27.4±4.8	29.6±4.3	27.6±5.9	0.309
hemoglobin (g/dl)	9.7±1.5	9.8±1.2	7.7±3.4	9.3±.9	9.8±1.1	9.5±1.2	9.1±1.5	9.5±1.4	9.2±2.0	0.407
prot. catabolic rate	0.89±.38			0.91±.41				0.81±.36		0.549
KT/V	1.12±.30			1.17±.25				1.17±.28		0.906

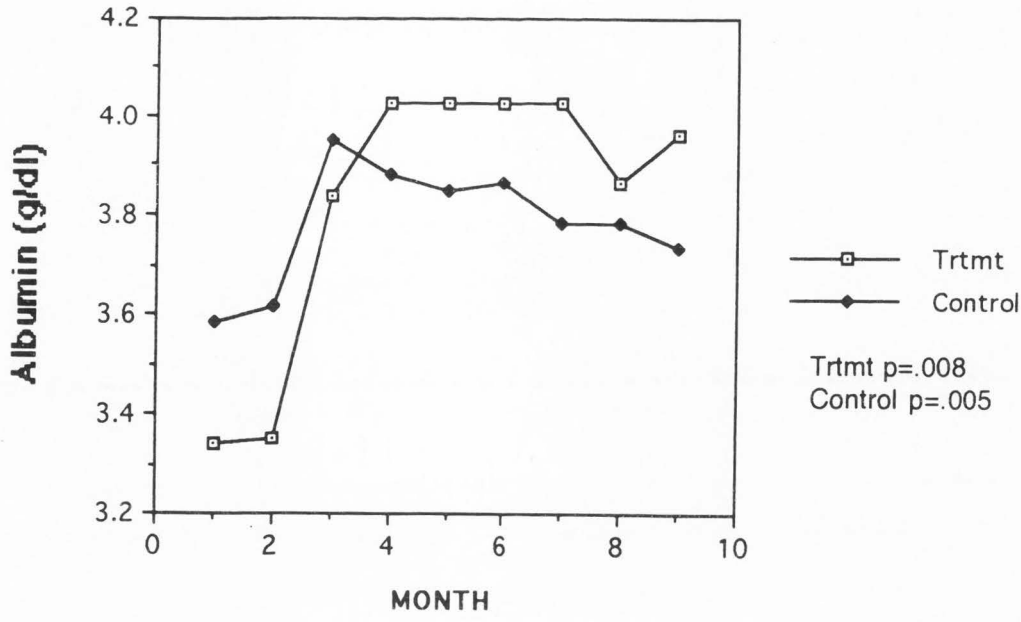

Figure 7. Average serum albumin levels of study participants by month.

trends should be evaluated on a regular basis (Shronts, 1989). The positive trend in albumin noted in this study suggests that nutritional status of subjects improved and was maintained at an acceptable level during the six-month study.

Serum total protein levels also showed significant improvement in both study groups (treatment, p=.030; control, p=.003) (Figure 8). However, there was a significant difference noted between the groups (p=.009), with the treatment group's average starting at a lower level and increasing to a slightly higher level than the control group's average. Total protein levels remained within the normal limits during the six-month study period, with means of 6.5-7.0 g/dl in the treatment group and 6.7-7.4 g/dl in controls. Normal total protein levels were also reported in the National Cooperative Dialysis Study Population (Schoenfeld et al., 1983). Total protein levels do not reflect nutritional status as well as albumin levels. Therefore they are not used as an indicator of nutritional status.

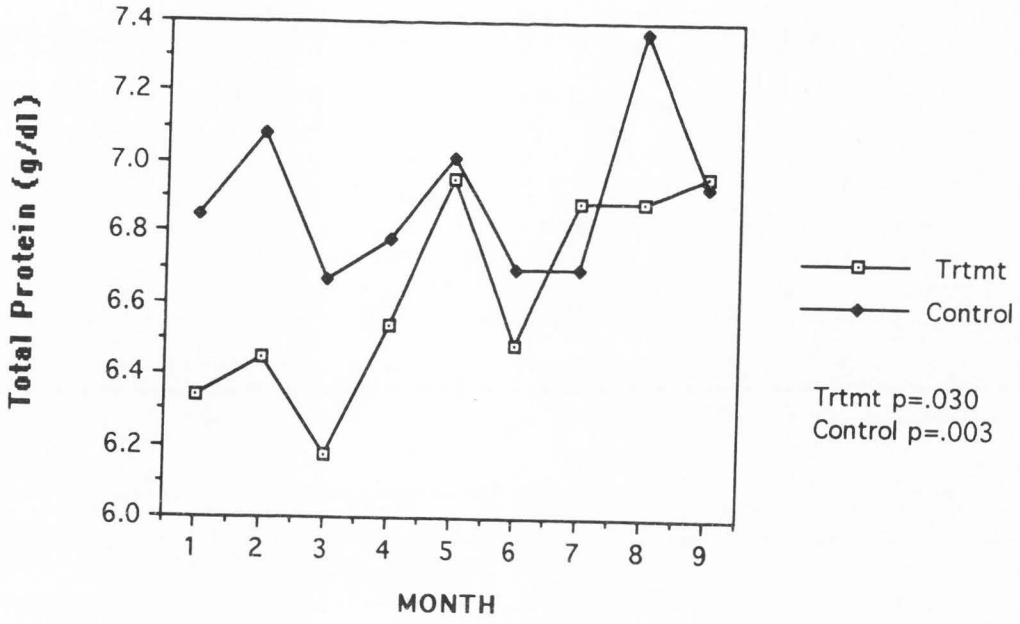

Figure 8. Average serum total protein levels of study participants by month.

Cholesterol

In this study total serum cholesterol levels fell significantly in the treatment group ($p=.04$). Means decreased from 172 mg/dl to 128 mg/dl during the study period. Cholesterol levels of control subjects remained fairly stable with means ranging from 211 to 184 mg/dl (Figure 9). Mean cholesterol levels of the two groups were not significantly different during the three months preceding the study ($p \geq 0.05$). However, there was a significant difference observed between the two groups over time ($p = .026$). Donadio (1991) reported average cholesterol levels of patients with IgA nephropathy to be 258±35 mg/dl. Donadio's finding is notably higher than average cholesterol levels observed in this study population. However, Guarnieri et al. (1980) reported average cholesterol levels of chronic dialysis patients to be 178±50, which more closely resembles findings in this study.

Hyperlipidemia is a common finding in dialysis patients. It has been suggested

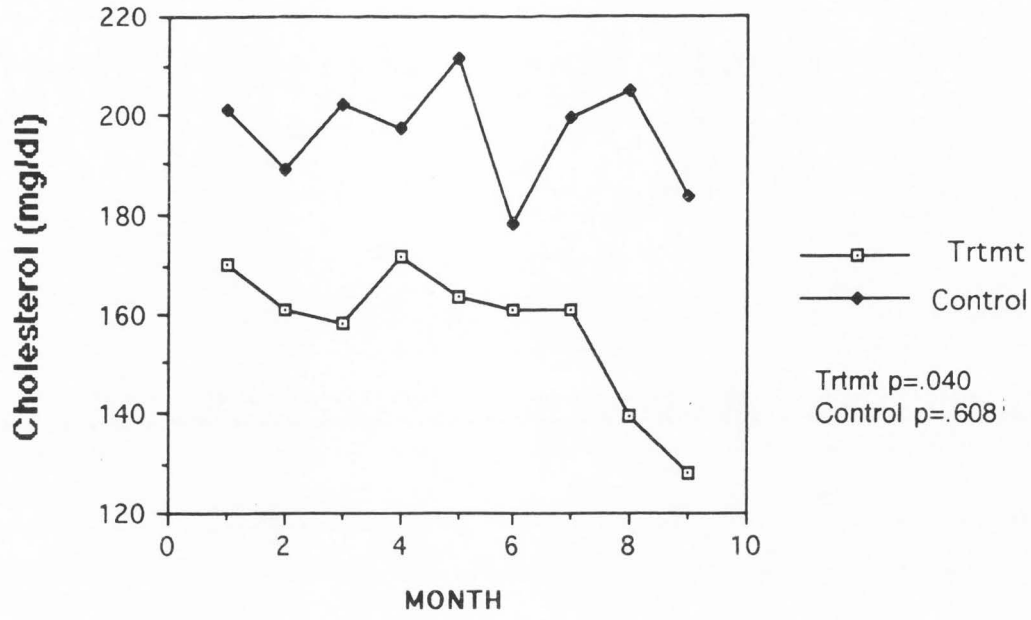

Figure 9. Average serum cholesterol levels of study participants by month.

that abnormal lipid metabolism may promote degenerative vascular disease, which in turn promotes renal destruction (Pagenkemper, 1991).

The average cholesterol level of treatment subjects for study month 6 was exceptionally low due to four subjects having cholesterol levels less than 130 mg/dl during this month. Serum cholesterol levels less than 150 mg/dl are associated with such abnormalities as megaloblastic and hypochromic anemia, liver disease, malnutrition, and dietary manipulation (Tilkian et al., 1987). It is difficult to determine why cholesterol levels dropped in the treatment group. To the researcher's knowledge, decreased levels were not associated with any infections or flu symptoms. It is unlikely that the drop could be attributed to malnutrition because average albumin levels increased during the same time period. Total dietary fat, polyunsaturated to saturated fat ratios, and dietary cholesterol were not analyzed in this study. However, it is likely that subjects receiving nutrient analysis computer printouts of their diets were more aware and more conscious of fat and cholesterol intake.

Blood Urea Nitrogen and Creatinine

Blood urea nitrogen (BUN) is determined by the rate of protein breakdown, which is equal to protein intake in a metabolically stable patient, and the urea clearance by the kidney. Serum creatinine levels are determined by creatinine production from muscle and the renal creatinine clearance (Blumenkrantz et al., 1980).

BUN levels did not change significantly in the treatment group with mean levels staying between 55 and 86 mg/dl, but levels did show a significant increase in controls (Figure 10). There were no significant differences observed between groups at the beginning of the study ($p \geq 0.05$), or over time (p=.491). Average BUN levels observed in this study population are slightly less than those reported by Guarnieri et al. (1980), (93±56 mg/dl). Significant correlations have been reported between protein intake and BUN levels in hemodialysis patients (Guarnieri et al., 1980). Other factors which can influence BUN levels include hydration status and GI bleeding. High BUN levels are also associated with inadequate dialysis.

Serum creatinine levels are a useful indicator of renal function. Levels rise as renal function deteriorates. Both study groups showed a significant increase in creatinine levels during the study period (Figure 11). Means for the treatment group ranged from 8.2 to 12.0 mg/dl, and control means ranged from 8.8 to 12.2 mg/dl. Significant differences were not observed between the two groups at the beginning of the study ($p \geq 0.05$), or over time (p=.863). Mean creatinine levels were also lower than those observed by Guarnieri et al. (1980) (14.9±3.1 mg/dl).

The increased levels of BUN and creatinine observed in this study population most likely reflect declining renal function. The increase in BUN may be reflecting an increase in dietary protein intake. While dietary records do not indicate an increased protein intake, serum albumin levels and protein catabolic rate do reflect an improvement in nutritional status and dietary protein intake.

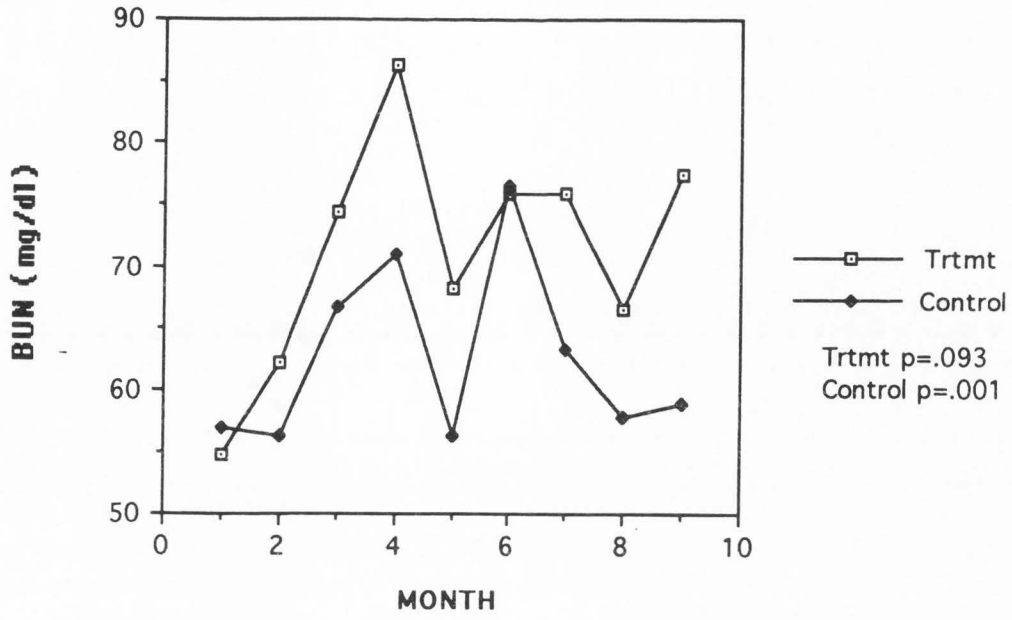

Figure 10. Average serum blood urea nitrogen levels of study participants by month.

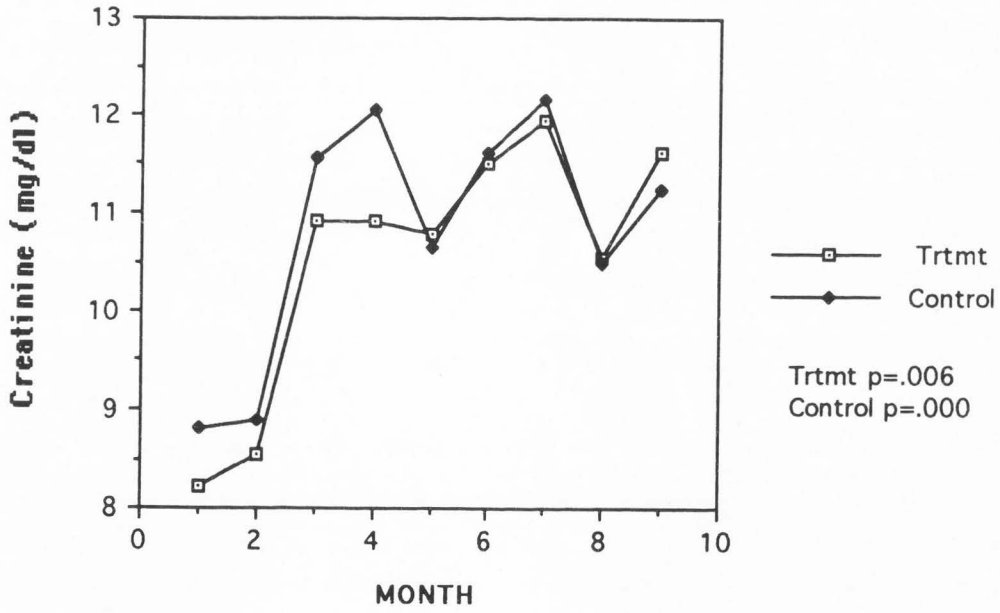

Figure 11. Average serum creatinine levels of study participants by month.

Sodium

In patients with end-stage renal failure, sodium excretion may be substantially decreased, causing edema, hypertension, and, possibly, congestive heart failure (Sanders et al., 1990). In most cases serum sodium reflects fluid status rather than dietary sodium intake. Treatment subjects had relatively stable serum sodium levels throughout this study with means ranging from 134 to 138 mmol/l. Controls did show a significant change (means ranged from 131-138 mmol/l) (Figure 12), and there was a significant difference observed between groups (p=.032). Mean serum sodium levels did not deviate far from the normal range of 135-145 mmol/l. The significant changes observed are not of clinical importance from a nutritional standpoint.

Potassium

No significant differences were observed in serum potassium levels over time in either group (Figure 13) or between groups (p=.587). However, there was a notable upward trend in mean potassium levels of treatment subjects. Average levels at the beginning of the study period were 5.4 mmol/l and rose to 5.7 mmol/l at the end of the study. Hyperkalemia in chronic renal failure is most often associated with excessive dietary potassium intake, but there are many other factors which can cause elevated serum potassium levels. Nondietary causes of hyperkalemia include: decreased gastrointestinal excretion with chronic constipation, acidosis insulin deficiency in diabetic patients, elevated parathyroid hormone, inadequate dialysis, drug interactions, tissue damage, or sepsis (Beto and Bansal, 1992). Since dietary records did not reflect increasing potassium intakes, it is likely that a nondietary etiology was contributing to the increased levels.

Metabolic Bone Status

Calcium balance is altered in renal failure due to increased levels of parathyroid hormone (PTH). Hypocalcemia in renal failure is caused by altered vitamin D metabolism

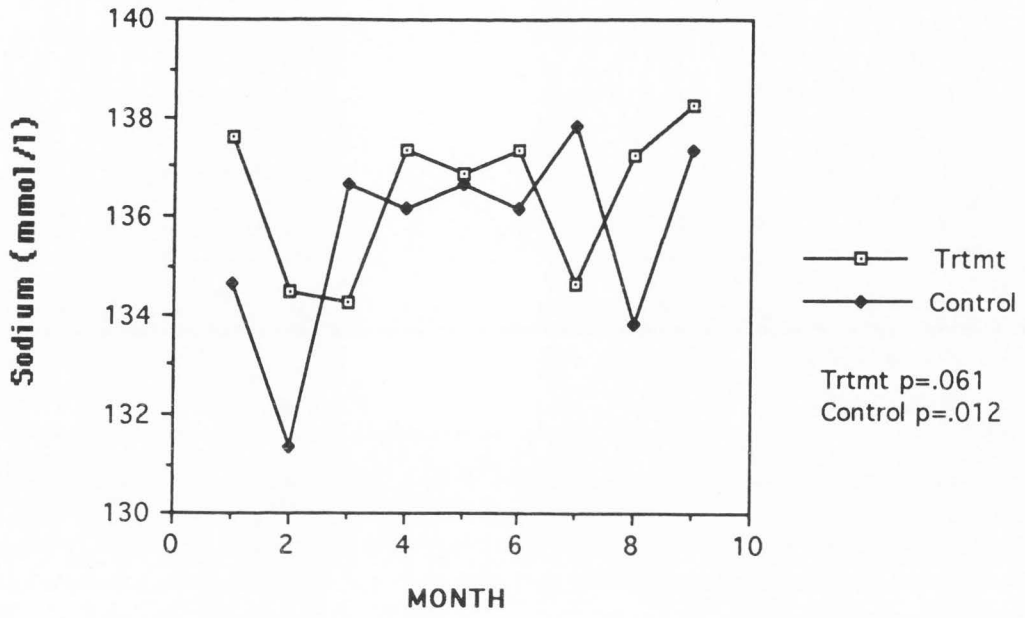

Figure 12. Average serum sodium levels of study participants by month.

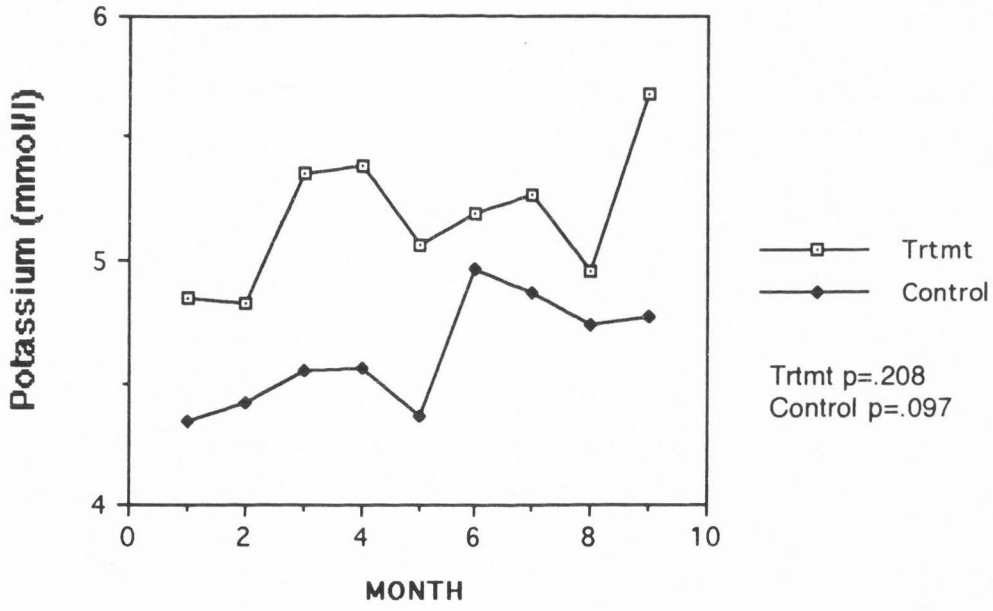

Figure 13. Average serum potassium levels of study participants by month.

and skeletal resistance to actions of PTH (Sanders et al., 1990). Hypercalcemia can also occur and should be avoided due to increased risk of soft tissue calcification. In recent years calcitriol, the active form of vitamin D, has been made available to dialysis patients to help prevent bone disease. It is available in tablet form (Rocaltrol) and IV form (Calcijex). In this study, no significant changes were observed in serum calcium levels over time (Figure 14), and the groups did not differ significantly from each other (p=.794).

Smith et al. (1991) reported mean serum calcium levels of hemodialysis patients of 8.41±.88 and mean dietary calcium intakes of 310±168 mg per day. Both of these findings are lower than what was observed at the end of this study (serum calcium: treatment, 9.3±1.5; control, 8.7±.4; dietary calcium: treatment, 502±198; control 748±340).

Serum phosphorus did not significantly change in the control group, but did show a significant increase in the treatment group (Figure 15). There were no significant differences observed between the groups over time (p=.341). Hyperphosphatemia is controlled primarily by phosphate-binding medications. Dietary phosphorus intake is not severely restricted because foods which are high in protein are also high in phosphorus and high protein foods are needed in the diet.

Smith et al. (1991) reported mean serum phosphorus levels of 5.19±1.49 mg/dl and mean dietary phosphorus intakes of 484±188 mg per day. Like calcium, both of these findings are lower than what was observed at the end of this study (serum phosphorus: treatment, 7.3±1.9; control, 5.5±2.0; dietary phosphorus: treatment, 750±240; control, 1,036±326). Although mean dietary phosphorus intakes were higher, they were still in the recommended range of 600 to 1,200 mg per day (Zeman, 1991).

Use of phosphate-binding medication was not assessed in this study. It is possible that the increase in the treatment group's serum phosphorus was due to subject's failure to take phosphate-binding medication properly, especially since there was no

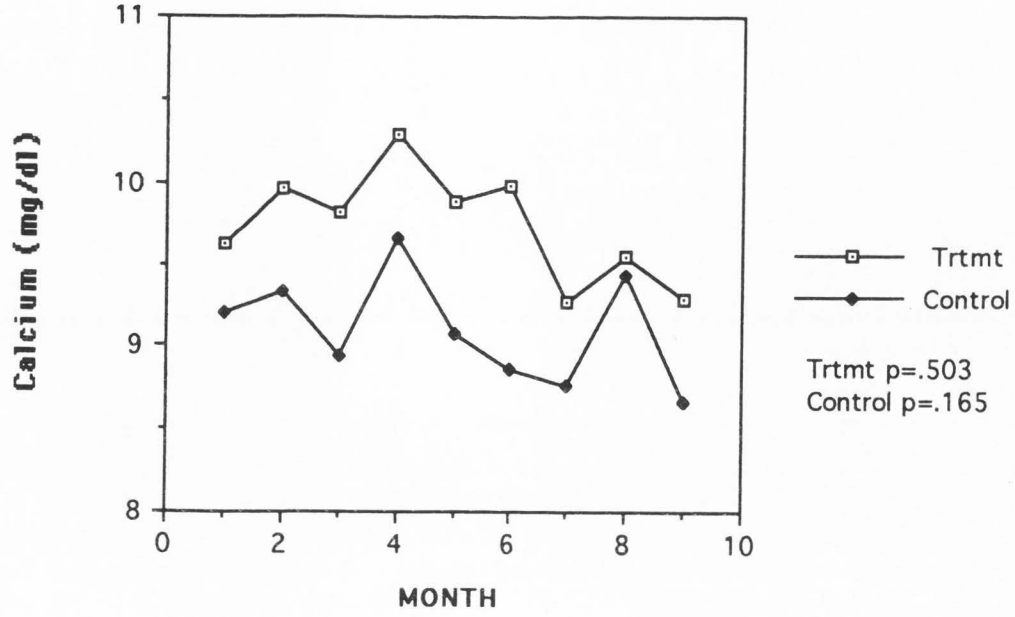

Figure 14. Average serum calcium levels of study participants by month.

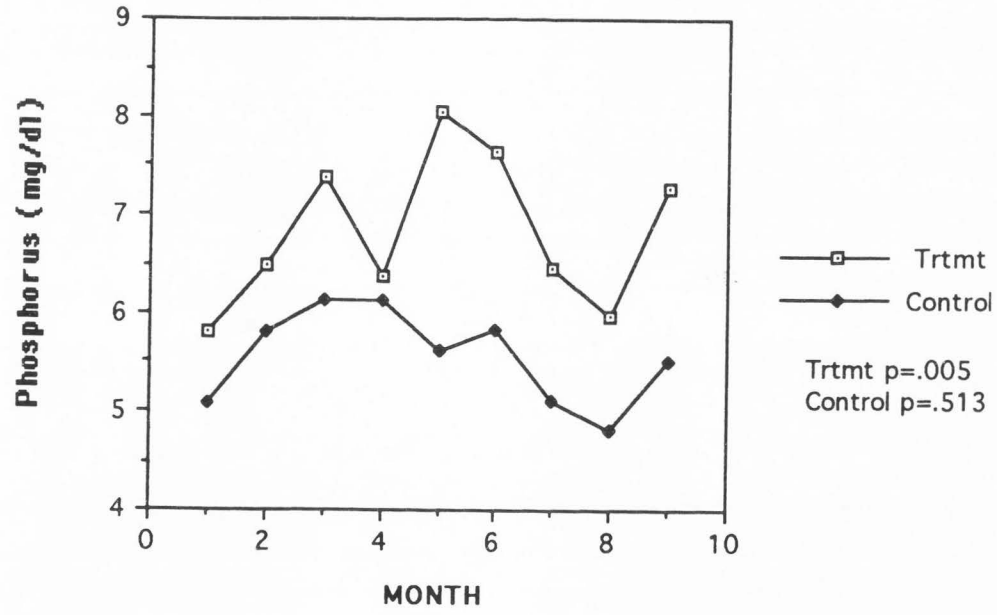

Figure 15. Average serum phosphorus levels of study participants by month.

significant increase in dietary phosphorus intake (p=.100).

Alkaline phosphatase is an enzyme involved in the calcification process of bones. Levels become elevated in conditions of hyperparathyroidism, rickets, and osteomalacia. Increased levels are also associated with liver disease (Tilkian et al., 1987). Alkaline phosphatase levels remained in the normal range and did not show any significant changes in either study group (Figure 16). There was also no significant difference observed between the two groups over time (p=.598).

Hemoglobin and Hematocrit

Low hemoglobin and hematocrit levels are common in hemodialysis patients due to the anemia associated with renal failure. This form of anemia is caused by bone marrow failure to make red blood cells, which is caused by decreased erythropoietin production by

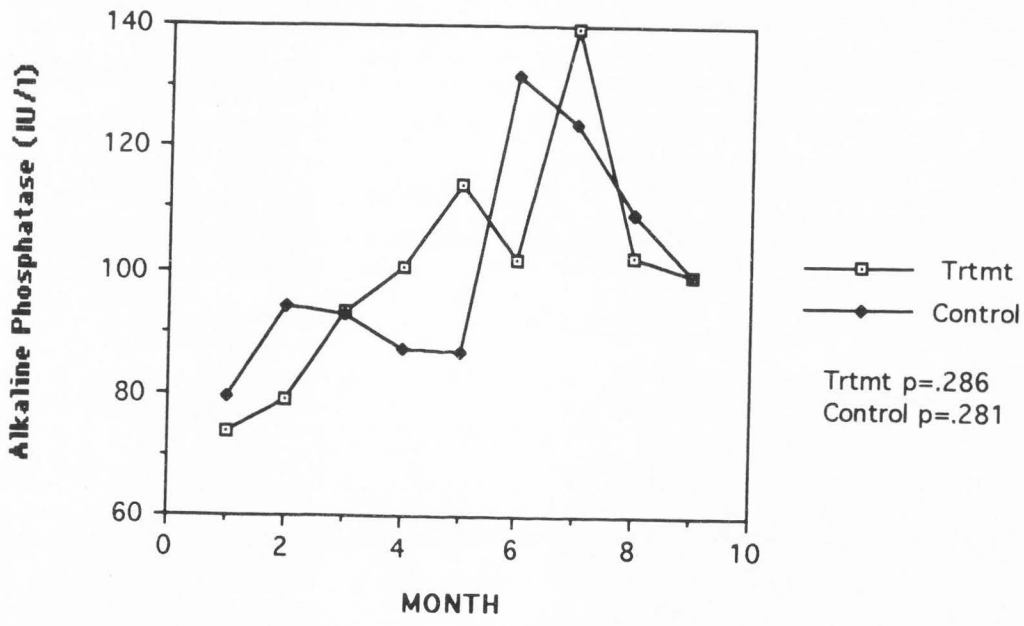

Figure 16. Average serum alkaline phosphatase levels of study participants by month.

the kidney. Other factors such as reduced iron absorption, gastrointestinal bleeding, and frequent blood sampling also contribute to the anemia (Zeman, 1991). Recently, human erythropoietin (EPO) has been manufactured by recombinant DNA technology and has been made available to the dialysis population. When combined with adequate iron stores, EPO can correct the anemia of chronic renal failure. This type of therapy is often associated with an increased appetite and an improvement in nutritional status (Bennett et al., 1991).

Subjects in this study were receiving EPO on a routine basis and were also provided with iron and folate supplements. No significant changes were observed over time in either group with respect to hemoglobin and hematocrit levels (Figures 17 and 18). There were also no significant differences between groups (hemoglobin p=.297, hematocrit p=.649). Mean hemoglobin levels in this study population were generally between 9.0 and 10.0 g/dl and were similar to those reported by Bennett et al. (1991), where hemodialysis patients, who had been treated with EPO for six months, had mean hemoglobin levels of 9.4 gm/dl. Changes in hemoglobin and hematocrit levels would not be expected to occur based on dietary changes alone when large amounts of iron and folic acid are being supplemented.

Kinetic Modeling

Urea kinetic modeling provides a marker by which to assess adequacy of dialysis therapy and to assess nitrogen balance in dialysis patients. Renal failure results in accumulation of protein metabolites: urea (BUN), non-urea compounds (creatinine,uric acid, "middle molecules"), acid (phosphate, sulfate), and potassium. The nutritional management and dialysis prescription of dialysis patients presents a difficult challenge. The goal is to meet protein and calorie needs and minimize protein catabolism while controlling metabolic waste accumulation with appropriate dialysis (Gee, 1985).

The major catabolic end product in protein metabolism is urea. Urea is the solute

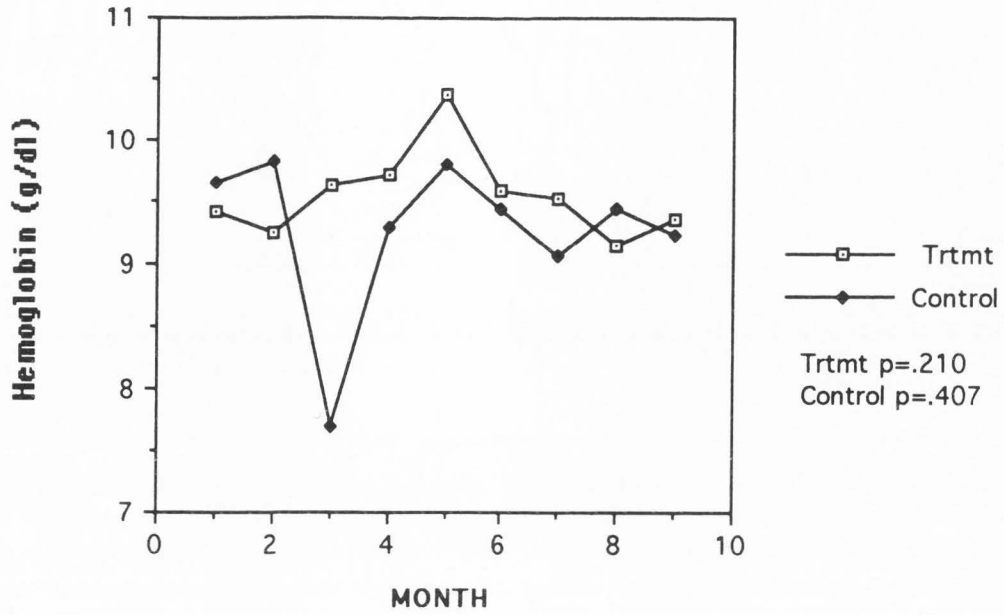

Figure 17. Average hemoglobin levels of study participants by month.

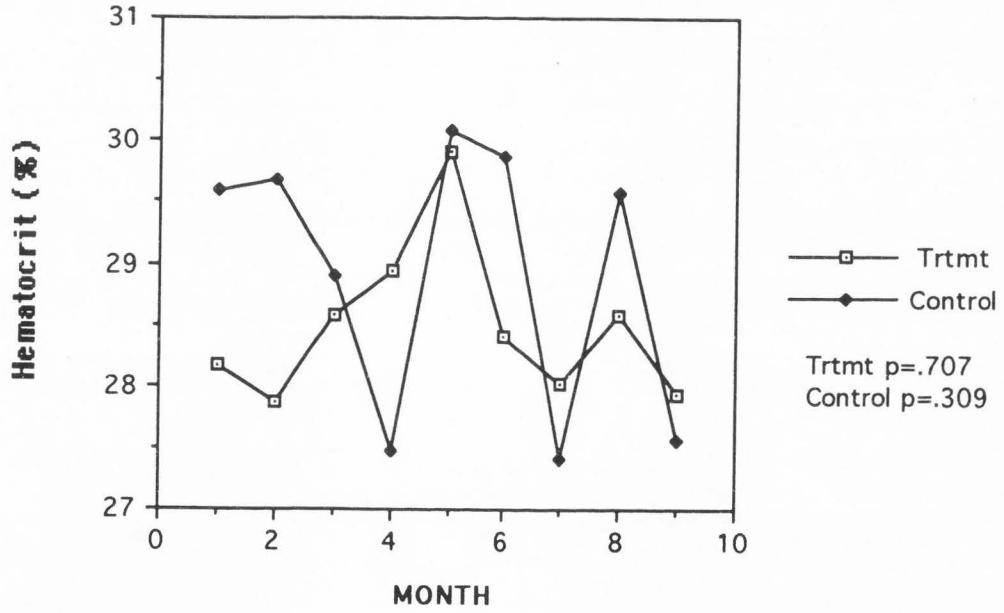

Figure 18. Average hematocrit levels of study participants by month.

marker used to monitor protein metabolism and guide dialysis therapy. A direct linear relationship exists between the rate of urea nitrogen production and the protein catabolic rate. Protein catabolic rate can be calculated using mass balance equations incorporating the rate of urea generation (Sargent and Gotch, 1979a, 1979b). The urea generation rate is calculated from the change in BUN between dialyses. The protein catabolic rate reflects the amount of protein that is being catabolized per day. In a nutritionally stable patient, dietary protein intake will equal protein catabolic rate. Because most adult chronic dialysis patients are considered stable (approximately zero nitrogen balance if body weight is stable), protein catabolic rate can be used to accurately assess dietary protein intake (Sargent et al., 1979a, 1979b). Ideally dialysis patients should consume between 0.8 and 1.4 gm protein per kilogram and therefore have a protein catabolic rate within this same range (Gee, 1985; Sargent et al., 1979a, 1979b). Low protein catabolic rates (<0.8) indicate either anabolism or inadequate nutrient intake. High protein catabolic rates (>1.4) indicate catabolism and negative nitrogen balance or excessive protein intake (Sargent et al., 1979a, 1979b).

Appropriate dialysis treatment time can also be determined by kinetic modeling principles. Adequacy of dialysis and clinical outcome are defined as a function of BUN, protein catabolic rate, and the amount of prescribed dialysis (Kt/V). Kt/V is a parameter describing the prescribed level of dialysis or normalized treatment defined as the product of the dialyzer urea clearance (K, in L/min) and treatment time (t, in min) divided by the volume of urea distribution (V, in L) (Gee, 1985). Treatment time depends on the blood flow rate and the urea clearance of the dialyzer. The constant K/V reflects the rate at which the BUN and other solute concentrations will change during dialysis. The rate of dialysis is determined by the urea clearance of the available dialyzers and the maximum blood flow rate that can be achieved with the patient's vascular access (Gee, 1985). For thrice-weekly dialysis, Kt/V for urea should be $\geq$1.0 and less than approximately 1.5 (Farrell, 1986). Appropriate relationships between protein catabolic rate and Kt/V are given in Table 8.

Table 8. Appropriate relationships between protein catabolic rate and Kt/V.

Protein Catabolic Rate/kg	Kt/V
.8	1.4
.8-.89	1.2
.9-1.09	1.1
>1.09	1.0

For a given protein catabolic rate, a low Kt/V can be corrected by increasing the time on dialysis, the size of the dialyzer, or dietary protein intake (if the patient is not eating well). Alternatively, a high Kt/V can abe corrected by decreasing the time on dialysis, the size of the dialyzer, or dietary protein intake (if excessive).

In this study, the mean protein catabolic rate increased significantly from 0.85 to 1.20 in the treatment group (Figure 19). This finding indicates an increase in average dietary protein intake. Protein catabolic rate has been shown to be a reliable indicator of dietary protein intake in stable dialysis patients, and is a more feasible indicator of dietary protein intake than food records because accurate food records are often difficult to obtain (Gee, 1985; Kimura et al., 1988; Mitch, 1991; Moore, 1991). The noted increase in protein catabolic rate helps explain the significant increase in albumin levels, which was discussed previously. Both of these findings point toward an improved nutritional status in subjects in the treatment group.

Kimura et al. (1988) showed a strong relationship between protein catabolic rate and patient recorded dietary protein intakes ($r=.857$, $p<.005$). Dietary records were kept for the same time period that changes in BUN were recorded for kinetic modeling calculation (after completion of dialysis on Monday up to the start of dialysis on Wednesday). This type of comparison could not be made in this study because dietary records did not reflect intake during the precise time period that kinetic modeling parameters were collected. The mean Kt/V parameter remained close to the expected level for the given protein catabolic rate (Table 8).

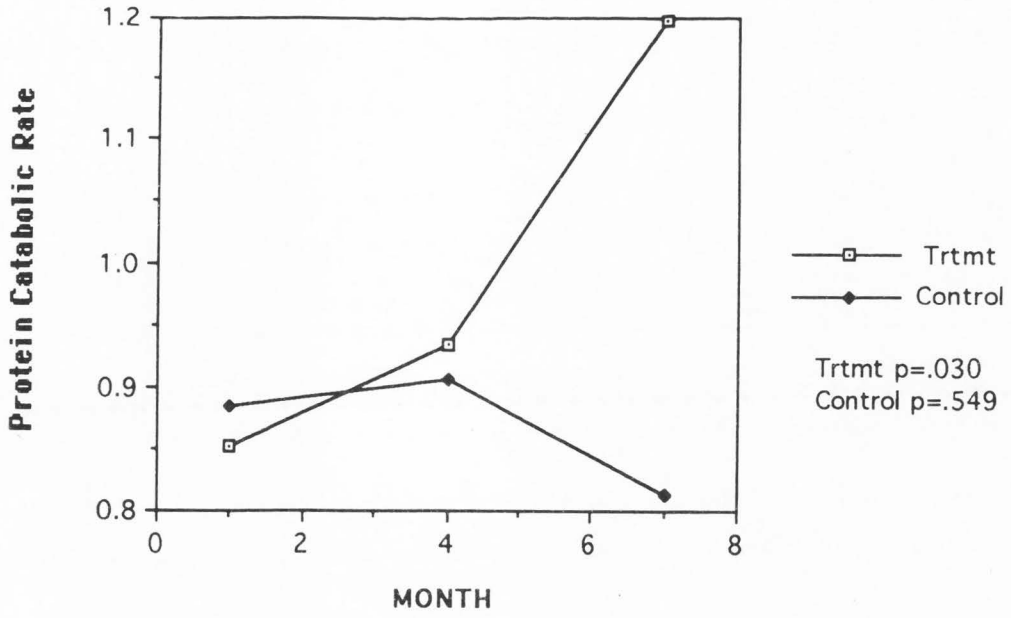

Figure 19. Average protein catabolic rate of study participants by month.

No significant change in protein catabolic rate was observed in control subjects. The mean at the beginning of the study was 0.89 and was 0.81 in the fifth month of the study (Figure 19). The mean Kt/V parameter in the control group also remained close to expected levels for the given protein catabolic rate (Table 8). There was a significant difference found between the mean protein catabolic rate between the two groups (p=.050), with the mean level for the treatment group being higher. The mean protein catabolic rate for both groups remained in the desired range of .8 to 1.4 gm/kg throughout the study (Tables 6 and 7).

Anthropometrical Data

Anthropometry is an important component in the clinical assessment of nutritional status. Typical anthropometric indicators used to assess nutritional status include measurements of height and weight and quantitative evaluation of body compartments (fat and lean tissue) (Nelsin, 1991). In the hemodialysis population, weight gains between

dialysis treatments are used to assess fluid intake compliance. The anthropometric data analyzed in this study included: dry weights (post-dialysis weight), intradialytic weight gains (every other day treatments), and percentage of body fat. No significant changes were observed in either study group with respect to these parameters (Tables 9 and 10).

Dry Weights

Weight-to-height comparisons listed in Tables 4 and 5 (page 44) show that 35% of the subjects were obese at the end of the study (actual weight $\geq$ 120% ideal weight for height). Twenty percent of the subjects were underweight (actual weight < 90% ideal weight for height). There were no significant differences in dry weights observed between study groups during the study period (p=.763).

Hemodialysis patients who participated in the National Cooperative Dialysis Study (NCDS) were found on average to have weight-to-height comparisons within the normal range (Schoenfeld et al., 1983). Body mass index (BMI) (weight in kg/height^2 in meters) was used as an indicator of obesity in the NCDS. Normal ranges were considered to be 19-24 for women and 20-25 for men. Women younger than 40 years had an average BMI of 21 and women greater than 40 years had an average BMI of 24. Men of all ages had an average BMI of 24 (Schoenfeld et al., 1983). These data most likely include some obese and some underweight subjects, similar to findings in the present study.

Average post-dialysis weights for women in the NCDS were 54.9 and 61.7 kg for subjects younger than and older than 40 years, respectively (Schoenfeld et al., 1983). Findings in the present study are similar, with mean post-dialysis weights for women ranging from 63.3 to 64.7 kg in the control group, and from 59.2 to 61.9 kg in the treatment group (Tables 11 and 12).

Average post-dialysis weights for men in the NCDS were 74.2 and 72.8 kg for subjects younger than and older than 40 years, respectively (Schoenfeld et al., 1983). Similar findings were observed in the present study, with mean post-dialysis weights for

Table 9. Anthropometrical data of treatment group (mean ± standard deviation) (n=12).

	Pre-Study		Study						p-value
MONTH	1	2	1	2	3	4	5	6	
dry weight (kg)	64.1±12.7	64.4±11.8	63.3±10.7	63.5±9.9	62.9±9.5	63.7±10.3	63.9±10.8	63.8±11.0	0.794
wt gain bet trmt (kg)	2.6±1.4	2.4±.8	2.1±1.3	2.1±.9	2.1±1.0	2.0±.7	2.2±1.2	1.9±1.1	0.565
% body fat			25.3±8.3	25.8±7.1	25.3±7.3	25.8±7.5	25.7±7.2	25.8±7.1	0.767

Table 10. Anthropometrical data of control group (mean ± standard deviation) (n=8).

	Pre-Study		Study						p-value
MONTH	1	2	1	2	3	4	5	6	
dry weight (kg)	65.5±24.2	65.2±22.6	65.2±22.3	65.2±21.9	65.8±21.9	65.8±22.1	66.1±22.0	66.2±22.1	0.353
wt gain bet trmt (kg)	2.0±.8	2.2±1.1	2.6±1.1	2.1±.2	2.3±.6	2.0±.7	3.0±3.7	2.1±.9	0.684
% body fat			26.5±6.5	27.6±6.3	27.2±6.1	27.6±6.1	27.1±6.3	27.7±6.3	0.661

Table 11. Anthropometrical data of men (n=6) and women (n=6) in treatment group (mean ± standard deviation).

	Pre-Study		Study					
MONTH	1	2	1	2	3	4	5	6
MEN								
dry weight (kg)	72.4±11.5	74.1±11.1	73.1±9.4	73.3±7.5	73.0±7.2	74.1±7.1	74.7±7.5	74.3±8.2
wt gain bet trmt (kg)	3.2±.8	2.6±.7	2.4±1.5	2.8±.7	2.3±1.2	2.3±.6	2.7±1.3	2.2±1.2
% body fat			21.5±7.0	22.7±6.8	22.1±6.2	22.2±5.8	22.9±6.3	21.3±4.8
WOMEN								
dry weight (kg)	61.2±14.9	61.9±14.2	60.6±13.4	60.1±11.8	59.2±10.8	59.4±11.4	59.5±11.8	59.6±11.7
wt gain bet trmt (kg)	2.1±1.9	2.2±.9	1.5±1.0	1.6±.4	1.9±.6	1.8±.7	1.7±.9	1.7±.9
% body fat			31.4±3.4	30.6±2.5	30.4±3.7	31.1±4.0	30.8±4.1	31.6±5.1

Table 12. Anthropometrical data of men (n=3) and women (n=5) in control group (mean ± standard deviation).

	Pre-Study		Study					
MONTH	1	2	1	2	3	4	5	6
MEN								
dry weight (kg)	69.5±23.3	69.5±23.3	86.5±34.0	84.8±30.8	85.0±29.0	83.5±28.8	83.3±28.4	82.7±27.5
wt gain bet trmt (kg)	2.5±.4	2.6±.1	3.8±1.2	1.3±1.0	2.2±.2	2.4±.8	5.3±5.3	3.2±1.2
% body fat			24.0±7.2	24.8±7.5	25.3±6.7	25.4±6.9	24.8±6.7	25.1±6.0
WOMEN								
dry weight (kg)	63.9±27.1	63.5±24.9	63.6±24.6	63.3±24.0	63.8±24.3	64.2±24.3	64.6±24.1	64.7±24.2
wt gain bet trmt (kg)	1.8±.8	1.9±1.5	2.2±1.0	2.2±.2	2.4±.7	1.9±.6	1.7±.6	1.9±.8
% body fat			28.0±6.4	29.2±5.9	28.3±6.2	28.8±6.0	28.5±6.4	29.3±6.6

men ranging from 69.5 to 86.5 kg in the control group, and from 72.4 to 74.7 kg in the treatment group (Tables 11 and 12). Only three male subjects were in the control group, and the lower mean weight (69.5) is the average of only two subjects. Therefore, data from the treatment group are more representative of the male study population.

Intradialytic Weight Gain

While weight gains between dialysis treatments did not show any statistically significant changes, positive decreasing trends were noted in the treatment group (Table 9). There were also no significant differences observed between the two groups over time ($p=.661$). The intradialytic weight gains observed in this study were similar to those reported by Schoenfeld et al. (1983), who reported intradialytic weight gains to be close to 2.0 kg.

When the initial pre-study data were collected on treatment subjects, intradialytic weight gains were averaging 2.6±1.4 kg. At the beginning of the study the average weight gain was 2.1±1.3 kg. Average weight gains stayed close to this level throughout the six-month study and dropped to the lowest level of 1.9±1.1 kg in the final month of the study. When male and female treatment subjects were separated, similar trends were still evident (Tables 11 and 12). Female subjects in both study groups usually had lower intradialytic weight gains than did their male counterparts (Tables 11 and 12). Because women generally have lower body weights than men, a lower intradialytic weight gain would seem to be a reasonable goal to prevent problems associated with fluid overload. This finding may also indicate that women are more "fluid conscious" and adhere to their fluid restrictions better than do men.

Body Composition

Typical methods for evaluating body composition involve measuring body fat. This can be done using circumference and skinfold measurements (Nelsin, 1991).

Problems associated with these types of measurements include difficulty in obtaining accurate measurements in obese subjects and the effect of peripheral edema. Current recommendations suggest measurements be obtained at the end of hemodialysis treatments. Nonetheless, some clinicians still lack confidence in the accuracy of these measurements (Byham, 1991).

Infrared interactance is now used to measure percent body fat (Konstant, 1988). Body fat percentage can be determined by using reflected infrared light analysis of subcutaneous adipose tissue thickness. The midline of the bicep belly is the site used to estimate the percentage of total body fat. This is a noninvasive technique which is preformed with a small, light-weight, portable device (Nelsin, 1991).

Liftman (1991) investigated the reliability of infrared interactance by comparing percent body fat measurements between 65 hemodialysis patients and 22 healthy controls. Results showed that infrared interactance is a safe, reliable, and easy technique for measuring percent body fat in hemodialysis patients; that percent body fat measurements by infrared interactance are not altered by the fluid status of the patient; and that the percent body fat of hemodialysis patients was not significantly different from that of healthy controls.

Infrared interactance was used in this study to assess percentage of body fat. No significant changes over time (Tables 9 and 10) or between groups ($p=.941$) were observed. Monthly mean percent body fat for male subjects ranged from 21.3±4.8% to 25.4±6.9% (Tables 11 and 12). These findings are similar to those reported by Liftman (1991) of 23.7±5.7% for male hemodialysis patients. Healthy male controls had a mean percent body fat of 23.7±5.9 in Liftman's study. Monthly mean percent body fat for female subjects ranged from 28.0±6.4% to 31.6±5.1% (Tables 11 and 12). These findings are slightly lower than those reported by Liftman (1991) of 34.2±5.5% for hemodialysis patients. Liftman (1991) reported healthy female controls to have an average

body fat percentage of 29.6±6.4, which is comparable to findings in the present study. These results add to the data that support the reliability of infrared interactance in measuring percent body fat in hemodialysis patients.

Quality of Life Data

Beck Depression Inventory

The Beck Depression Inventory © (BDI) is a 21-item instrument designed to assess severity of depression in psychiatrically diagnosed patients (Beck et al., 1979). It has also been widely used for detecting the presence of and severity of depression symptoms in normal populations (Beck and Steer, 1988).

Responses to the 21 questions were numerically ranked and scores for all responses were summed to get a total score. The following guidelines were used to interpret scores: scores from 0 to 9 were considered within the normal range or asymptomatic; scores of 10 to 18 indicated mild-moderate depression; scores of 19 to 29 indicated moderate-severe depression; and scores of 30 to 63 indicated extremely severe depression (Beck and Steer, 1988).

The control group had BDI scores of 11.6±9.6 and 8.6±5.4, pre- and post-study, respectively. The treatment group had BDI scores of 14.5±9.6 and 13.8±6.1, pre- and post-study, respectively (Table 13). Pre-study scores were not significantly different for the two groups ($p=0.357$). No significant differences were observed over time for either group and there were no significant differences observed between the two groups over time ($p=0.472$). The scores indicate that subjects generally fell into the mild-moderate depression classification, with the control group scores being somewhat lower than the scores of the treatment group. The large standard deviations indicate wide variability among subjects. Depression is associated with a loss of appetite and may therefore be a contributing factor to nutritional problems seen in the hemodialysis population.

Table 13. Beck Depression Inventory data (mean ± standard deviation).
[T=treatment, (n=12); C=control, (n=8)]

	pre-study (averages)		post-study (averages)		p-value	
	(T)	(C)	(T)	(C)	(T)	(C)
BDI	14.5±9.6	11.6±9.6	13.8±6.1	8.6±5.4	0.734	0.283

Sickness Impact Profile

The Sickness Impact Profile© (SIP) is a valid (Bergner et at., 1976b; Carter et al., 1976), reliable (Pollard et al., 1976), standardized instrument used to measure sickness-related dysfunction among many dimensions. It consists of 136 statements which have been scaled and weighted and are divided into 12 behavioral dysfunction categories (Bergner, 1977). These categories include: home management (HM), recreation and pastimes (RP), ambulation (A), mobility (M), body care and movement (BCM), social interaction (SI), alertness behavior (AB), emotional behavior (EB), communication (C), sleep and rest (SR), eating (E), and work (W).

In this study, the last five categories were not used because any change in nutritional status would most likely not affect function in these areas. The emotional behavior category included statements such as: "I laugh or cry suddenly," and "I act irritable and impatient with myself, for example, talk badly about myself, swear at myself, blame myself for things that happen." The communication category included statements such as: "I have trouble writing or typing," and "I do not speak clearly when I am under stress." The sleep and rest category included statements such as: "I sit during much of the day," and "I sleep or nap during the day." The eating category included statements such as: "I am eating no food at all, nutrition is taken through tubes or intravenous fluids," and "I just pick or nibble at my food." This category was not included because a more sensitive nutrition-related quality of life scale was used to measure this area (discussed below). The work category included statements such as: "I am not working at all," and "I often act irritable toward my work associate."

sensitive nutrition-related quality of life scale was used to measure this area (discussed below). The work category included statements such as: "I am not working at all," and "I often act irritable toward my work associate."

Examples of statements in the seven categories which were used include: "I do work around the house only for short periods of time or rest often," and "I am not doing any of the shopping that I would usually do" (HM); "I am going out for entertainment less often," and "I do my hobbies and recreation for shorter periods of time" (RP); "I walk more slowly," and "I walk only with help from someone"(A); "I am staying in bed more," and "I stay away from home only for brief periods of time" (M); "I am in a restricted position all the time," and "I do not have control of my bowels" (BCM); "I am going out less to visit people," and "I often express concern over what might be happening to my health" (SI); and "I am confused and start several actions at a time," and "I make more mistakes than usual" (AB).

Statements in these seven categories, which the subject marked, were totaled to provide subscale scores which were expressed as a percentage of the total possible score. Scores were calculated for each of the seven categories and a physical domain. The physical domain included scores from the mobility, ambulation, and body care and movement categories. Higher scores indicated more subject-perceived functional limitation. SIP scores may range from 0 to 100, where a high score indicates poor functional status and a low score indicates good functional status.

Pre- and post-study SIP scores are listed in Table 14. Table 14 also lists mean SIP scores for in-center hemodialysis patients reported by Hart and Evans (1987), for comparison. Hart and Evans reported lower scores, indicating a better functional status in most of the categories. Differences in sample size could account for this variation (347 vs 8 and 12).

Subjects in the treatment group showed significant improvement in the alertness

Table 14. Data from the Sickness Impact Profile (mean ± standard deviation). [T=treatment, (n=12); C=control, (n=8)]

	pre-study (averages)		post-study (averages)		p-value		Hart &
	(T)	(C)	(T)	(C)	(T)	(C)	Evans
home mngt.	30.2±23.2	30.0±31.8	32.0±27.7	27.4±22.4	0.672	0.639	24.0
ambulation	19.3±13.4	22.3±18.5	21.2±12.9	27.3±25.7	0.714	0.413	16.3
recr. & pastimes	36.6±14.3	30.4±18.5	34.2±20.5	47.4±31.4	0.743	0.020	23.7
alertness behav.	24.7±32.4	8.3±7.5	12.8±18.9	17.7±18.5	0.026	0.221	11.2
social interaction	23.8±17.5	11.4±6.4	27.7±22.8	12.0±11.0	0.359	0.883	11.4
body care & movmt	6.2±5.8	12.7±20.0	7.3±9.8	11.9±17.4	0.623	0.528	7.7
mobility	14.0±10.5	14.6±17.0	10.4±11.0	13.6±15.9	0.282	0.758	10.4
physical domain	10.8±5.7	15.3±18.0	11.3±8.9	15.9±17.1	0.853	0.718	10.3

(p=0.094). These findings suggest that improved nutritional status, through computer-assisted nutrition education, can have a positive impact on perceived alertness behavior functional ability.

Another significant finding was an increase in the control group's mean recreation and pastimes scores (p=.020). There was not a significant difference observed between groups in this category (p=.078) and mean pre-study scores were not significantly different (p=.347). Since the treatment group's mean score did not change, improved nutritional status may help patients maintain their level of recreation and pastime activities. Positive, but nonsignificant trends were observed in the treatment group in the recreation and pastimes, and mobility dimensions.

Nutrition-Related Quality of Life

A nutrition-related quality of life instrument was developed to assess subject perceptions of nutritional factors related to quality of life. Responses to 11 questions were ranked using a Likert scale with possible results ranging from 0.00 to 5.00. The questions and results are listed in Table 15.

Subjects in the treatment group showed significant improvement in their perceived understanding of their renal diet (p=0.054), but they felt they followed all components of

Table 15. Nutrition-related quality of life data. Likert scale (0.00 to 5.00)

A. Do you worry about your diet? (not at all -> very much)
B. Do you understand your renal diet? (not at all -> very well)
C. Do you feel your food choices are restricted? (very restricted -> not restricted)
D. How much strength do you have? (none -> a great deal)
E. Is the amount you eat sufficient to meet your needs? (not at all -> completely)
F. How is your quality of life? (extremely poor -> excellent)
G. Does your diet affect your overall quality of life? (not at all -> a great deal)
H. Do you look forward to meal times? (never -> always)
I. Do you avoid social situations where food or beverages are involved? (never ->always)
J. Do you eat away from home? (never -> very frequently)
K. Do you follow all components of your renal diet? (never -> always)

Question	Treatment			Control		
	pre	post	p	pre	post	p
A	2.46±1.1	2.18±1.2	.53	2.89±1.6	2.72±1.5	.77
B	2.75±.9	3.31±.8	.05	3.12±.8	2.84±1.2	.46
C	2.35±1.3	2.11±1.2	.49	2.02±1.1	2.38±1.6	.62
D	2.44±1.1	2.55±.6	.65	2.45±1.2	1.81±1.1	.30
E	3.16±1.0	2.97±1.1	.48	3.57±1.0	3.08±1.4	.44
F	2.59±1.0	2.86±1.0	.25	2.71±.9	2.71±1.4	1.0
G	1.87±1.0	2.48±1.2	.07	2.49±1.4	2.16±1.5	.55
H	3.08±.8	2.36±1.2	.09	3.14±1.0	2.60±1.0	.09
I	2.25±1.2	2.10±1.1	.68	1.09±1.1	2.39±1.6	.03
J	3.16±.9	2.77±.7	.25	2.38±1.0	3.13±1.1	.04
K	3.22±.9	2.62±.9	.04	2.39±.8	2.92±1.3	.23

their diet less often ($p=.035$) at the end of the study. Mean pre-study responses showed no significant differences between the two groups ($p \geq 0.05$). The self-perceived decline in dietary adherence was most likely due to subjects becoming more aware of their dietary practices rather than an actual decline in dietary compliance. Dietary analyses would also suggest this to be the case.

Mean scores of subjects in the control group showed a significant increase in the frequency which social situations involving food or beverages were avoided ($p=.03$). Yet, there was also a significant increase in the frequency in which control subjects reported eating away from home ($p=.04$). These results contradict each other and suggest a possible misunderstanding of these questions.

Mean scores of question "G" indicated that subjects in this study felt that their diet

had a small effect on their perceived quality of life. This question did not assess how nutritional status affected quality of life. Subjects perceived their overall quality of life to be slightly better than the midpoint of the scale range (question "F").

Quality of life is an important concept in the treatment of patients with renal failure. This study has shown that improved nutritional status through computer-assisted nutrition education can have a positive effect on a limited number of quality of life domains. More research needs to be done on the effects of nutrition on the quality of life of dialysis patients.

Post-Study Questionnaire Data

A post-study questionnaire was designed to assess treatment subjects' perceptions of the project. Results are listed in Table 16.

Computrition nutrient analysis computer printouts were used extensively as an educational tool with the goal of preventing and controlling hyperdietism. At the completion of the study, 64% of patients in the treatment group felt that their diet had improved over the last six months. Ninety-one percent reported that their knowledge about nutrition had either somewhat or greatly increased. The majority (55%) of the patients felt that computer printouts were useful and had made changes in their diets after reviewing the printouts. These findings are encouraging and should help promote the use of nutrient analysis computer printouts in the hemodialysis setting.

Table 16. Post-study questionnaire and responses.

1. My diet has _____ over the last six months. improved (n=7); not changed (n=3); gotten worse (n=1); no response (n=1)
2. My knowledge about nutrition and my renal diet has _____ over the last six months. greatly increased (n=4); somewhat increased (n=6); stayed same (n=1); no response (n=1)
3. Are computer dietary analyses printouts useful? very much (n=6); somewhat (n=5); not at all (n=0); no response (n=1)
4. Have you made changes in your diet after reviewing the printouts? yes (n=6); no (n=5); no response (n=1)
5. Have you used your copy of "Eating Well on Dialysis"? yes (n=10); no (n=2)

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Nutrition Knowledge

Average nutrition knowledge test scores improved by 7% for subjects in the treatment group. Test scores of control subjects improved by only 2%. Increased nutrition knowledge does not guarantee improved dietary compliance, but compliance cannot be expected to improve if patients do not have adequate knowledge of what they are expected to do.

Nutrient analysis computer printouts do seem to have a positive impact on increasing patients' knowledge about the nutrient content of foods. Having a good understanding of the protein, sodium, and potassium content of foods is particularly valuable for hemodialysis patients.

Nutrient Intake Results

Average energy intakes were below recommended intake levels of 35-50 kcals/kg per day for both study groups throughout the study. Mean energy intakes ranged from 20.5 Kcal/kg to 26.0 Kcal/kg per day. Similar findings have been reported by other researchers. Average energy intakes of the treatment group fell during the six-month study period. Since intakes of other nutrients such as protein and calcium did not show a significant decline, the drop in energy could indicate a reduction in calorie-rich, nutrient-poor foods. More emphasis needs to be placed on the importance of adequate calorie consumption and ways to increase calories for patients who are not eating well.

Average protein intakes were close to recommended levels of approximately 1.0 gm/kg per day for both groups throughout the study. No significant changes were observed. Protein powder provided by the dialysis center helped increase protein intake of

patients who consumed inadequate protein from foods.

No significant changes were observed in average intakes of sodium, potassium, calcium, or phosphorus in either study group. Average intakes of sodium and potassium were always less than the recommended intake limits of 2000 mg per day. Average sodium and potassium intakes ranged from 1455 to 1980 mg/day and 1372 to 2034 mg/day, respectively. Decreasing intakes of these nutrients further would not be a necessary treatment goal. Average intakes of calcium and phosphorus were similar to those reported by other researchers and were within an acceptable range. Dietary nutrient analysis computer printouts helped patients increase their dietary flexibility by allowing them to see the actual nutrient content of foods.

Nutrient analysis computer printouts did not have a significant effect on subjects' intake of any of the nutrients analyzed except calories. Average protein intakes remained fairly stable. Significant changes were not desired or expected to occur in average intakes of sodium and potassium because of the already existing overall good compliance.

Biochemical Results

Average serum proteins (total protein and albumin) significantly increased in both study groups. Serum albumin is used as a marker of nutritional status. Albumin levels increased and were maintained at a higher level throughout the study. This indicates that nutritional status improved and was maintained at a good level.

Average serum cholesterol levels fell significantly in the treatment group. Low cholesterol levels most likely did not reflect malnutrition because average albumin levels were within the normal range. Dietary fat and cholesterol were not analyzed in this study, but it is reasonable to assume that subjects receiving nutrient analysis computer printouts were more aware of their dietary fat and cholesterol intake.

Declining renal function was noted as evidenced by increasing serum creatinine and

BUN levels. Average serum sodium levels did show a significant change in control subjects. However, this change was not of clinical importance from a nutritional standpoint.

Average serum potassium levels did show an upward trend in the treatment group, but the increase was not of statistical significance. Nutrient analysis computer printouts allowed subjects to see the potassium content of the foods they were eating. This gave them the reassurance that their dietary potassium intake was appropriate, and gave them more freedom in their food selections, or helped them identify high potassium foods in their diet if intake levels were too high.

Mean levels of serum calcium and alkaline phosphatase did not change significantly during the study. Serum phosphorus levels did significantly increase in the treatment group. Since mean dietary phosphorus intakes actually decreased, the increase in serum phosphorus was most likely due to subjects' failure to take phosphate-binding medications properly. Phosphate-binding medication use was not monitored in this study.

Hematological parameters (hemoglobin and hematocrit) did not change significantly during the study period. EPO was given to patients with low hematocrits. No changes related to dietary intake were evident.

An important finding was observed in the kinetic modeling data. Protein catabolic rate corresponds to dietary protein intake, and mean protein catabolic rates significantly increased in the treatment group. This finding along with the increase in serum albumin indicates an increase in protein intake and an improvement in the nutritional status of subjects in the treatment group. Dietary records did not show an increase in protein intake. However, the dietary records may not have provided an accurate representation of protein intake, or patients may have temporarily increased their protein intake after reviewing their computer printout. In either case, subjects receiving nutrient analysis computer printouts did show improvement in protein catabolic rate levels.

Anthropometry Results

No significant changes were observed in dry weights and percent body fat measurements of study participants. The decrease in reported calorie intake of subjects in the treatment group did not decrease the average dry weights of these subjects. Relatively stable mean percent body fat measurements indicate that the amount of lean tissue mass was not altered.

Weight gains between dialysis treatments did not show any significant changes. Average weight gains for the treatment group were close to the recommended level of approximately two kilograms. Average weight gains for control subjects were notably greater than two kilograms for two months of the study.

Quality of Life Results

Level of depression, as measured by the Beck Depression Inventory©, did not significantly change in either study group. Therefore, change in severity of depression was not a confounding factor when assessing quality of life.

Seven domains of the Sickness Impact Profile© were used to assess quality of life. Subjects in the treatment group showed significant improvement in the alertness behavior dimension while controls showed a nonsignificant decline in this area. These findings imply that improved nutritional status, through use of nutrient analysis computer printouts as an education tool, can have a positive impact on patient perceived alertness behavior functional ability.

Scores of the control group showed a significant decline in the recreation and pastimes dimension of the Sickness Impact Profile©, but scores of treatment subjects did not show a significant change in this area. These findings suggest that improved nutritional status helps patients maintain their level of recreation and pastime activities.

The nutrition-related quality of life instrument showed that treatment subjects had a

significant improvement in their perceived understanding of their renal diet. They also felt that they followed all components of their diet less often at the end of the study than they did at the beginning of the study. The subject-perceived decrease in dietary adherence was most likely due to an increased awareness of dietary practices, rather than a true decrease in dietary compliance. A decrease in dietary compliance was not observed in the nutrient analysis of the three-day food records.

Quality of life has been recognized as an important treatment goal for dialysis patients. This study has shown that good nutritional status attained/maintained with the use of computer-assisted nutrition education can have a beneficial impact on certain dimensions of quality of life.

The majority (64%) of treatment subjects felt that their diet improved during the study period, and 55% felt that computer printouts were useful and made changes in their diet after reviewing the printouts. Ninety-one percent of treatment subjects felt that their nutrition knowledge had either somewhat or greatly increased. These findings are encouraging and suggest the importance and value of using nutrient analysis computer printouts in patient dietary education.

Recommendations

Recommendations for further study include:

1. Enlarge the study population to include patients from other dialysis treatment centers as well as peritoneal dialysis patients.
2. Correlate dietary food records with kinetic modeling data by having subjects keep accurate food records during the time between lab draws for kinetic modeling.
3. Analyze dietary fat and cholesterol content and examine relationships with serum lipid levels.

4. Collect more detailed information on medication and supplement use.
5. Use other quality of life assessment instruments to further study the effects of nutrition on quality of life of dialysis patients.
6. Refine nutrition-related quality of life tool and use further in the dialysis population and in other patient populations where diet and nutrition are important treatment components.
7. Refine diet/nutrition education materials.

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APPENDICES

APPENDIX A. INFORMED CONSENT LETTER

UTAH STATE UNIVERSITY • LOGAN, UTAH 84322-8700

Department of Nutrition and Food Sciences
College of Agriculture
College of Family Life
Telephone (801) 750-2126
FAX (801) 750-2379

The purpose of this study is to determine how monthly nutrition education sessions incorporating the Computrition dietary analysis computer system, will affect the nutritional status, quality of life and dietary adherence of hemodialysis patients.

You will be asked to complete pre and post study questionnaires on quality of life, depression and nutrition information. The Sickness Impact Profile will be used to measure sickness-related dysfunction. This questionnaire contains a variety of questions about physical abilities, recreation, home management, and eating. The Beck Depression Inventory measures disturbances in mood, ranging from a mild case of the blues to severe depression. It contains questions about your mood and feelings. These questionnaires will be given at the beginning and at the end of the study and will require approximately 30 minutes to complete. You will be asked to keep a record of everything you eat for 3 consecutive days each month during the 6 month study period. You will also be asked to participate in monthly nutrition education sessions which will be held during or following your regular dialysis appointment, or at another agreed upon time. During the education sessions your body composition (% body fat) will be determined using the Futrex nir infrared body composition analyzer. The monthly education sessions will require approximately 30 minutes. The researcher will have access to your medical record kept by the dialysis center and you laboratory results will be analyzed.

All information you provide and all laboratory data will be kept confidential and the results of the study will not include reference to individuals. The results will be available to you upon request. Participation in this study is voluntary and nonparticipation will not affect the care you receive at the dialysis center in any way. Any questions regarding this study can be answered by calling: Julianne Stewart at 625-2028 (work), 621-5015 (home); or Noreen Schvaneveldt at 750-2105.

This study will help determine the benefits of using a computer dietary analysis system for hemodialysis patients. The results of this study will be beneficial in helping dialysis patients improve their nutritional status while faced with the many restrictions of a renal failure diet.

I, the undersigned, voluntarily agree to take part in the above described study. I agree to participate and understand that I can withdraw from the study at any time without penalty.

_____

participant's signature date

_____

investigator's signature date

APPENDIX B. NUTRITION INFORMATION

NUTRITIONAL ASSESSMENT

Name:_____ Date:_____ Age:_____

Height:_____ Dry Weight:_____

1. Has your dry weight changed lately? YES NO
   If yes, has it increased or decreased?

2. How is your current appetite? EXCELLENT GOOD FAIR POOR

3. Does your body produce any urine? YES NO
   If so, how much?

4. How long have you been on dialysis?

5. What is your current diet?

6. What diets have you followed in the past?

7. What medications are you taking? How much? How often?

8. Do you use any "special" diet products? (Vitamin/mineral supplements, health foods, protein supplement, herbs, etc.)

9. What is the most difficult part about following your diet?

10. Do you have any food allergies?

11. What foods do you especially like?

12. What foods, if any, do you especially dislike?

13. Do you salt food when cooking or at the table?

14. Have you experienced any taste changes lately? If so, describe.

15. Do you have any chewing or swallowing difficulties?

16. Do you do your own cooking? YES NO
If not, who usually does?

17. How often do you eat away from home?

18. Do you take a phosphate binder with meals and snakes?
If so, which one? How many do you take?

19. Do you take a Calcium supplement?

If so, how much? When do you take it?

20. How important do you feel it is for you to follow your dietary prescription?

Not important Somewhat important Very important

21. How many days a week do you stay within your dietary and fluid guidelines?

22. Are you: Inactive:_____ Moderately active:_____ Very active:_____

23. Do you exercise regularly? YES NO
If yes, what do you do?

24. Are you Employed full-time_____ Employed part-time_____
Retired_____ Homemaker_____
Student_____ Other_____

APPENDIX C. NUTRITION KNOWLEDGE QUIZ

Name_____ Date_____

Nutrition Information

1. What is your diet prescription for the amount of fluid_____cc/day, potassium_____mg/day, sodium_____mg/day, and protein_____gm/day?

2. Which 4 foods are high in calcium?

milk	cheese
banana	corn
broccoli	yogurt

3. Which 4 foods are highest in phosphorous?

milk	meat
pineapple	peanuts
chocolate	potatoes

4. Which 4 foods are high in sodium?

ham	milk
tuna	oranges
bread	canned vegetables

5. Circle the foods which add calories to your diet.

mayonnaise	margarine
sugar-free gelatin	milk

True or False

6. T F Many foods high in calcium are also high in phosphorous.

7. T F Pudding, ice cream and gravies are counted as fluids in your diet.

8. T F If the sodium level in your blood is too high, you may become thirsty.

9. T F Most herbs and spices are high in sodium.

10. T F The best time to eat a high potassium food is 6-8 hours before dialysis.

11. T F Soaking vegetables overnight will remove all the potassium.

12. T F Some vitamins can be removed from the body during dialysis.

13. Name 3 strategies to stimulate saliva to help decrease thirst.

1.

2.

3.

14. Circle appropriate guidelines to limit sodium when eating out.
    -Ask to have your food cooked without salt.
    -Order plain, not breaded meats, without gravy.
    -Choose a lettuce salad over a fruit salad.
    -Have soups and drinks at the end of your meal.
    -Order sandwiches without pickles, cheese, bacon, catsup or mustard

15. Which 5 foods are good sources of protein?

cheese	vegetables
eggs	peanut butter
milk	whole grain breads and cereals
meat	fats and oils
fruit	hard candy

16. Which 5 fruits are in the highest potassium fruit group?

grapes	banana	apricots
raisins	apples	cantaloupe
pineapple	pear	
kiwi	orange juice	

17. Which 5 vegetables are in the highest potassium vegetable group?

avocado	green beans	peas
broccoli	cucumber	radishes
potatoes	lettuce	winter squash
tomatoes	parsnips	

APPENDIX D. NUTRITION-RELATED QUALITY OF LIFE INDICATOR

Name_____

Date_____

Read each question and answer by placing a slash on the line below.

1. Do you worry about your diet?

|_____|_____|_____|_____|_____|
not at all very much

2. Do you understand your renal diet?

|_____|_____|_____|_____|_____|
not at all very well

3. Do you feel your food choices are restricted?

|_____|_____|_____|_____|_____|
very restricted not restricted

4. How much strength do you have?

|_____|_____|_____|_____|_____|
none at all a great deal

5. Is the amount you eat sufficient to meet your needs?

|_____|_____|_____|_____|_____|
not at all completely

6. How is your quality of life?

|_____|_____|_____|_____|_____|
extremely poor excellent

7. Does your diet affect your overall quality of life?

|_____|_____|_____|_____|_____|
not at all a great deal

8. Do you look forward to meal times?

|_____|_____|_____|_____|_____|
never always

9. Do you avoid social situations where food or beverages are involved?

|_____|_____|_____|_____|_____|
never always

10. Do you eat away from home?

|_____|_____|_____|_____|_____|
never very frequently

11. Do you follow all components of your renal diet? (fluid, sodium, potassium, protein)

|_____|_____|_____|_____|_____|
never always

APPENDIX E. BIOCHEMICAL DATA COLLECTION FORM

BIOCHEMICAL INDICATORS

Name: _____ Age: _____ Height: _____

Date:												
Hemoglobin												
HCT:												
MCV:												
MCH:												
MCHC:												
RDW:												
Sodium:												
Potassium:												
Calcium:												
Phosphorus:												
Glucose (diabetics):												
BUN:												
Creatinine:												
Uric Acid:												
Cholesterol:												
Total Protein:												
Albumin:												
Alk Phos:												
K T/V:												
PCR:												

APPENDIX F. ANTHROPOMETRICAL DATA COLLECTION FORM

ANTHROPOMETRIC/CLINICAL INDICATORS

Name: _____ Age: _____ Height: _____

Date:												
TSF:												
MAMC:												
%LBM:												
%Fat:												
Ave Pre-WT:												
Ave Post-WT:												
Ave WT gain:												
Ave Pre-BP:												
Ave Post-BP												
Dry WT:												
Ave Diet protein												
Ave Diet Na												
Ave Diet K												
Ave Diet Ca												
Ave Diet P												

APPENDIX G. DIETARY INTAKE FORM

24 HOUR DIETARY RECORD

Name: _____ Date: _____

Please list everything you eat or drink during the day. (see example)

Time	Food	How Prepared	Amount
example			
12:00	Chicken	Skinless, baked	2 oz.
	2% milk		1/2 cup
	white rice	boiled	1/3 cup

Is this a usual day's intake? YES NO

If no, explain what is usual.

APPENDIX H. SAMPLE COMPUTRITION PRINTOUT

Individual Intake Analysis

COMPUTRITION, INC.

Date: 06/07/91 Page: 1

Day 1 - 06/05/91

Name/Address...2000 CAL DIABETIC DIET
100 GM PROTEIN
2000 MG SODIUM
2000-3000 MG POTASSIUM

RA/RM Standard NATIONAL RESEARCH COUNCIL
Workorder 1

Consultant

Height (in)	72
Weight (lbs)	156
Age	37
Sex	MALE

FOOD DESCRIPTION	AMT USED	ENERGY	PRO TEIN	FAT	CARBO HYDRA	FIBER	CHO LESTRL	IRON	SODIUM	CAL CIUM	PHOS PHOR	VIT A	THIA MINE	RIBO FLVN	VIT C	POTAS SIUM	ZINC	NIA CIN	VIT B6	VIT B12	FOL CIN
	GM	KCAL	GM	GM	GM	GM	MG	MG	MG	MG	MG	IU	MG	MG	MG	MG	MG	MG	MCG	MCG	MCG
CEREAL,WHEAT,PUFFED,PLAIN (1 CUP)	12	44	1.8	0.1	9.5	0.4	0	0.6	0	3	43	?	0.02	0.03	?	42	0.28	1.3	20	0.00	4
MILK,LOWFAT,2% FAT,FLUID (1 CUP)	244	122	8.1	4.7	11.7	0.0	20	0.1	122	298	232	500	0.10	0.40	2	376	0.90	0.2	105	0.88	12
TOAST,WHEAT/SLICE (1 EACH)	20	58	2.5	0.7	11.3	1.0	1	0.5	125	24	54	0	0.05	0.03	0	65	0.32	0.7	18	0.00	6
BUTTER (1 TEASPOON)	5	34	0.0	3.8	0.0	0.0	10	0.0	39	1	1	145	0.00	0.00	0	1	0.00	0.0	0	?	0
SANDWICH,TUNA SALAD/EACH (1 EACH)	109	238	11.6	9.0	26.5	1.4	45	1.9	496	46	111	116	0.15	0.12	1	166	0.51	3.8	128	0.54	34
LEMONADE,CND,PRPD,COUNTRY TIME (8 OUNCE)	227	85	0.0	0.0	21.2	0.0	0	0.0	56	0	0	0	0.00	0.00	14	6	0.01	0.0	0	0.00	0
CHICKEN, CKD,MEAT/OZ (6 OUNCE)	170	323	49.2	12.6	0.0	0.0	151	2.1	146	26	332	90	0.12	0.30	0	413	3.40	15.6	799	0.54	10
COTTAGE CHEESE,LOWFAT,2% FAT (1/2 CUP)	113	102	15.5	2.2	4.1	0.0	9	0.2	459	77	170	79	0.03	0.21	0	108	0.45	0.2	86	0.80	15
MILK,LOWFAT,2% FAT,FLUID (8 OUNCE)	227	113	7.5	4.3	10.9	0.0	18	0.1	113	277	215	465	0.09	0.37	2	349	0.84	0.2	98	0.82	11
FRUIT COCKTAIL,CND,IN JCE,DIET DLIT (1 CUP)	248	100	2.0	0.0	27.9	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
1. YOUR DAILY TOTALS		1248	98.9	37.6	130.1	5.1	254	5.8	1582	769	1188	20663	0.62	1.50	26	1748	6.86	22.6	1355	3.60	102
2. YOUR RECOMMENDED ALLOWANCE (RA)			63.0		398.8	20.0		10.0		800	800	5000	1.50	1.70	60	2000	15.00	19.0	2000	2.00	200
3. YOUR RECOMMENDED MAXIMUM (RM)		2900		96.7			300		2400												
4. YOUR PERCENT OF RA/RM		43.0	157.0	38.9	32.6	25.3	84.6	57.9	65.9	96.1	148.5	413.3	41.3	88.4	42.9	87.4	45.8	118.9	67.7	179.9	51.0
5. RECOMMENDED % CALORIE DISTRIBUTION			15.0	30.0	55.0																
6. ACTUAL % CALORIE DISTRIBUTION			31.5	27.0	41.5																
7. % CALORIES FROM ALCOHOLIC BEVERAGES		0.0																			

APPENDIX I. PATIENT NUTRITION INTEREST SURVEY

Utah State University

Department on Nutrition and Food Sciences

Please numerically rank the following topics which you would be interested in learning more about. (1 = most interest, 13 = least interest)

_____ Eating out and staying on your diet

_____ Using convenience foods (frozen dinners, prepackaged items, fast food)

_____ Decreasing sodium and potassium in the diet

_____ The renal diet exchange system

_____ Getting adequate protein from food sources and high protein supplements

_____ Maintaining flexibility while adhering to dietary regimens

_____ Strategies for restricting fluids

_____ Calcium and phosphorus content of foods

_____ Planning menus

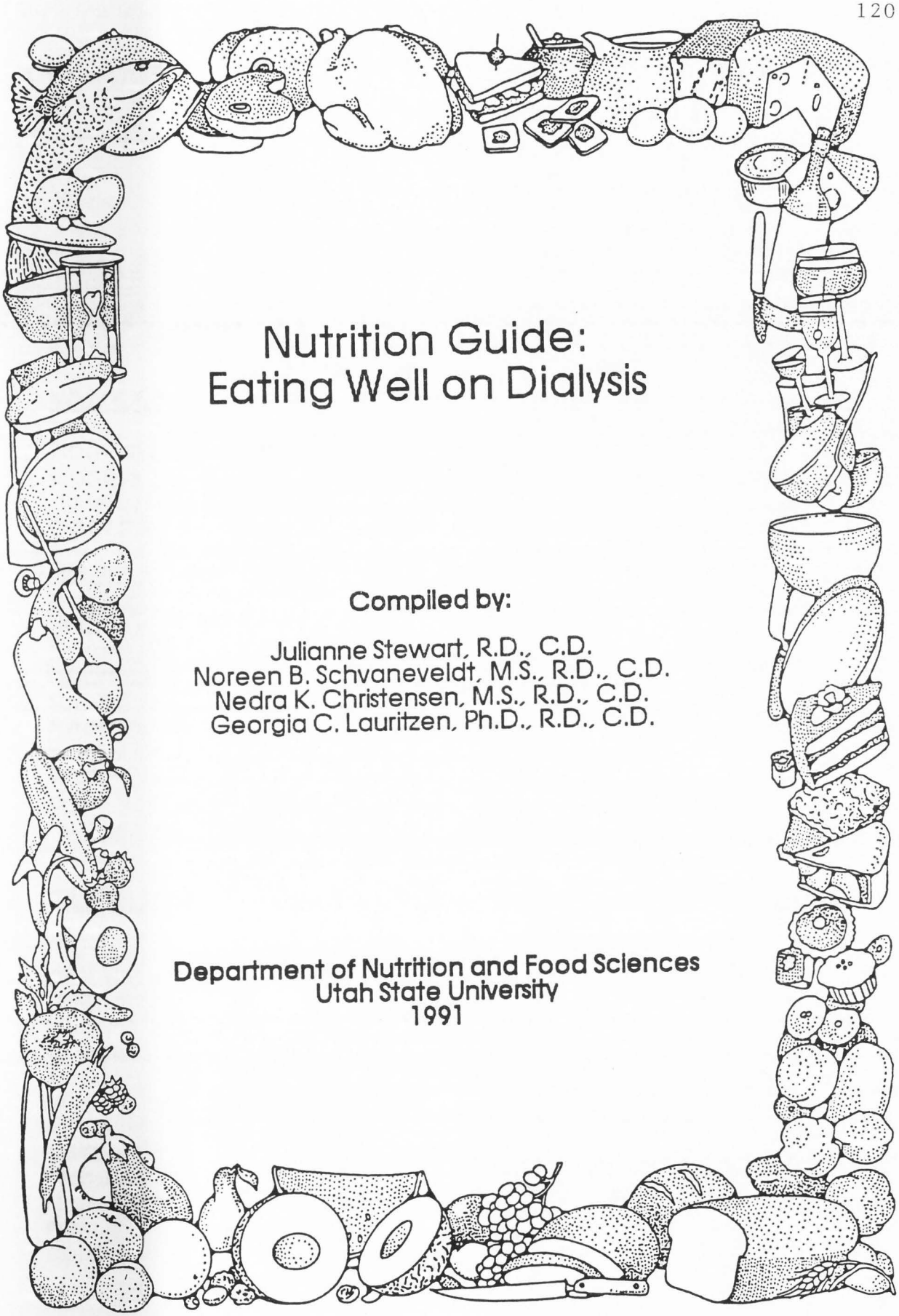
_____ Following your diet on a budget

_____ Planning for special occasions - birthdays, holidays, etc.

_____ Recipe analysis

_____ Other:_____

APPENDIX J. PATIENT EDUCATION MANUAL



Nutrition Guide: Eating Well on Dialysis

Compiled by:

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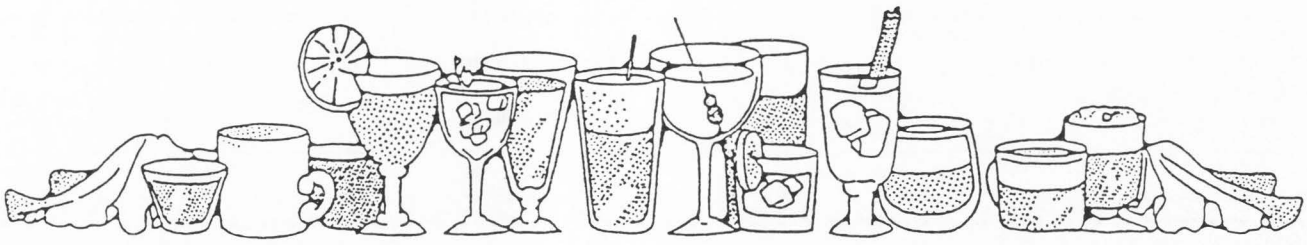
Department of Nutrition and Food Sciences
Utah State University
1991

CONTROLLING FLUID INTAKE



WHY CONTROL FLUID INTAKE?

Normally the body is able to get rid of extra fluid (or liquid) by the kidneys producing urine. But when the kidneys stop working there is no way for the body to get rid of the extra fluid. The main way to get rid of it is through dialysis.

When extra fluid remains in the body, it can cause several problems. It can make your hands, feet, and legs swell. Sometimes the extra fluid builds up in the lungs and cause you to have trouble breathing. Extra fluid can also cause blood pressure to rise which makes your heart overwork. Also, the pressure of the dialysis machine must be turned up to pull off the extra fluid. This can make you have headaches and muscle cramps and feel nauseated and dizzy.

Watching your fluid intake is one of the most important parts of your diet. Your fluid allowance depends on your urine output and how long your dialysis treatments are.

GUIDELINES

It is normal to gain some weight between dialysis treatments. Most of this weight gain is fluid. You must determine your own fluid tolerance to have a "wet" gain of no more than one kilogram (two pounds) per day. This usually means an fluid intake of 4-6 eight-ounce cups per day. Two cups of retained fluid is equal to one pound of fluid weight gain. You may not feel bad when you exceed your fluid limit, but the long term effects are bad for your heart and lungs. Your body may feel "dried up" after having a large amount of fluid removed by dialysis. This is because your body tissues get used to being surrounded by the excess fluid. Expect to feel thirsty after dialysis and plan ahead. Set firm limits on your fluid intake until the next dialysis treatment. This special effort will help you develop self-control over your thirst which will lead to smaller fluid weight gains.

SODIUM AND THIRST

Inside the body, sodium acts like a sponge for water. Eating salty foods increases the sodium in your blood stream. This activates your thirst mechanism and causes you to drink in order to dilute the level of sodium in your blood. The more sodium you eat, the thirstier you will be. Therefore, too much salt in your diet can cause high fluid weight gains.

WHAT COUNTS AS FLUID?

Anything that is liquid at room temperature counts as part of your fluid intake. Obvious sources of fluid include:

water	coffee
milk	tea
juices	soft drinks
soups	alcoholic beverages

Other foods which are counted as fluids include:

syrup or juice served with canned fruit
gelatin
ice cream
sherbet
popsicles
ice cubes

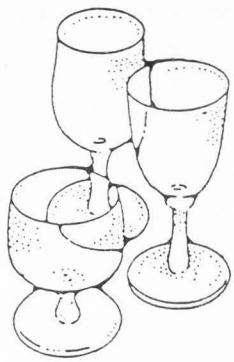
Fruits, vegetables, puddings, custards, and stews do contain fluid, but they are not counted as part of your fluid intake.

HINTS TO CONTROL FLUID INTAKE

- Drink only when thirsty. Don't drink from habit or to be social.
- Drink lemonade instead of water.
- Put lemon juice in ice cubes. Use half a lemon per tray of ice.
- Brush your teeth more often.
- Swallow your pills along with meals or soft food like applesauce or pudding, and save your fluid for something you enjoy.
- Freeze allowed fruit juices or water in ice cube trays. Ice is more satisfying because it stays in the mouth longer.

CONVERSION TABLE

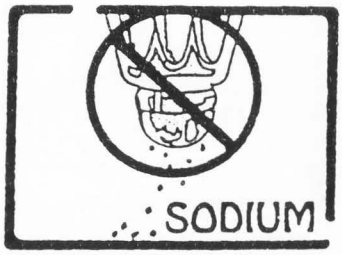
4 cups	=	1 quart (960 cc)	=	2 pounds
2 cups	=	1 pint (480 cc)	=	1 pound
1 liter	=	1000 cc	=	32 ounces (1 quart)
1 cup	=	240 cc	=	8 ounces
1/2 cup	=	120 cc	=	4 ounces
1/3 cup	=	80 cc	=	3 ounces
1/4 cup	=	60 cc	=	2 ounces
2 Tbsp.	=	30 cc	=	1 ounce
1 Tbsp.	=	15 cc	=	1/2 ounce



SODIUM AND POTASSIUM

SODIUM - SHAKE THE HABIT!

Sodium acts like a sponge for water inside the body. The main goal of reducing sodium in the diet is to prevent excess fluids from building up in the body. Too much fluid can cause problems such as high blood pressure and will increase your weight gains between dialysis treatments. Sodium (a component of salt) is found naturally in almost all foods. Dairy products, meat and eggs contain larger amounts of sodium than most fruits and vegetables. Processed or canned foods have added salt. Learning to be a label reader will help you identify foods which are high in sodium. For most people, some of the main sources of sodium in the diet are salt, baking soda, and baking powder. Always check with your doctor or pharmacist before using unprescribed medicine. Many are high in sodium such as: Alka Seltzer, Bromo Seltzer, Instant Mix Metamucil and Rolaids.



SUGGESTIONS FOR FOOD PREPARATION

1. Milk and eggs used in cooking must be subtracted from your day's allowance. It is possible to use water in place of milk in most recipes by using 1 cup minus 1 tablespoon of water for each cup of milk.

2. Rinse fresh fish well in clear water before using. This will remove some of the salt which was used in the water to preserve it.

3. Drirking water which contains no more than 5 milligrams of sodum in 8 ounces is allowed. The water in Utah is low enough in sodum to be used. However, water which has been softened in the home usually contains too much sodium to be used in a low sodum diet. Use unsoftened water for drinking and cooking.

CONDIMENTS AND SEASONINGS

Allowed
herbs and spices (see below)
pepper
garlic and onion powder
salt-free and potassium chloride-free seasonings (e.g., "Mrs. Dash")
vinegar
tabasco sauce
liquid smoke
artificial sweeteners
flavoring extracts (vanilla, rum, mint, etc.)

Avoid
bouillon cubes
monosodium glutamate
cocoa
cream of tartar
meat tenderizers
relish
Lite salt
salt substitutes such as "Nu-salt" or "No-salt"
salt and seasoning salts such as: accent, butter-flavored salt, celery salt, garlic, onion, etc.
salted or unsalted sauces: barbeque, chili, meat, soy, worchestershire, etc.

LOW SODIUM SEASONING GUIDE

Green Beans:	Basin, bay leaves, caraway seed, celery seed, cloves, ginger, nutmeg, savory, tarragon
Beets:	All spice, bay leaves, caraway seed, celery seed, cloves, ginger, nutmeg, savory, tarragon
Cabbage:	Allspice, basil, caraway seed, celery seed, chives, curry, dill, dry mustard, nutmeg, oregano, savory, tarragon
Carrots:	Allspice, bay leaves, caraway seed, celery seed, chives, curry, dill, ginger, mace, marjoram, mint, nutmeg, savory, tarragon, thyme
Cauliflower:	Caraway seed, celery seed, curry, dill, dry mustard, nutmeg, oregano, savory, tarragon
Eggplant:	Allspice, basil, bay leaves, chili powder, marjoram, sage, thyme
Mushrooms:	Rosemary, tarragon, thyme
Onions:	Basil, bay leaves, caraway seed, chili powder, curry, ginger, dry mustard, nutmeg, oregano, sage, thyme
Spinach:	Allspice, basil, cinnamon, dill, mace, marjoram, dry mustard, rosemary
Summer Squash:	Allspice, basil, cinnamon, dill, mace, marjoram, dry mustard, rosemary
Turnips:	Allspice, caraway seed, celery seed, dill, oregano
Lima Beans:	Cloves, ginger, oregano
Corn:	Chili powder, chives
Sweet Potatoes:	Allspice, cardamon, cinnamon, cloves, ginger, nutmeg
White Potatoes:	Basil, bay leaves, caraway seed, chives, dill, mave, dry mustard, oregano, rosemary, savory, thyme

Main Dishes

Beef:	Allspice, basil, bay leaves, caraway seed, celery seed, chili powder, cumin, ginger, mace, marjoram, oregano, rosemary, savory, tarragon, thyme
Veal:	Bay leaves, ginger, mace, marjoram, mint, oregano, rosemary, savory, thyme
Pork:	Bay leaves, caraway seed, chili powder, cloves, curry, marjoram, oregano, rosemary, savory, thyme
Poultry:	Bay leaves, curry, ginger, marjoram, oregano, rosemary, sage, saffron, savory, tarragon, thyme
Shellfish:	Basil, bay leaves, chili powder, curry, marjoram
Eggs:	Basil, celery seed, chili powder, curry, cumin, marjoram, mustard, rosemary, savory, tarragon, thyme
Cheese:	Caraway seed, cumin, ginger, mace, mustard, oregano, rosemary, sage

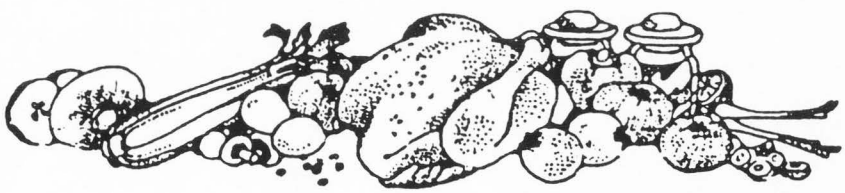
No Salt Seasonings

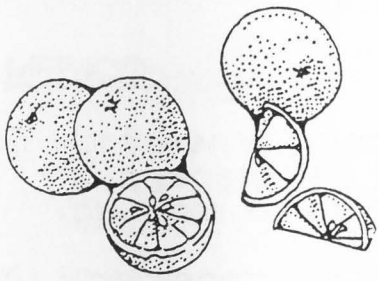
ALL SEASON
1 Tb. paprika
1 tsp. pepper
1 tsp. onion powder
1 tsp. garlic powder
1 tsp. dry mustard
1 tsp. allspice
1 tsp. allspice
1 tsp. coriander
Dash nutmeg

MEXICAN SEASONING
1 tsp. chili powder
1 tsp. cumin
1/2 tsp. paprika
1/2 tsp. crushed dried red chilies
1/4 tsp. garlic powder
1/4 tsp. onion powder

ALL PURPOSE BLEND
1 Tbsp. garlic powder
1 tsp. black pepper
1 Tbsp. oregano
1 Tb. parsley flakes
1 Tbsp. basil

*For all of the above recipes, follow the same directions. Mix all ingredients together in a tightly closeable jar. An empty, recycled seasoning jar is the best.

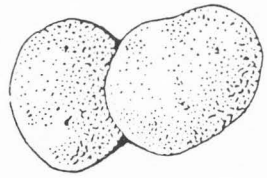




POTASSIUM AND YOUR HEART

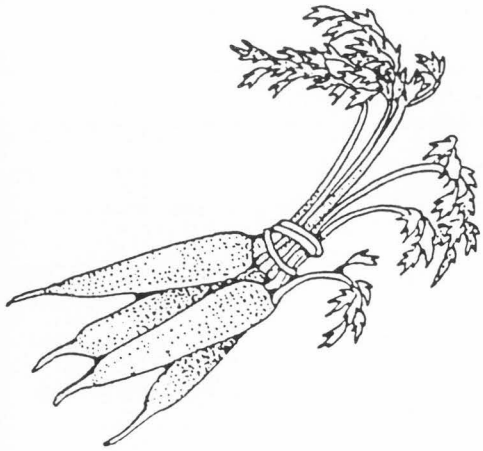
Potassium is a mineral found in many foods. In the body it helps nerves and muscles work properly, especially the heart. If the potassium in the blood gets too high, muscles become weak and the heart may slow down and even stop beating. Healthy kidneys remove extra potassium from the body. But this no longer happens when the kidneys fail. Dialysis removes extra potassium from the blood. The potassium in the diet must be controlled in order to keep the potassium in the blood from becoming too high between dialysis treatments. This requires learning which foods are higher in potassium. Much of the potassium in our diets comes from fruits and vegetables.

Vegetables provide many vitamins and minerals in our diet. But for people with kidney failure, some vegetables are limited due to their high potassium content. The potassium content of vegetables can be decreased by "leaching" or "dialyzing" some of the potassium out of the vegetables. This method works well with the following vegetables:



asparagus	cauliflower	okra
beets	corn	potatoes*
broccoli	eggplant	spinach
cabbage	green beans	squash
carrots	lima beans	sweet potatoes

*Always leach potatoes because they are very high in potassium.



METHOD:

1. For frozen vegetables: Thaw at room temperature and drain. For fresh vegetables: Clean vegetables, peel and slice tubers (potatoes, beets, carrots, etc.) to 1/8" thickness.

2. Rinse vegetables under warm water for a few seconds.

3. Soak vegetables in warm water (100-120°F) using 5-10 times the amount of water as vegetables. (5-10 cups water to 1 cup vegetables)

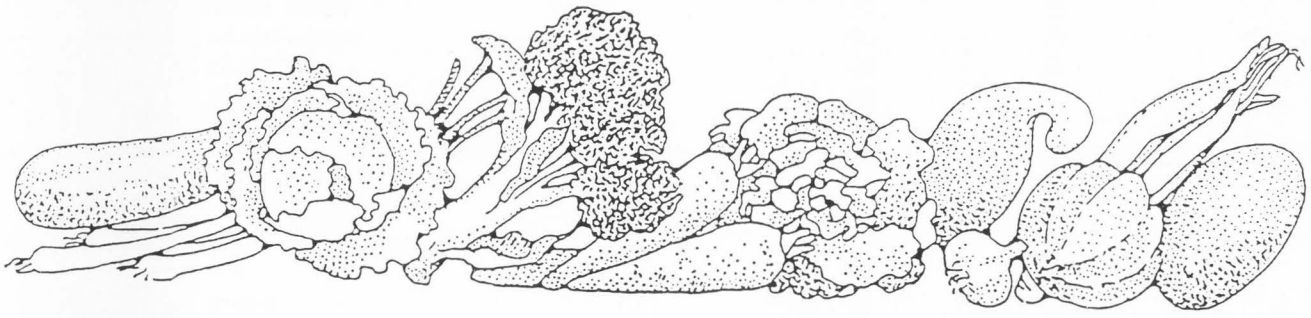
4. Repeat step #2.

5. Boil vegetables in 5 times the amount of water to vegetables for 5-10 minutes. (5 cups water to 1 cup vegetables)

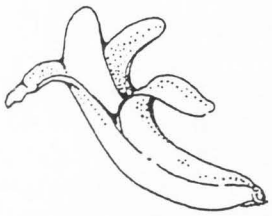
6. Discard liquids used in cooking.

Your vegetables are now ready to be eaten, or they can be frozen in individual serving portions for later use.

This method removes vitamins from the vegetables as well as potassium. Be sure to take your multi-vitamin supplement, and don't serve "leached" vegetables to the rest of your family too often.



SODIUM AND POTASSIUM GUIDELINES



The amount of potassium and sodium you can have depends on your dialysis and kidney function. For your best health, limit your intake to 2000-3000 mg. of each per day. The following list gives potassium and sodium levels of many foods. Use it to plan your diet and your potassium and sodium needs.

DESCRIPTION	AMOUNT	SODIUM (MG)	POTASSIUM (MG)
Beverages			
Alcoholic drinks:			
gin, rum, vodka, whiskey	3 oz.	1	2
Beer	12 oz.	10	70
Cocoa	1 cup	130	365
Coffee	1 cup	1	85
Ensure Plus	8 oz. can	270	550
Gatorade	1 cup	120	25
Kool Aid, Hi-C	1 cup	1	7
Postum	1 cup	5	130
Soda Pop	12 oz.	30	5
Tang	1 cup	12	100
Tea	1 cup	1	80
Wines	1/2 cup	5	110
Bread Products			
Biscuits, muffins, rolls	1	220	40
Bread: white	1	130	25
whole wheat	1	130	75
Doughnuts	1	125	30
Graham Crackers	2	90	50
Flour: wheat, raw	1 Tbsp.	0	20
Macaroni	1/2 cup	1	50
Noodles	1/2 cup	1	40
Noodle mixes	1/2 cup	570	70
Pancakes: homemade	1 (4")	115	50
mix	1 (4")	150	50
crepe	1 (4")	25	40
Rice: white	1/2 cup	2	30
brown	1/2 cup	3	60
Rice mixes	1/2 cup	725	60
Rye bread	1	140	40
Ry-Krisp	1 triple cracker	215	115
Saltine crackers	5	165	20
Snack crackers	1	40	10
Spaghetti	1/2 cup	1	50
Sweet rolls	1 small	245	84
Waffle: homemade	1 (4")	240	75
mix	1 (4")	345	100
Wheat germ	1 Tbsp.	0	55
Wheat bran	1 Tbsp.	0	36

DESCRIPTION	AMOUNT	SODIUM (MG)	POTASSIUM (MG)
Cereals			
All Bran	1 cup	560	515
Cheerios	1 cup	280	80
Corn Flakes	1 cup	280	40
Cream of Wheat,			
Rice, cooked	1 cup	1	60
Farina: cooked	1 cup	1	30
40% Bran Flakes	1 cup	205	135
Granola	1/2 cup	75	265
Grapenuts	1/4 cup	200	80
Hominy Grits: cooked	1 cup	25	8
Oatmeal: instant, flavored	1 cup	230	100
regular, plain instant	1 cup	1	90
Puffed Rice	1 cup	1	15
Puffed Wheat	1 cup	1	50
Raisin Bran	1 cup	210	155
Rice Krispies	1 cup	250	25
Shredded Wheat	1 cup or 2 biscuits	1	175
Special K	1 cup	155	40
Wheaties	1 cup	315	100
Dairy Products			
Cheese:			
Blue	1 oz.	420	75
Cheddar	1 oz.	200	25
Cottage	1/3 cup	175	85
Cream	1 oz.	75	35
Monterey Jack	1 oz.	150	25
Mozzerella	1 oz.	130	25
Parmesan	1 oz. or 1/4 cup	220	25
Processed	1 oz.	325	50
Processed spreads	2 Tbsp.	460	70
Ricotta	1/2 cup	100	130
Salt free	1 oz.	5	100
Swiss	1 oz.	200	30
Cream:			
Half-n-Half	1 Tbsp.	10	20
Ice Cream	1/2 cup	40	115
Sour	1 Tbsp.	10	15
Whipping	1 Tbsp.	5	15
Milk:			
Buttermilk	1 cup	310	370
Chocolate	1 cup	100	420
Skim	1 cup	125	395
2%	1 cup	120	380
Whole	1 cup	120	350
Non Dairy: liquid creamer	1 Tbsp.	3	11
Whipped topping	1 Tbsp.	2	1
Milkshake	2 cups	280	565
Sherbet	1 scoop	50	100
Yogurt	1 cup	100	440

DESCRIPTION	AMOUNT	SODIUM (MG)	POTASSIUM (MG)
Fruits and Juices			
Apples	1	1	195
Apple juice	1/2 cup	1	125
Applesauce	1/2 cup	1	90
Apricots: raw, canned	2	1	280
Apricot nectar	1/2 cup	1	190
Avocado	1/4	4	300
Bananas	1	1	440
Blackberries	1/2 cup	1	120
Blueberries	1/2 cup	1	70
Cantaloupe	1/2 cup	10	165
Cherries	1/2 cup	1	155
Cranberry sauce	1/2 cup	1	30
Cranberry juice	1 cup	1	25
Dates	5	1	260
Figs	2	2	190
Fruit Cocktail	1/2 cup	5	205
Grapes	1/2 cup	3	120
Grape juice: canned	1/2 cup	1	190
frozen	1 cup	1	85
Grapefruit	1/2	1	160
Grapefruit juice	1/2 cup	1	215
Honeydew melon	1/2 cup	1	190
Kiwi	1	10	340
Lemons	1	1	120
Lemonade	1 cup	1	40
Limes	1	1	70
Limeade	1 cup	1	15
Mango	1/2 cup	7	225
Nectarines	1	6	290
Oranges	1	1	300
Orange juice	1/2 cup	1	250
Papaya	1 whole or 1 cup	8	780
Peaches: raw	1	3	200
canned	2 halves	1	155
Peach nectar	1/2 cup	1	80
Pears: raw	1	3	200
canned	2 halves	1	100
Pear nectar	1 cup	1	98
Pineapple: raw	1/2 cup	1	115
canned	1 slice	2	120
Pineapple juice	1/2 cup	1	185
Plums: raw	3	2	240
canned	2	1	140
Prunes: dried	5	4	330
Prune juice	1/2 cup	2	300
Raisins	1/2 cup	30	555
Raspberries	1/2 cup	1	140
Rhubarb: cooked	1/2 cup	2	115
Strawberries	1/2 cup	1	140
Tangerines	1	2	125
Watermelon	1/2 cup	1	80

DESCRIPTION	AMOUNT	SODIUM (MG)	POTASSIUM (MG)
Meat, Fish, Poultry			
(Fresh of frozen unless otherwise noted)			
Bacon	1 strip	70	15
Bacon: Canadian	1 oz.	715	120
Bacon substitutes	1 strip or 1 tsp.	180	40
Beef	3 oz.	50	245
Chicken	3 oz.	70	235
Clams	3 oz.	25	170
Corned beef	3 oz.	1100	90
Crab: canned	3 oz.	425	70
fresh, shelled	3 oz.	315	70
fresh, unshelled	3 oz.	200	260
Eggs	1	60	65
Egg substitute	1/4 cup	130	130
Fish: white	3 oz.	85	390
Frankfurter	1 (2 oz.)	550	110
Ham	3 oz.	840	300
Luncheon meats	1 oz. slice	300	50
Lamb	3 oz.	45	220
Liver	3 oz.	155	310
Lobster	3 oz.	70	60
Oysters	1/2 cup	85	145
Pork	3 oz.	60	235
Salmon	3 oz.	100	330
Salmon: canned	3 oz.	325	305
Sausage	3 oz. or 4 links	860	240
Scallops	3 oz.	240	405
Shrimp	3 oz.	125	200
Tuna: regular canned	3 oz.	800	300
low sodium or rinsed	3 oz.	40	280
Turkey	3 oz.	70	330
Veal	3 oz.	40	260
Commercial Entrees			
(canned or frozen unless otherwise noted)			
Chili, stew, spaghetti, etc.	1 cup	1085	555
Fast Foods:			
chicken	1 piece	485	380
fish-n-chips	1 serving	655	975
hamburger	1/4 lb.	710	445
hot dog	1	770	205
pizza	1 slice	495	235
taco	1	400	143
Soups: canned	1 cup	955	185
dried & bouillon	1 cup	1000	60
low sodium	1 cup	35	240
T.V. Dinners: regular	1 portion	1125	515
large size	1 portion	2200	900

DESCRIPTION	AMOUNT	SODIUM (MG)	POTASSIUM (MG)
Vegetables			
(cooked, unless otherwise noted. No added salt.)			
Artichokes: fresh	1 small	30	300
Asparagus: fresh	6 spears	1	200
canned	6 spears	285	200
Avocado: raw	1/4	4	300
Beans, green: fresh	1/2 cup	4	100
canned	1/2 cup	160	70
Beans, lima	1/2 cup	1	420
Beans: kidney, navy, pinto	1/2 cup	7	368
Bean sprouts: cooked	1/2 cup	2	80
raw	1/2 cup	1	115
Beets: fresh	1/2 cup	40	180
canned	1/2 cup	195	135
Broccoli	1/2 cup	15	195
Brussel sprouts	1/2 cup	10	220
Cabbage: cooked	1/2 cup	10	120
raw	1/2 cup	20	95
Carrots: cooked	1/2 cup	30	170
raw	1 (7 x 1")	50	245
Cauliflower: cooked	1/2 cup	5	130
raw	1/2 cup	5	150
Celery: raw	1/2 cup, 1 stalk	70	155
Corn: fresh	1/2 cup or 5" ear	0	160
canned	1/2 cup	200	80
Cucumbers: raw	1/2 cup	5	85
Eggplant	1/2 cup	1	150
Greens: cooked	1/2 cup	90	320
raw	1 cup	30	380
Lentils	1/2 cup	8	250
Lettuce: head	1 cup	10	95
leaf	1 cup	10	145
Mixed vegetables: plain	1/2 cup	50	190
frozen with sauce	1/2 cup	350	75
Mushrooms: cooked	1/2 cup	0	200
raw	1/2 cup	15	145
Onions: cooked	1/2 cup	10	110
raw	1/2 cup	10	135
Parsnips	1/2 cup	8	295
Peas: green frozen	1/2 cup	1	110
canned	1/2 cup	200	80
split peas, blackeye peas	1/2 cup	40	290
Peppers: raw	1	10	160
Potatoes: boiled	1 (2 1/2")	3	535
baked	1 (2 1/2")	5	600
french fried	10	3	375
hash brown	1/2 cup	230	220
mashed	1/2 cup	50	290
soaked	1/2 cup	3	80
Pumpkin	1/2 cup	2	295
Radishes: raw	5	10	130
Rutabagas: cubed	1/2 cup	5	140

DESCRIPTION	AMOUNT	SODIUM (MG)	POTASSIUM (MG)
Vegetables (cont.)			
Spinach: cooked	1/2 cup	45	300
raw	1 cup	70	260
Sauerkraut	1/2 cup	750	140
Squash: summer	1/2 cup	1	140
winter	1/2 cup	1	460
Sweet potatoes, yams	1/2 cup	10	300
Tomatoes: canned	1/2 cup	130	260
sauce	1/4 cup	280	260
paste	2 Tbsp.	15	280
raw	1 cup	70	475
Turnips: cubed	1/2 cup	40	145
V-8 tomato juice	1/2 cup	240	275
Waterchestnuts	4	5	125
Snack Foods			
Cake with chocolate icing	1 cupcake	100	45
Candy: hard	1	10	0
caramels	1	65	55
chocolates	1 oz. bar	30	100
Coconut	1/2 cup	5	100
Cookies: assorted	4 small	130	25
Corn chips	1 ounce	200	25
Custard	1/2 cup	130	175
Gelatin dessert	1/2 cup	55	90
Marshmallows	4 large	15	2
Nuts, assorted: salted	1/2 cup	250	450
unsalted	1/2 cup	5	450
Olives: green	4	275	15
ripe	4	175	15
Peanut butter	1 Tbsp.	95	100
Pickles: dill	1 medium	1430	130
sweet	1 small	100	15
Pie	1/8 9" pie	355	100
Popcorn	1 cup	0	30
Potato chips	1 oz. or 10 chips	100	225
Pudding: chocolate	1/2 cup	160	170
Sunflower seeds: unsalted, shelled	1 Tbsp, 1/3 oz.	3	80
Miscellaneous			
Apple butter	1 Tbsp.	1	50
Baking soda	1 tsp.	821	0
Baking powder	1 tsp.	310	5
Barbecue sauce	1 Tbsp.	130	25
Butter or margarine	1 Tbsp.	140	3
Catsup	1 Tbsp.	150	55
Dips, commercial	2 Tbsp.	155	80
Horseradish	1 Tbsp.	20	50
Honey	1 Tbsp.	1	10
Jams & Jellies	1 Tbsp.	5	10
Mayonnaise	1 Tbsp.	85	5

DESCRIPTION	AMOUNT	SODIUM (MG)	POTASSIUM (MG)
Miscellaneous (cont.)			
Molasses	1 Tbsp.	15	300
Mustard	1 tsp.	65	7
Oil: vegetable	1 tsp.	0	0
Salad dressing, commercial	1 Tbsp.	175	10
Salt: regular	1 tsp.	2132	0
garlic salt	1 tsp.	1830	30
seasoned salt	1 tsp.	1230	0
salt substitute	1 tsp.	1	2490
light salt	1 tsp.	975	1300
Soy sauce: regular	1 Tbsp.	1100	55
low sodium Kikkoman	1 Tbsp.	340	70
Steak sauce	1 Tbsp.	200	65
Sugar: white	1 Tbsp.	0	0
brown	1 Tbsp.	3	30
Syrup: chocolate	1 Tbsp.	15	35
maple flavored	1 Tbsp.	3	1
Tabasco	1 tsp.	20	3
Vinegar	1 Tbsp.	0	2
Worcestershire	1 tsp.	50	40

From: Wilkins, K. and Schiro, K., Nutrition: The Art of Good Eating. Northwest Kidney Foundation. Seattle, 1989

PHOSPHORUS AND CALCIUM

Phosphorus and calcium are two minerals that are needed to build strong bones and teeth. They also help nerves and muscles work properly. These minerals have an inverse, or "see-saw" relationship in the blood; when one goes up, the other goes down.

Normally, the kidneys get rid of extra phosphorus. But when the kidneys fail, phosphorus builds up in the blood stream. This causes the calcium level to fall. Parathyroid hormone causes calcium to be released from the bones into the bloodstream. This causes the bones to become brittle. Bone pain, fractures and broken bones can easily result.

The process of bone disease is very long and slow. You may not notice any problems right away, but be aware of the following signs.

Itching
Pain in joints and bones
Abnormal blood values for phosphorus or calcium
Easily broken bones
Calcium deposits (painless hard or soft lumps) under your skin

There are severcl things you can do to prevent this from happening.

- Limit the high phosphorus foods in your diet.
- Take your phosphate binders as prescribed with meals and snacks.
- Take your calcium supplement as prescribed by your doctor.

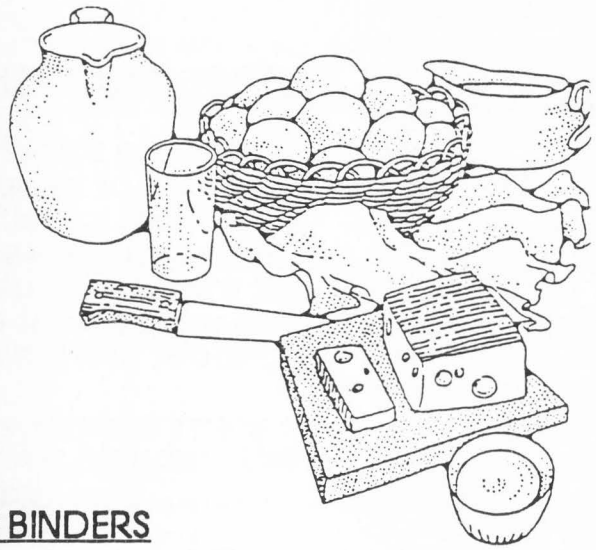
Foods which are high in phosphorus include milk and dairy products, cheese, meat, fish, poultry, eggs, nuts, dried beans, while grains, some vegetables, and colas. See the phosphorus and calcium food lists for specific amounts.

Substitutions for dairy products can help decrease your phosphorus intake.

- Use non-dairy creamers such as Coffee Rich and Mocha Mix on cereals and in creamed soups, puddings and other recipes that call for milk.
  2 1/2 c. non-dairy creamer = 1 dairy serving

- Use cream cheese in sandwiches, toast and casseroles in place of regular cheese or cottage cheese.
  10 Tbsp. cream cheese = 1 dairy serving

- Use sour cream or imitation sour cream on fruits or in dips to replace yogurt.
  1 1/2 c. sour cream = 1 dairy serving



PHOSPHATE BINDERS

Phosphate binders bind the phosphorus in the foods you eat, thus reducing the amount of phosphorus that enters the blood stream. It is best to take your "binder" with meals. If you forget, take them as soon as you remember. If you skip a meal, you still need to take your binders.

If you have trouble taking your binders, try these helpful hints.

- Each morning set aside the number of pills you need to take for the day. Carry the pills with you in a small container. At the end of the day the container should be empty.

- If you have trouble swallowing the binders, mix them into applesauce, Jello, whipped potatoes, pudding, peanut butter, or some other soft food.

- When you go out to eat, put your binder pills in a small container and place this in your purse. If you forget to take them, you will be reminded when you pay for your meal.

- Constipation may be a side effect of your phosphate binders. If this is a problem, try these suggestions.

    - Include light exercise in your daily schedule.
    - Add raw (unrefined) bran to your food. Start with 1-2 Tbsp. and increase as needed up to 5 Tbsp. a day.
    - Use part of your fluid allowance as a warm beverage first thing in the morning or before going to bed at night.
    - Ask your doctor about using a laxative.

- If you don't like taking so many pills, grind them up and add them to baked goods. See the phosphate binder recipes below.

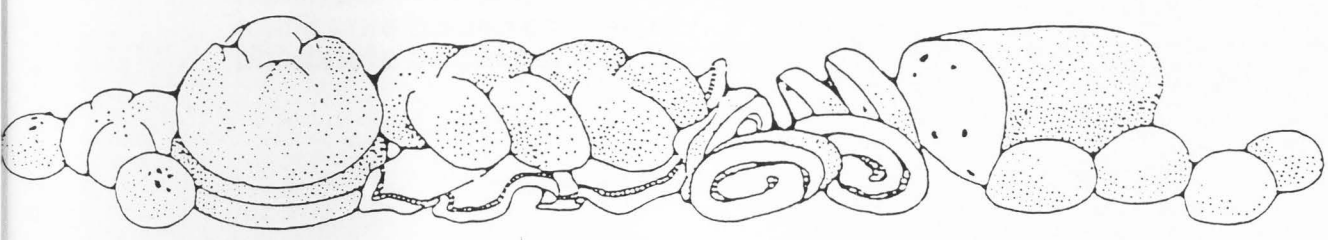
BAKING WITH PHOSPHATE BINDERS

Phosphate binders can be added to your favorite recipes when they are reduced to a powder form. Large batches of biscuits, cookies, waffles, or muffins can be baked and stored in the freezer for several weeks. These foods can be easily warmed, making binders easy to take at any time. However, you must be careful not to take more than is prescribed. Also, don't let other people eat them because these foods contain medicine!

To reduce the binders into a powder, open capsules into a bowel or grind tablets in a blender. Use this powder in place of part of the flour in a recipe.

For example, you have 1/2 cup of binder powder. The recipe calls for 1 1/2 cups of flour. You should use the 1/2 cup of binder powder plus 1 cup of flour to total 1 1/2 cups.

Be sure to make all portions of cookies, biscuits etc. the same size. Divide the number of tablets used in your recipe by the number of cookies you made. For example, 96 tablets divided by 32 cookies = 3 tablets per cookie.



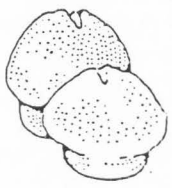
Homemade Master Biscuit Mix

This mix may be used to easily make phosphate binder biscuits, waffles and other quick bread products. It keeps indefinitely and can be used at a moments notice to make biscuits, pancakes, waffles or quick breads.

Binder Master Mix
66 powdered phosphate binders plus flour to equal 8 cups
1/4 c. baking powder
1 c. dry powdered milk
1 1/2 c. shortening

Sift dry ingredients together three times. Cut in shortening until the size of small peas. Keep in covered container at room temperature. Yield: 11 cups (6 binders per cup).

Here are some recipes using the master mix:



Binder Biscuits
2 c. binder master mix
1/2 c. water

Measure mix into bowl and add water; stir just to blend. Turn onto lightly floured board. Knead a few times. Roll to 3/4 inch thickness. Cut into circles or squares. Place on ungreased baking sheet. Bake at 425°F for about 12 minutes or until golden in color. Yield: About 12 medium biscuits (1 phosphate binder per biscuit).

Binder Muffins
1 beaten egg
1 c. water
2 Tbsp. sugar
3 c. binder master mix

Combine egg and water. Stir sugar into dry ingredients. Combine liquid and dry ingredients. Stir just until moistened. Fill greased muffin pans about 2/3 full. Bake at 425°F for about 20 minutes or until muffins are golden and test done. Yield: 12 medium muffins (1 1/2 phosphate binder per muffin).

Binder Bread Sticks
2 c. binder master mix
1/2 c. water
3 Tbsp. butter or margarine
Sesame or poppy seeds

Combine mix and water and stir until blended. Turn onto lightly floured board. Knead about 15 to 20 times. Divide into 24 equal parts. Roll each piece between hands into pencil-thin strips, about 8 inches long. Melt butter in rimmed 10 x 15 inch pan. Place bread sticks in pan, rolling in the melted butter to coat each one. Sprinkle with sesame or poppy seeds. Bake at 425°F for about 12 minutes or until golden. Yield: 2 dozen bread sticks (1/2 phosphate binder per bread stick).

Binder Pancakes
1 beaten egg
1 1/2 c. water
2 c. binder master mix

Combine egg and water. Stir into biscuit mix until well blended. Bake on a lightly greased griddle or over medium heat. Yield: 12 medium pancakes (1 phosphate binder per pancake.)

Binder Streusel Coffee Cake
2 c. binder master mix
2/3 c. water
Streusel topping

Combine mix and water, stirring just until blended. Pat into greased 7 x 11 x 1 1/2 pan. Sprinkle Streusel Topping over batter. Bake at 400°F for 20 to 25 minutes, until cake tests done. Yield: 12 servings (1 phosphate binder per serving).

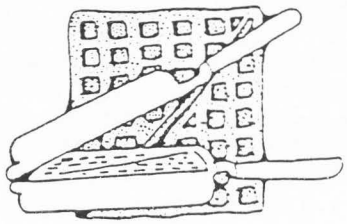
Streusel Topping
1/2 c. brown sugar
2 Tbsp. flour
1 tsp. cinnamon
2 Tbsp. melted butter or margarine
1/2 c coconut

Combine above ingredients and sprinkle over batter.

Binder Waffles
1 egg
2 Tbsp. salad oil
1 1/2 c. water
2 c. binder master mix

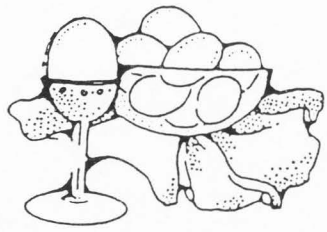
Beat egg, add oil and water. Stir into mix. Blend well. Bake on waffle griddle set on medium. Yield: 6 waffles (2 phosphate binders per waffle).

Recipes from: Wilkins, K. and Schiro, K. Nutrition: The Art of Food Eating. Northwest Kidney Foundation. Seattle, 1989.



PHOSPHORUS AND CALCIUM GUIDELINES

The following list will help you find out how much phosphorus you are eating, and which foods are too high in phosphorus for you. Your daily intake should be about 800-1,200 mg. You need calcium in your diet too, about 1,000 mg. per day. Check with your doctor if you think you need a supplement.



DESCRIPTION	AMOUNT	PHOSPHORUS (MG)	CALCIUM (MG)
Beverages			
Alcoholic drinks:			
gin, rum, vodka, whiskey	3 oz.	10	8
Beer	12 oz.	100	15
Coffee, Tea	1 cup	5	5
Ensure Plus	8 oz. cup	150	150
Gatorade	1 cup	0	25
Instant Breakfast	1 cup	390	400
Kool Aid, Hi-C, Punch	1 cup	20	0
Ovaltine, mix with milk	1 cup	310	370
Postum	1 cup	60	10
Soda Pop	12 oz.	20	10
Tang	1 cup	150	165
Wines	1/2 cup	10	9
Bread Products			
Biscuits	1	60	25
Bread: white, rye	1 slice	25	20
brown	1 slice	55	25
Crepes	1	35	25
Doughnuts	1	50	15
Graham crackers	2	20	6
Flour	1 Tbsp.	20	5
Macaroni, noodles	1/2 cup	40	5
Muffins: bran, corn	1	160	75
other types	1	60	40
Pancakes	1 (4")	65	45
Rice: white	1/2 cup	20	8
brown, wild	1/2 cup	70	10
Ry-Krisp	2 triple crackers	40	10
Saltine crackers	2	5	1
Snack crackers	2-5	20	10
Spaghetti	1/2 cup	40	5
Sweet rolls	1	60	50
Waffles: homemade	1	130	85
mix	1	260	180
Wheat germ	1 Tbsp.	65	10

DESCRIPTION	AMOUNT	PHOSPHORUS (MG)	CALCIUM (MG)
Cereals			
All Bran	1 cup	495	70
Cheerios	1 cup	115	35
Corn Flakes	1 cup	10	10
Cornmeal: cooked	1 cup	35	5
Cream of Wheat, Rice: ckd	1 cup	40	15
Farina: cooked	1 cup	150	190
40% Bran Flakes	1 cup	120	15
Granola	1/2 cup	200	110
Grapenuts	1/4 cup	20	10
Hominy Grits: cooked	1 cup	25	1
Oatmeal: cooked	1 cup	135	20
Puffed Rice	1 cup	25	3
Puffed Wheat	1 cup	35	4
Raisin Bran	1 cup	30	5
Rice Krispies	1 cup	30	5
Shredded Wheat	1/2 cup or 1 biscuit	100	10
Special K	1 cup	40	15
Sugar Pops	1 cup	8	2
Sugar Crisps, Smacks	1 cup	40	5
Wheaties	1 cup	100	15
Dairy Products			
Butter	1 Tbsp.	2	3
Cheese sauce	2 Tbsp.	55	70
Cream sauce	2 Tbsp.	40	40
Cheese:			
Blue	1 oz.	110	150
Cheddar	1 oz.	145	205
Cottage	1/3 cup	100	45
Cream	1 oz. or 2 Tbsp.	30	25
Monterey Jack	1 oz.	125	210
Mozzarella	1 oz.	135	140
Parmesan	1 oz.	230	390
Processed	1 oz.	215	175
Processed spreads	1 oz.	165	160
Ricotta	1/3 cup	140	200
Swiss	1 oz.	175	275
Cream:			
Half-n-Half	1 Tbsp.	15	15
Ice cream	1 scoop	70	100
Ice milk	1 scoop	65	90
Imitation sour	2 Tbsp.	15	0
Sour	2 Tbsp.	25	30
Whipping	1 Tbsp.	10	15
Cheesecake	1 serving	55	55
Custard	1/2 cup	155	160
Pudding	1/2 cup	120	120

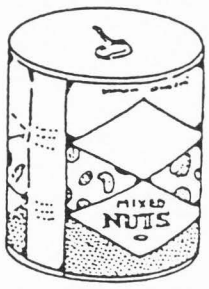
DESCRIPTION	AMOUNT	PHOSPHORUS (MG)	CALCIUM (MG)
Dairy Products (cont.)			
Milk:			
Buttermilk	1 cup	220	290
Chocolate	1 cup	250	280
Condensed	1 cup	630	800
Evaporated	1 cup	520	635
Malted milk powder	3 Tbsp.	110	80
Milkshake	2 cups	570	690
Skim	1 cup	250	300
2%	1 cup	230	300
Whole	1 cup	290	290
Non-Dairy: liquid creamer	1 cup	160	25
Sherbet	1 scoop	40	50
Yogurt	1 cup	330	415
Frozen yogurt	1 scoop	100	100
Whipped topping	1 Tbsp.	0	0
Fruits and Juices			
Apples	1	15	10
Apple juice	1/2 cup	15	10
Applesauce	1/2 cup	5	4
Apricot nectar	1/2 cup	20	15
Apricots	1/2 cup	25	20
Avocado	1/4	20	5
Bananas	1	40	10
Blackberries	1/2 cup	15	25
Blueberries	1/2 cup	10	10
Cantaloupe	1/4 melon	15	15
Cherries	1/2 cup	15	15
Cranberry: juice	1/2 cup	5	5
sauce	1/2 cup	5	10
Dates	5	30	30
Figs	3	25	35
Fruit cocktail	1/2 cup	15	10
Grapes	1/2 cup	15	10
Grape juice	1/2 cup	5	10
Grapefruit	1/2	15	15
Grapefruit juice	1/2 cup	15	15
Honeydew melon	1/4 melon	15	15
Kiwi	1	40	25
Lemons	1	15	25
Lemonade	1/2 cup	1	1
Limes	1	20	35
Limeade	1/2 cup	1	1
Nectarines	1	25	5
Oranges	1	30	60
Orange juice	1/2 cup	20	10
Papaya	1/2	20	25
Peaches	1	20	10
Peach nectar	1/2 cup	15	5
Pears	1	20	20
Pear nectar	1/2 cup	5	5

DESCRIPTION	AMOUNT	PHOSPHORUS (MG)	CALCIUM (MG)
Fruits and Juices (cont.)			
Pineapple	2 slices	20	30
Pineapple juice	1/2 cup	15	20
Plums	2	20	20
Prunes: dried	5	40	25
Prune juice	1/2 cup	25	15
Raisins	1/2 cup	70	45
Raspberries	1/2 cup	15	15
Rhubarb: cooked	1/2 cup	20	100
Strawberries	1/2 cup	15	15
Tangerines	1	20	40
Watermelon	1/2 slice, 1"thick	45	30
Meat, Fish, Poultry			
Bacon	1 strip	25	2
Beef	3 oz.	180	10
Canadian bacon	1 slice	45	5
Chicken	3 oz.	175	20
Clams	3 oz.	130	60
Corned beef	3 oz.	100	20
Crab	3 oz.	70	35
Eggs	1	100	30
Fish: white	3 oz.	195	55
Frankfurter	1 (2 oz.)	60	3
Luncheon meats	1 oz.	40	3
Ham	3 oz.	150	5
Lamb	3 oz.	160	10
Liver	3 oz.	400	10
Lobster	3 oz.	105	35
Oysters	3 oz.	130	72
Pork	3 oz.	170	10
Salmon: fresh	3 oz.	240	135
canned with bones	3 oz.	300	170
Sausage	4 links or 2 patties	170	5
Scallops	3 oz.	280	100
Shrimp	3 oz.	225	100
Tuna	3 oz.	190	5
Turkey	3 oz.	215	25
Veal	3 oz.	200	10
Commercial Entrees (canned or frozen unless otherwise noted)			
Canned soups: mix with milk	1 cup	160	180
mix with water	1 cup	50	20
Chili, Pork-and-beans	1 cup	280	115
Fast Foods:			
fish-n-chips	1 serving	280	30
hamburger	1/4 lb.	225	125
cheeseburger	1/4 lb.	325	255
hot dog	1	110	60
pizza	2 slices	340	410
taco	2	350	240

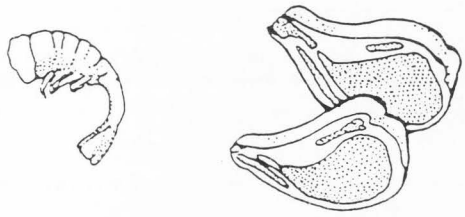
DESCRIPTION	AMOUNT	PHOSPHORUS (MG)	CALCIUM (MG)
Commercial Entrees (cont.)			
Lasagna	1 cup	275	230
Macaroni-and Cheese: mix	1 cup	300	280
T.V. Dinners	1 serving	270	60
Vegetables (fresh and cooked, unless otherwise noted).			
Asparagus	6 spears	50	20
Artichokes	1	90	50
Avocado	1/4	20	5
Beans: green	1/2 cup	20	30
Beans: kidney, navy, lima	1/2 cup	140	40
Beans: pinto, garbanzo	1/2 cup	210	75
Bean sprouts, alfalfa	1/2 cup	25	10
Beets	1/2 cup	20	10
Broccoli	1/2 cup	60	70
Brussels sprouts	1/2 cup	50	25
Cabbage	1/2 cup	15	30
Carrots	1	30	30
Cauliflower	1/2 cup	25	10
Celery	1 stalk	15	20
Corn	1/2 cup	55	5
Cucumbers	1/2 cup	20	20
Eggplant	1/2 cup	20	10
Greens	1/2 cup	40	115
Lentils	1/2 cup	120	20
Lettuce	1 cup	25	40
Mixed vegetables: plain	1/2 cup	55	25
frozen with sauce	1/2 cup	50	60
Mushrooms: fresh, canned	1/2 cup	90	10
Onions	1/2 cup	30	25
Parsnips	1/2 cup	60	45
Peas: green	1/2 cup	65	20
Splitpeas, blackeye peas	1/2 cup	130	10
Peppers	1	20	10
Potatoes: baked, boiled	1	100	10
Potatoes: fried, mashed	1/2 cup	50	20
Pumpkin	1/2 cup	30	30
Radishes	10	30	30
Rhubarb	1/2 cup	10	60
Rutabagas	1/2 cup	30	60
Spinach	1/2 cup	35	85
Sauerkraut	1/2 cup	15	30
Squash: summer	1/2 cup	25	25
Squash: winter	1/2 cup	50	30
Sweet potatoes, yams	1/2 cup	35	40
Tomatoes	1	30	15
Turnips	1/2 cup	20	25
Vegetable juice: V-8 , tomato	1/2 cup	30	15
Waterchestnuts	4	15	1

DESCRIPTION	AMOUNT	PHOSPHORUS (MG)	CALCIUM (MG)
Snack Foods			
Breakfast bar	1	60	20
Cake with chocolate icing	1 slice	130	70
Candy: hard, caramels	1 oz. package	30	30
chocolate bar	1 oz.	75	50
Commercial dips	1 Tbsp.	15	15
Cookies: homemade	1	10	10
Chips: corn, potato	1 oz. bag (10-20)	50	25
Gelatin dessert	1/2 cup	5	2
Marshmallow	4 large	4	4
Nuts	1 oz. or 2 Tbsp.	150	40
Peanut butter	1 Tbsp.	60	10
Pickles	1	20	25
Pie: fruit	1/8 pie	60	30
Pie: pecan	1/8 pie	140	65
Popcorn	1 cup	40	2
Sunflower seeds, shelled	1 Tbsp.	75	10
Miscellaneous			
Baking powder	1 tsp.	90	60
phosphate type	1 tsp.	335	225
Catsup	1 Tbsp.	10	3
Horseradish	1 Tbsp.	5	10
Honey	1 Tbsp.	5	5
Jams & Jellies	1 Tbsp.	5	10
Margarine	1 Tbsp.	3	3
Mayonnaise	1 Tbsp.	5	5
Molasses	1 Tbsp.	40	255
Mustard	1 tsp.	5	5
Olives	5	5	15
Oil: vegetable	1 Tbsp.	0	0
Salad dressing	1 Tbsp.	5	5
Sauce: soy, teriyaki	1 Tbsp.	40	3
Sauce: BBQ, steak, tartar	1 Tbsp.	5	5
Sugar: white, brown	1 Tbsp.	5	5
Syrup: chocolate	1 Tbsp.	25	15
Syrup: maple flavored	1 Tbsp.	5	10
Vinegar	1 Tbsp.	0	2

From: Wilkins, K. and Schiro, K. Nutrition: The Art of Good Eating. Northwest Kidney Foundation. Seattle, 1989.



HOW TO GET ENOUGH PROTEIN



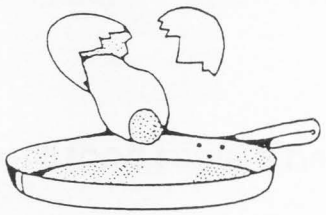
PROTEIN

Protein is the body builder. The body needs it to build all tissues (muscles, bones, skin, hair, etc.). It also helps to fight infection and keep your body fluids in balance. Each time you dialyze you loose a little protein. The protein in your diet must be high enough to replace those losses PLUS supply your daily protein needs. If you don't eat enough protein, you may begin to break down your muscles. If your body protein stores are low, you may feel weak and get sick more easily.

Eating too much protein is not good either. Too much protein can cause waste products to build up in your blood. This may cause nausea, vomiting, poor appetite, and taste changes.

PROTEIN SOURCES

What foods are high in protein? Good sources of protein include:



meat	fish
eggs	poultry (chicken, turkey, duck)
milk	cheese
	cottage cheese

The following meats are not recommended because they are high in sodium:

bacon	canned meats or fish
ham	chipped or corned beef
bologna	smoked fish
sausage	luncheon meats
hot dogs	processed cheese

The following foods are not recommended because they have a low quality of protein and are high in potassium and phosphorus:

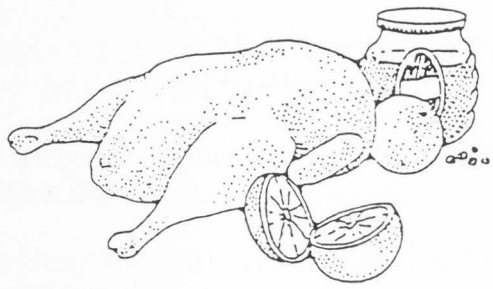
nuts and seeds (i.e. peanuts and sunflower seeds)
dried beans and peas (i.e. navy beans, kidney beans, pork 'n beans, split peas, refried beans)

HOW MUCH PROTEIN IS ENOUGH?

Your doctor or dietitian can tell you how much protein you need each day. Most people on hemodialysis need at least 6 ounces of meat or meat substitutes a day. Use the table below to see if you are getting enough protein.

whole chicken breast	6-8 ounces
chicken thigh	2-2 1/2 ounces
chicken leg	1-1 1/2 ounces
pork chop	2-2 1/2 ounces*
spareribs (6 small)	3 ounces*
T-bone steak	3-10 ounces*
hamburger patty, 3" X 1/2"	3 ounces*
shrimp (4 medium)	3 ounces

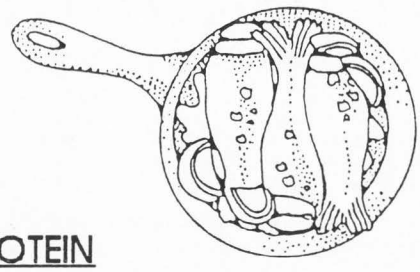
*portion size depends on thickness



A small food scale is helpful when measuring meats and cheeses at home.

If you are not eating enough protein, your monthly blood tests will show a low albumin and/or a low BUN and/or a low KT/V. Your dietitian will discuss these and other lab results with you.

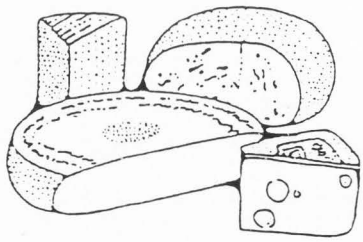
*Remember: You must take your phosphate binders regularly. All foods that are high in protein are also high in phosphorus.



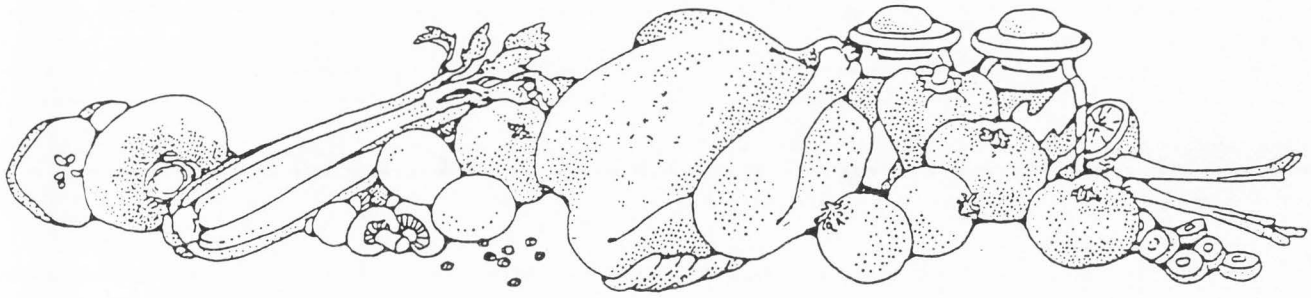
SUGGESTIONS FOR INCREASING PROTEIN

If you do not like eating plain red meat, here are some other ways to get enough protein and enjoy your meals.

- You may want to "mask" the flavor of the meat with spices or sauces. Try adding your meat to homemade lasagna, spaghetti with meat sauce, beef stroganoff, tacos, chile, or pizza.
- Use more eggs in your menus. (custards, eggnogs, egg salad sandwiches, omelets, quiches, hardboiled or deviled eggs, stirred into casseroles or soups, added to fruit juices or sherbet shakes)
- Serve cold meat in salads or sandwiches.
- Use spices, seasonings, gravies, or sauces to improve the flavor of meats.
- Blend powdered milk or protein modules into casseroles, sauces, puddings, soups, or peanut butter.
- Add grated cheese or small pieces of meat to salads, soups, noodles, or casseroles.
- Stay away from the kitchen while meat is cooking. The odors may decrease your appetite.



EATING WELL AND BOOSTING CALORIES IN RENAL DIETS

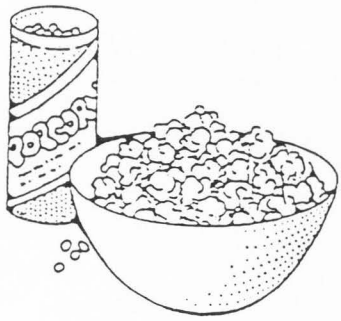


Eating well will help you feel your best. There may be times when you have a poor appetite and do not feel like eating. If this happens, you are not alone. Many people on dialysis have this problem. It is important to eat well to stay at your best weight and prevent weight loss. Try these suggestions for increasing calories in your diet.

1. SNACK OFTEN

- Try to eat three meals and three snacks every day. Eating smaller meals more often can help you get extra calories without becoming too full.
- Simple foods make the best snacks. If foods are easier to prepare, you will have more energy left to eat them. Here are some suggestions:

buttered popcorn
cake
donut or sweet roll
fruits
cold cereal with milk
cottage cheese and fruit
puddings or custards
milkshakes
cookies
cold fried chicken
hard boiled eggs
hard candy
cheese and crackers
popsicles



2. ADD EXTRA CALORIES

Milk and Dairy Products:

- Use whole milk, half-and-half or non-dairy creamer rather than 2% or skim milk.
- Make creamed soups, sauces, gravies, and puddings with half-and-half or cream.
- Add syrup toppings to ice cream or yogurt.

Proteins:

- Coat meat, fish, or poultry with breading or crumbs and fry.
- Add powdered milk to casseroles, sauces, or peanut butter.
- Use gravy, sauces or sour cream on meats or casseroles.

Fruits:

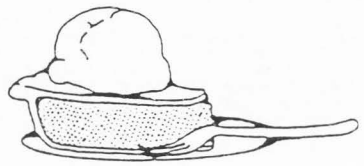
- Eat fruits canned in heavy syrup rather than low-sugar varieties.
- Top fruit with whipped cream, yogurt, or sour cream.
- Use fruit desserts like baked apples with sugar, cinnamon, and butter.
- Drink fruit juices or other calorie containing beverages (regular soda pop, punch, lemonade) instead of drinking water.

Vegetables:

- Use generous amounts of vegetable oil salad dressing on tossed salads.
- Serve vegetables with extra butter, margarine, sauces, or sour cream.

Breads and Cereals:

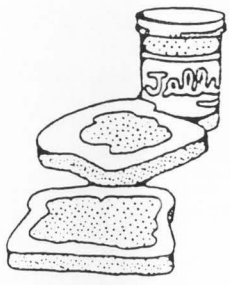
- Add butter or margarine to cooked cereal, rice, and pasta.
- Add margarine or mayonnaise to sandwiches. Grill sandwiches with margarine.
- Use generous amounts of butter or margarine on bread, toast, and rolls.
- Serve breads hot, so more butter or margarine will be absorbed. Add jelly, honey, or cream cheese foe extra calories.
- Add sugar to cereals.
- Top pancakes and waffles with whipped cream, syrup (not maple), and add extra butter or margarine.
- Add frosting to cakes and cookies.



3. INCREASE YOUR APPETITE

- Find which time of the day your appetite is best and eat your largest meal then.
- Increasing your activity may help increase your appetite.
- Use seasonings such as lemon juice, mint, basil, dill, and other spices to improve the smell and flavor of food.
- Vary the color and textures of foods served on your plate. Use garnishes to make your meals look more appetizing.
- Make meal time an enjoyable time. Eat with your family or friends, listen to enjoyable music, or dine out.
- Motivate yourself to eat by thinking how much stronger you will feel.

Adapted from: Nutrition: The Art of Good Eating by K. Wilkens, and K. Schiro, Northwest Kidney Foundation; Seattle, WA; 1989.



MENU PLANNING AND RENAL DIETS

Planning menus for renal diets can be challenging when trying to balance all parts of your diet prescription. Most people enjoy a diet which contains a variety of food flavors, colors, and textures. This is still possible with a renal diet.

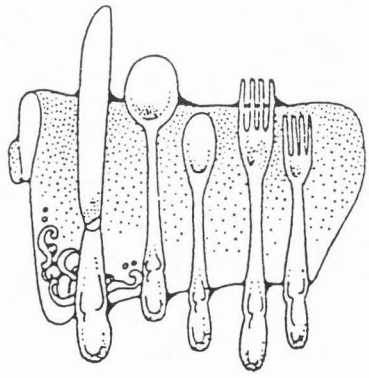
Start with these basic guidelines for a general healthy diet.

- Have a meat or meat substitute at each meal.
- Enjoy several servings of bread or starch at each meal.
- Include at least 4 servings of allowed fruits and vegetables every day.
- Use dairy products as allowed.

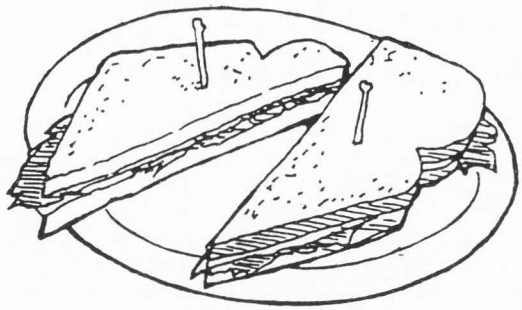
To make your meal look more appetizing, try these suggestions.

- Avoid serving a plate of food which is all the same color. (rice, chicken, cauliflower, roll)
- Use garnishes (lettuce leaf, parsley, mint leaves, etc.) to make your plate look more attractive.
- Use a variety of textures - avoid all soft or all hard foods.

Here is a week's worth of menus to get you started. Sample menus for diabetics follow.



SEVEN-DAY MEAL PLAN



Sometimes it can be confusing organizing all the different parts of your diet. Below is an example of a week's meals to show you that it **can** be done! It contains approximately 3,000 mg. sodium, 2,500 mg. potassium 1,200 mg. phosphorus, 2,300 calories, and 85 gm. protein per day.

Day 1

Morning
2 fried eggs
1 slice toast with margarine & jelly
1 c. oatmeal with margarine and
1/4 c. half-and half
1/2 grapefruit

Noon
Sandwich
- 3 oz. chicken
- 2 slices bread
- 2 Tbsp. mayonnaise
- 1 lettuce leaf

1 c. fruit cocktail

Snack
3 shortbread cookies

Evening
4 oz. meatloaf with gravy
1 c. rice with margarine
1/2 c broccoli
1 c. Jello with whipped topping

Day 2

Morning
3 scrambled eggs
1/2 English muffin with margarine
1 c. cream of wheat with sugar and
1/4 c. half-and-half
1/2 c. cranberry juice

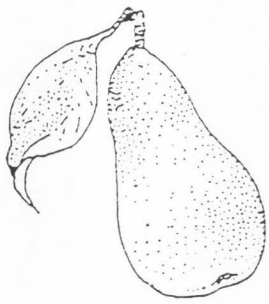
Noon
Sandwich
3 oz. meatloaf
2 slices bread
1 Tbsp. mayonnaise
1 lettuce leaf
1/2 c. berries with whipped topping
1/2 c. ice cream

Snack
3 ginger snaps

Evening
4 oz. pork chop
1/2 c. scalloped potatoes
1/2 c. mixed vegetables
1 c. tossed green salad with French dressing
1/2 c. ice cream

Day 3

Morning
2 slices French toast with margarine and syrup
1/2 c. apple juice
1/2 c. cream of rice with
1/4 c. half-and-half



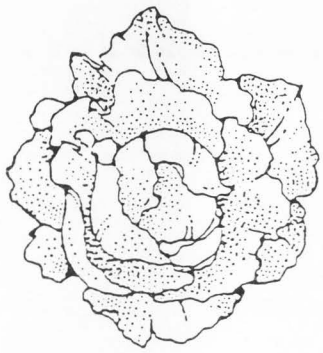
Noon
Sandwich
3 oz. pork shop (sliced)
2 slices bread
1 Tbsp. mayonnaise
1 lettuce leaf
1/2 c. low-sodium soup (or homemade)
1 c. pear slices

Snack
3/4 c. lemon pudding

Evening
Spaghetti
1 c. meat sauce (use lots of meat!)
1 c. noodles with melted margarine or butter
1 slice French bread with margarine
1 c. tossed green salad with oil and vinegar dressing
1 c. sherbet

Day 4

Morning
2 soft-boiled eggs
1 c. oatmeal with margarine and
1/4 c. half-and-half
1 slice toast with margarine & jelly
1/2 c. grape juice



Noon
Fruit salad
- 1/3 c. cottage cheese
- 1/2 c. canned peaches
- 1 fresh strawberries
- 3 melon balls
- 1/2 banana

1 slice toast with margarine

Snack
3/4 c. lemon pudding

Evening
6 oz. fish (breaded and fried)
1 c. rice with margarine
1/2 c. green beans
1/2 c. cole slaw
3 shortbread cookies

Day 5

Morning
2 poached eggs
1 slice toast with margarine & jelly
1 c. cream of rice with margarine and
- 1/4 c. half-and-half

1/2 grapefruit

Noon
Sandwich
- 2 eggs with mayonnaise (egg salad)
- 2 slices bread
- 1 lettuce leaf

1/2 c. low-sodium soup (or homemade)
1/2 c. canned peaches

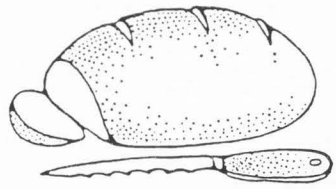
Snack
1 slice gingerbread with whipped topping

Evening
2 c. beef stew
4 oz. meat
2 carrots
1 stalk celery, 1 slice onion
1 dinner roll with margarine
1 c. tossed green salad with dressing
1 c. sherbet

Day 6

Morning
2 egg omelet with
1/4 cup grated cheese
1 Tbsp. diced onion
2 sliced mushrooms
1 English muffin with jelly
1/2 c. grape juice

Noon
1 c. leftover beef stew
1 slice bread with margarine
1 c. Jello and pineapple
1 frosted cupcake



Snack
1 apple

Evening
2 pieces fried chicken
1/2 c. potato salad
1 dinner roll with margarine
1 slice gingerbread with whipped topping

Day 7

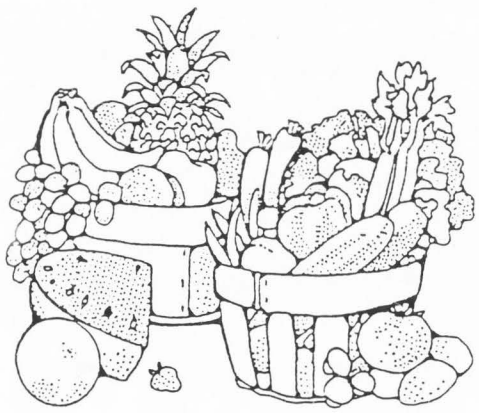
Morning
1/2 c. cranberry juice
2 fried eggs
1 slice toast with margarine or jelly
3/4 c. shredded wheat with 1/2 c. half-and-half

Noon
Sandwich
- 1/2 c. tuna, rinsed
- 2 Tbsp. mayonnaise
- 1 slice Swiss cheese
- 2 slices bread
- 1 lettuce leaf

3 carrot sticks
8 apple slices

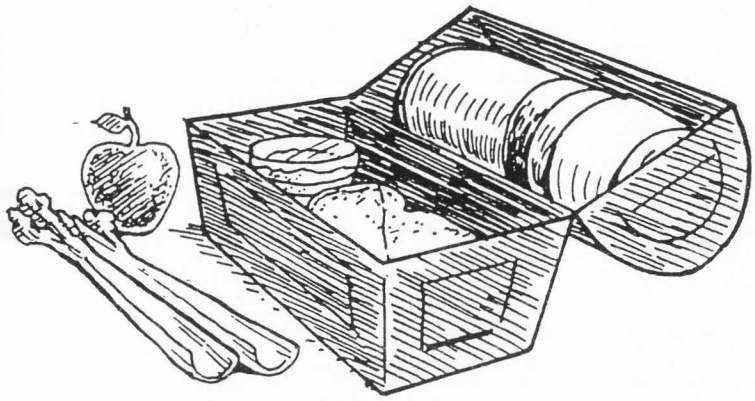
Snack
1 roll with butter & jelly

Evening
3 slices roast beef
1/2 baked potato with sour cream and butter
1/2 c. green beans
1 c. tossed green salad with dressing
1 frosted cupcake



From: Wilkins, K. and Schiro, K. Nutrition: The Art of Good Eating - 3rd edition. Northwest Kidney Foundation Seattle, 1989.

SEVEN-DAY MEAL PLAN FOR DIABETICS



Sometimes it can be confusing organizing all the different parts of your diet. Below is an example of a week's meals to show you that it **can** be done! It contains approximately 3,000 mg. sodium, 2,500 mg. potassium, 1,200 mg. phosphorus, 2,300 calories, and 85 gm. protein per day.

Day 1

Morning
2 fried eggs
2 slices toast with margarine
1/2 grapefruit

Snack
2 graham crackers with cream cheese

Noon
Sandwich
- 3 oz. chicken
- 2 slices bread
- 2 Tbsp. mayonnaise
- 1 lettuce leaf

1 c. milk

Snack
1/2 c. applesauce

Evening
6 oz. meatloaf
1 c. rice with margarine
1/2 c. corn
1 c. Jello (regular is o.k.) with whipped topping
1 slice bread with margarine

Snack
3 vanilla wafers
1/2 banana

Day 2

Morning
2 scrambled eggs
1/2 c. cream of wheat with 1/2 c. milk
1/2 c. apple juice

Snack
1/2 English muffin with peanut butter

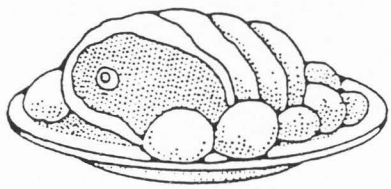
Noon
Sandwich
- 3 oz. meatloaf
- 2 slices bread
- 1 Tbsp. mayonnaise
- 1 lettuce leaf

1/2 c. berries (fresh or frozen) with
1/2 c. plain yogurt

Snack
1 slice angel food cake

Evening
6 oz. pork chop
1/2 c. scalloped potatoes
1/2 c. spinach
1 c. tossed green salad with dressing
1 slice bread with margarine
1 c. fruit cocktail (juice pack)

Snack
3 ginger snaps



Day 3

Morning
2 slices French toast with margarine
and sugar-free syrup
1/2 c. apple juice

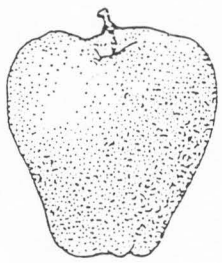
Snack
Hard boiled egg with mayonnaise

Noon
Sandwich
3 oz. pork chop (sliced)
2 slices bread
1 Tbsp. mayonnaise
1 lettuce leaf
1/2 c. low sodium soup (or homemade)

Snack
1/2 c. low calorie lemon pudding

Evening
Spaghetti
1 c. meat sauce (use lots of meat!)
1 1/2 c. noodles
1 slice French bread with margarine
1 c. tossed green salad with dressing

Snack
1 apple
1/2 c. milk



Day 4

Morning
2 poached eggs
1 slice toast with margarine
1/2 c. grape juice

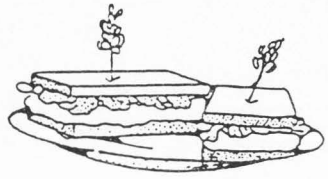
Snack
1/4 c. granola with 1/2 c. milk

Noon
Fruit salad
1/3 c. cottage cheese
1/2 c. canned peaches (juice pack)
2 fresh strawberries
3 melon balls
1/2 banana
2 slices toast with margarine

Snack
1/2 c. low calorie lemon pudding

Evening
6 oz. fish
1 c. rice with margarine
1/2 c. green beans
1/2 c. cole slaw
1 slice bread with margarine
1/2 c. low calorie apple crisp (made with sugar substitute)

Snack
3 ginger snaps



Day 5

Morning
1 slice toast with margarine
1/2 c. cream of rice with 1/4 c. milk
1/2 grapefruit

Snack
2 deviled eggs

Noon
Leftover spaghetti (from Day 3)
1 slice bread with margarine

Snack
1/2 c. sliced peaches (juice pack)

Evening
2 c. homemade beef stew
- 6 oz. meat
- 2 carrots
- 1 stalk celery
- 1 slice onion

Dinner roll with margarine
Tossed green salad with dressing
1 slice angel food cake

Snack
1/2 c. low calorie apple crisp (made with sugar substitute)
1/2 c. milk

Day 6

Morning
2 egg omelet with
1/4 c. grated cheese
1 Tbsp. diced onion
2 sliced mushrooms
1 English muffin with margarine

Snack
1/2 c. applesauce

Noon
1 c. leftover stew
1 slice bread with margarine
1/2 c. pineapple

Snack
3 vanilla wafers

Evening
2 pieces fried chicken
1/2 c. potato salad
Dinner roll with margarine
1/2 c. canned peas
1 slice angel food cake

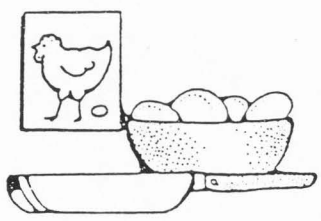
Snack
1/2 c. sliced peaches
1/2 c. plain yogurt

Day 7

Morning
1/2 c. cranberry juice
2 fried eggs
1 slice toast with margarine or butter

Snack
3/4 c. shredded wheat with 1/2 c. milk

Noon
Sandwich
1/4 c. tuna, rinsed
2 Tbsp. mayonnaise
1 slice Swiss cheese
2 slices bread
1 lettuce leaf
3 carrot sticks



Snack
1 apple
2 graham crackers

Evening
3 slices roast beef
1/2 baked potato with sour cream
and margarine
1/2 c. green beans
1 c. tossed green salad with French dressing

Snack
1 roll with margarine

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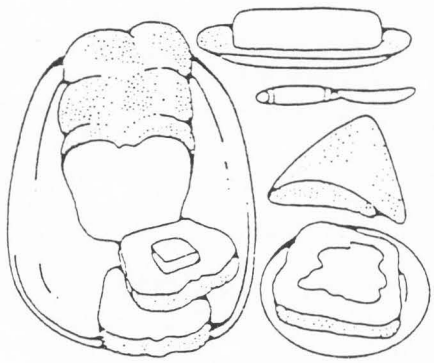
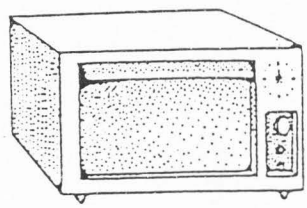
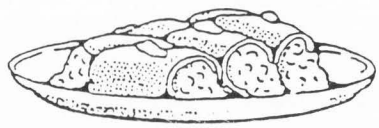


USING CONVENIENCE FOODS

Today's supermarkets are full of prepackaged, easy to prepare convenience foods. However, many of these foods are high in potassium and contain very large amounts of sodium.

Frozen dinners have become very popular because they greatly simplify meal preparation. The following nutrient information is provided by the manufacturers of "Healthy Choice Dinners" and "Right Course Entrees" to help consumers who use these products. Many other brands contain twice as much potassium and 3-5 times as much sodium. Always check the label for the sodium content when using convenience foods and choose frozen dinners which contain low potassium foods.





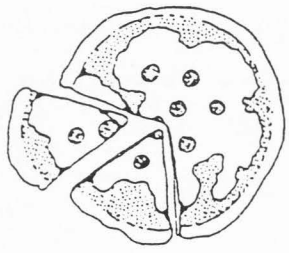
NUTRITIONAL ANALYSIS

Thanks to Marilyn Gammarino, R.D., Shady Grove Dialysis Center, Rockville, Maryland here is a complete nutrient analysis of Healthy Choice™ Dinners. For the diabetic exchanges, call the phone number listed below.

Dinner	Kcals	Pro (gm)	CHO (gm)	Fat (gm)	Na^+ (mg)	K^+ (mg)
Chicken Oriental	220	21	31	2	460	450
Shrimp Creole	210	8	42	1	560	420
Sweet & Sour Chicken	260	22	44	2	260	480
Breast of Turkey	290	21	39	5	420	550
Oriental Pepper Steak	290	24	35	6	530	390
Sirloin Tips	290	25	33	6	350	540
Sole Au Gratin	270	16	40	5	470	430
Chicken Parmigiana	280	23	38	3	310	620
Salisbury Steak	300	19	41	7	480	620
Chicken & Pasta Divan	310	23	45	4	510	440

**HEALTHY CHOICE™ Dinners
1-800-323-9980 1:00-9:00 p.m. (Central Time Zone)

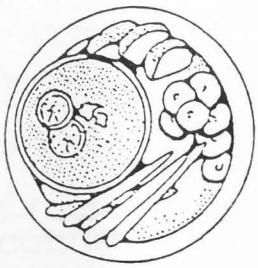
Con Agra® Frozen Foods
Ballwin, Missouri 63022-0070



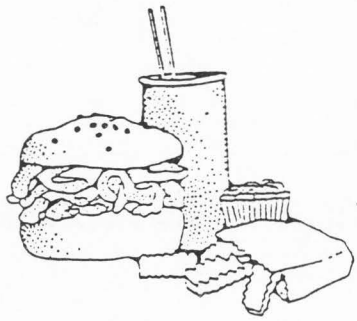
Right Course Entrees™ by Stouffer

Entree	Serving Size (oz.)	Calories	Protein (g)	Carbo-hydrate (g)	Fat (g)	Chol-esterol (mg)	Sodium (mg)	Pot-assium (mg)
Beef Dijon with Pasta & Vegetables	9-1/2	290	20	31	9	40	580	270
Beef Ragout with Rice Pilaf	10	300	19	38	8	50	550	320
Chicken Tenderloins in Barbeque Sauce with Rice Pilaf	8-3/4	270	20	35	6	40	590	590
Chicken Tenderloins in Peanut Sauce with Linguini and Vegetables	9-1/4	330	27	32	10	50	570	470
Chicken Italiano with Fettucini and Vegetables	9-5/8	280	24	29	8	45	560	520
Fiesta Beef with Corn Pasta	8-7/8	270	18	33	7	30	590	430
Homestyle Pot Roast	9-1/4	220	17	22	7	35	550	480
Sesame Chicken	10	320	25	34	9	50	590	400
Sliced Turkey in a Mild Curry Sauce with Rice Pilaf	8-3/4	320	23	40	8	50	570	550
Shrimp Primavera	9-5/8	240	12	32	7	50	590	150
Vegetarian Chili	9-3/4	280	9	45	7	0	590	600

Reference: CRN Quarterly, 1990, Vol. 14, No. 1.



DINING OUT ON A RENAL DIET



Kidney disease has probably caused you to make many changes in your life. Following a renal diet may be the biggest change you have had to make. Eating away from home is a normal part of everyday life. It gives you a chance to relax, visit with other people, and enjoy yourself. Don't let your special diet keep you from going out. Go out and enjoy! Dining out on a renal diet is possible if you keep the following guidelines in mind.

- If possible, decide exactly what you will eat before you go out. Call ahead to see if the restaurant will prepare special menu items for you. If you know you are eating out ahead of time, cut back on your serving sizes earlier in the day to avoid eating too much.
- Choose restaurants that serve a wide variety of foods. Your best choices are steak and seafood restaurants, family style restaurants and cafeterias.
- If servings are too large, ask for a "doggie bag". You can take the extra food home for lunch the next day.
- Four ounces of "raw" meat is equal to 3 ounces cooked meat. Three ounces of meat is about the size of a deck of playing cards.
- Ask for foods prepared without salt. Many people are health conscious and make special requests at restaurants. Ask how foods are prepared if you are not sure. Remember, you are paying to be served.
- Order salads and sandwiches without pickles, cheese, bacon, catsup or mustard. Bring your own low-sodium condiments from home, or ask them to be served on the side so you can use them sparingly. Do ask for lettuce, onion, and a slice of tomato. Oil and vinegar make a good low-sodium salad dressing.

- Avoid soups, stews, and casseroles. They are usually high in sodium.

- Remove the breading on fried foods to decrease the amount of sodium.

- If entrees are served with a baked potato, ask for a lower potassium substitute such as noodles or rice.

- It is best to avoid French fries because they are high in potassium and sodium. If you do order them, eat only half of a small serving.

- Select a small sized beverage with no refills. Avoid bottomless cups of coffee and the free refill offers on soda. Ask the server to remove your drinking glasses at the end of the meal so you will not be tempted to drink too much.

- Average glass sizes are as follows:

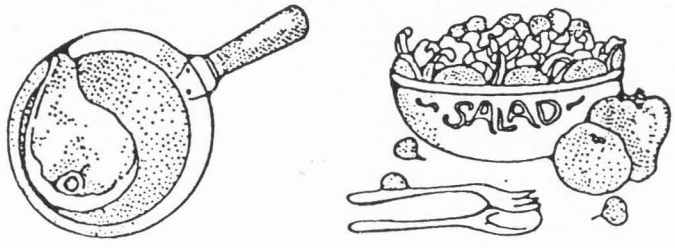
wine glass	4 oz (1/2 cup)
coffee cup	6 oz (3/4 cup)
coffee mug	8 oz (1 cup)
small juice glass	4 oz (1/2 cup)
water glass	8 oz (1 cup)

- Alcoholic beverages are generally low in potassium except for drinks made with high potassium mixers such as tomato juice or orange juice.

Here are some tips to help you make wise decisions at different types of restaurants.

AMERICAN

American family-style restaurants are probably the easiest place to eat outside your own home. They usually offer plenty of variety. Just remember to watch portion sizes. Ask for unsalted meats without gravy and order fruits and vegetables which are allowed on your diet. Bread, dinner rolls, and melba toast should be eaten in place of salted crackers. Have rice or noodles in place of potatoes. Most desserts are fine with the exception of those containing chocolate, lots of nuts (like pecan pie), coconut, milk shakes, and high-potassium fruits.



MEXICAN

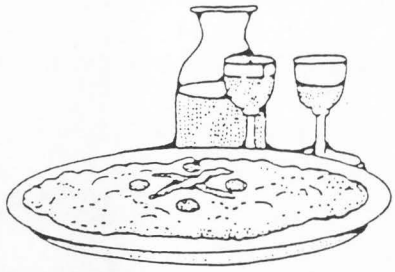
Many Mexican foods contain low quality protein and are high in sodium, potassium and phosphorus. It is best to order from the a la carte menu. Avoid the refried beans and limit the tomato and guacamole sauces. Two tablespoons of tomato chili sauce will add an extra 100 mg of potassium to your diet. So you probably should not exceed this amount. Cheese toppings also increase the sodium and phosphorus in your diet. Ask for unsalted meats and unsalted nacho chips. A good choice would be a taco with meat and lettuce and plain rice.

ORIENTAL

Oriental dishes are cooked with many high sodium ingredients. Ask for your food to be prepared without salt, monosodium glutamate (MSG), soy sauce, or fish sauce. If your food needs more flavor, add a small amount (less than one teaspoon) of hot mustard or sweet and sour sauce. Do not add extra soy sauce because there is 1000 mg of sodium in one tablespoon full! Choose dishes containing vegetables you are allowed. Steamed rice is much lower in sodium than fried rice. Steer you chopsticks away from tofu (high in phosphorus) and skip the soup.

ITALIAN

Pasta is an excellent food for the renal diet. But, beware of the sauces! Italian sauces should be use in small quantities because they are high in sodium and phosphorus. Order sauces on the side so you can control the amount you eat. White sauces and butter sauces have less potassium than the red tomato (marinara) sauces.

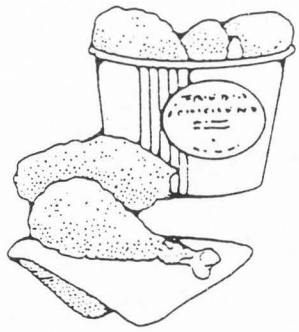


Tomato sauce should be limited to 1/4 cup. Avoid adding extra cheese (high in sodium). A good choice would be a tossed salad, French bread, or unsalted garlic bread, and a plain pasta dish. Order fettuccine alfredo, manicotti (take off the extra tomato sauce), steak, meatballs made without sausage, or seafood. Avoid lasagna and dishes containing ham, sausage and olives.

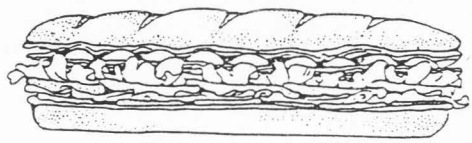
Of course pizza is high in sodium and potassium, but you can enjoy it if you take a few precautions. Order pizza with hamburger, green pepper, and/or onions instead of one with pepperoni, sausage, olives, anchovies, and/or extra cheese. Limit yourself to a piece the size of your hand and fill up with a nice salad and plain bread sticks, or dessert.

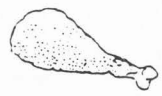
FAST FOOD

Eating out at fast food restaurants can be more challenging and takes careful planning. Many fast food items are pre-salted, but you can ask for salty condiments to be left off. Choose a small sized, non-cola soda instead of a milk shake or a large sized soda. Small plain sandwiches or salad bars usually make good choices. See the following tables for nutrient breakdowns of foods provided by specific fast food restaurants.



	Energy Kcal	Pro (gms)	Fat (gms)	Carb (gms)	Chol (mg)	Sodium (mg)	Potas-sium (mg)	Phos-phorus (mg)
Arby's								
Sandwiches								
Beef 'N Cheddar	459	27.5	26.0	42.8	60	1224		
Club Sandwich	572	30.6	30.6	43.9	102	1607		
Ham & Cheese	355	21.5	15.7	30.7	62	1357		
Junior Roast Beef	225	12.2	9.2	21.4	34	531		
Regular Roast Beef	347	21.7	14.9	31.6	43	879		
Super Roast Beef	685	33.2	30.7	67.2	83	1424		
Turkey Deluxe	492	26.8	23.2	44.2	72	1218		
Burger King								
Sandwiches								
Dbl cheeseburger, w/bac	594	34.6	34.6	35.6		976	446	535
Dbl cheeseburger	523	32.2	28.2	35.2		871	403	513
Cheeseburger	360	18.0	16.0	35.0		705	250	310
Chicken	685	25.8	41.7	51.6		724	199	321
Ham & Cheese	547	28.9	29.9	42.8		1542	448	483
Dbl hamburger	424	25.6	20.7	34.5		577	197	583
Hamburger	310	16.0	12.0	35.0		560	150	300
Veal Parmagiana	579	35.9	26.9	45.9		803	349	264
Whaler	540	24.0	24.0	57.0		745	250	150
Whaler w/cheese	589	26.0	28.0	57.9		884	350	160
Whopper Junior	370	16.0	18.0	35.0		545	150	345
Whopper Jr. w/cheese	419	19.0	21.0	35.0		737	250	355
Whopper	669	27.0	38.0	56.0		974	250	644
Whopper w/cheese	761	33.0	45.1	56.1		1261	451	666
Dbl Whopper w/cheese	975	50.7	65.3	60.7		1289	597	1005
Dbl cheeseburger	523	32.2	28.2	35.2		871	403	513
Other								
Apple Pie	328	3.0	13.9	47.8		383	20	100
French Fries	210	3.0	11.0	25.0		230		380
Onion Rings	271	3.0	16.0	29.1		451	60	140
Kentucky Fried Chicken								
Orig. Recipe 9 pcs	1849	147.8	112.6	57.6	844			
Orig. Rec. Drumstick	115	11.8	6.3	2.5	62	203	93	120
Orig. Rec. Thigh	255	18.1	17.4	6.4	108	561	168	215
Orig. Rec. Wing	133	9.3	8.7	4.1	53	295	74	84
Orig. Rec. Dinner	846	53.0	46.9	57.1	291	2295		
Orig. Rec. Keel	233	23.7	12.0	7.3	86	623	202	263
X-Crispy Dinner	955	52.1	54.2	63.1	74	1920		

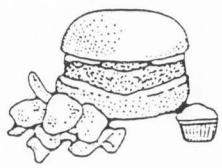




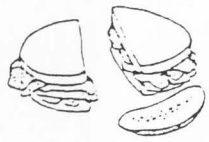
	Energy Kcal	Pro (gms)	Fat (gms)	Carb (gms)	Chol (mg)	Sodium (mg)	Potas-sium (mg)	Phos-phorus (mg)
Taco Bell								
Bellbeefer, w/cheese	278	19.0	12.0	23.0		330	208	195
Bellbeefer	220	14.9	7.0	22.9		230	139	182
Burrito, Supreme	452	20.8	21.8	42.6		362	243	347
Burrito, Bean	340	10.7	11.7	47.4		269	172	233
Burrito, Beef	464	29.8	20.9	36.7		326	287	318
Burrito, Combination	403	20.6	15.9	42.9		299	229	277
Enchirito	449	24.7	20.6	41.5		1162	334	486
Pintos 'N Cheese	167	10.9	5.0	20.9		102	209	305
Taco	183	14.8	7.9	13.7		78	172	141
Tostada, Beefy	289	18.9	14.9	20.9		138	263	275
Tostada	177	8.9	5.9	24.7		100	184	170
McDonald's								
Breakfast								
Biscuit w/bac, egg, cheese	483	16.4	31.5	33.1	262	1269	463	232
Biscuit w/sausage	467	12.1	30.9	35.3	48	1147	353	231
Biscuit w/sausage,egg	585	19.8	39.7	36.2	285	1302	476	312
Biscuit w/spread	287	4.9	18.2	36.6	9	789		
Biscuit, plain	330	4.8	18.1	36.5	9	785	300	108
Cheese danish, iced	395	7.4	21.7	42.3	48	424		
Apple danish	389	5.8	17.9	51.2	26	368		
Cinn Raisin Danish	445	6.4	21.0	57.5	35	430		
Raspberry Danish	414	6.1	15.9	61.5	27	308		
Egg McMuffin	337	18.2	15.5	30.8	257	878	319	167
Sausage McMuffin	423	17.4	26.0	29.8	58	1002	185	213
Sausage McMuffin w/egg	513	22.6	32.6	32.0	285	1036	285	292
Sausage	206	9.6	18.3	0.6	38	415	94	125
Scrambled Eggs	180	13.2	13.0	2.5	514	205	264	135
English Muffin	183	4.9	5.1	29.1	15	305	73	69
Hash Brown Potatoes	125	1.5	7.0	14.0	7	325	67	247
Pancake/bttr/syrup	501	7.9	10.3	93.9	47	1070	501	187
Sandwiches								
Big Mac	570	24.6	35.0	39.2	83	980	274	354
Hamburger	264	12.3	11.3	28.3	29	508	117	20
Cheeseburger	315	14.8	15.8	28.3	40	736	185	206
Filet-o-Fish	432	14.6	25.6	35.6	45	794	247	250
McDLT	681	30.0	43.9	39.9	101	1030		
McRIB	459	26.3	19.9	43.4	51	1015	237	
Qtr. Pounder	427	24.5	23.4	29.1	81	718	200	368
Qtr. Pounder w/cheese	525	29.4	31.6	30.3	107	1220	337	387

	Energy Kcal	Pro (gms)	Fat (gms)	Carb (gms)	Chol (mg)	Sodium (mg)	Potas-sium (mg)	Phos-phorus (mg)
Chicken McNuggets & Sauces								
Chicken McNuggets	323	19.1	21.3	13.7	73	511	283	302
Barbecue sauce	30	0.2	0.2	6.9	0	156	5	37
Hot Mustard sauce	32	0.3	1.1	5.3	1	130	7	11
Sweet & Sour sauce	32	0.1	0.2	7.5	0	94	2	20
Salad Items								
Chef Salad	226	21.0	13.1	5.7	125	853		
Chicken Oriental Salad	146	23.0	3.9	4.8	92	266		
Garden Salad	91	6.1	5.5	4.3	110	102		
Shrimp Salad	101	13.9	2.6	4.5	187	571		
Side Salad	48	3.4	2.6	2.6	17	43		
Croutons	52	1.4	2.2	6.8	0	138		
Bacon Bits	15	1.5	1.0	0.0	3	89		
Other								
French Fries	220	3.0	11.4	26.1	9	109	101	564
Apple pie	253	1.9	14.2	29.2	13	398	27	39
Cherry Pie	257	1.9	13.5	31.8	13	422	27	38
Chocolaty Chip Cookies	337	4.1	16.0	44.1	18	309	106	168
Hot Fudge Sundae	308	7.0	10.6	46.0	18	174	235	407
Caramel Sundae	328	7.2	9.8	52.5	26	195	230	336
Strawberry Sundae	287	6.5	8.6	45.8	20	96	179	289
Ice Cream Cone	182	4.2	5.1	29.9	23	108	158	180
McDonaldland cookies	309	4.2	10.8	48.6	10	358	74	52
Chocolate Shake	381	9.9	8.7	59.7	29	300	335	582
Strawberry Shake	363	8.7	8.7	61.8	32	206	313	423
Vanilla Shake	352	9.3	8.4	59.7	32	201	314	422

Wendy's

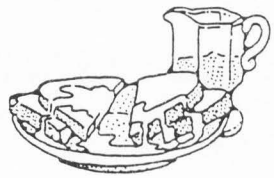


Sandwiches								
Hamburger, Single	472	25.6	26.0	33.4	68	774	238	444
Hamburger, Dbl	667	44.0	39.2	33.5	125	977	364	809
Hamburger, Trpl	830	62.3	50.0	31.9	200	1183	511	1117
Cheeseburger	576	32.6	34.3	33.8	89	1085	314	552
Cheeseburger, Dbl	796	49.7	48.1	41.0	156	1414	488	865
Cheeseburger, Trpl	1036	71.2	67.2	35.2	224	1848	712	1080
Chicken	317	24.8	9.9	30.7	58	495		317
Baked Potato and Potato Entrees								
Potato, Bac/Chez	579	19.3	30.1	57.9	22	1197		1400
Potato, Broc/Chez	493	12.8	24.6	53.2	22	423		1528
Potato, Cheese	599	17.2	34.5	55.8	22	457		1400
Potato, Chic Ala King	350	14.6	6.0	59.0	20	820		1549
Potato, Chili/Chez	510	22.0	20.0	63.0	22	610		1590
Potato, Plain	250	6.0	2.0	51.8	0	60		1360
Potato, Sr Crm/chive	441	5.7	23.0	50.9	14	221		1362
Potato, Strog/Sr Crm	488	13.9	20.9	59.8	43	907		1912
French Fries	328	5.2	15.7	41.0	6	113	196	786



	Energy Kcal	Pro (gms)	Fat (gms)	Carb (gms)	Chol (mg)	Sodium (mg)	Potas-sium (mg)	Phos-phorus (mg)
Breakfast								
Breakfast sandwich	369	17.0	19.0	32.9	200	769		155
Omelet #1 Ham/Chez	249	17.9	16.9	6.0	447	402		179
Omelet #2 Ham/Chez Mushroom	288	17.9	20.9	6.9	357	567	0	189
Omelet #3 Ham/Chez Mush/Pepper	277	18.8	18.8	6.9	519	480		198
Omelet #4 Mush/On Pepper	209	13.9	14.8	6.9	458	199		189
Other								
Pasta Salad	267	8.0	12.0	34.0		800		170
Taco Salad	388	22.9	17.9	35.8	40	1096		787
Chili	228	19.5	7.5	20.8	25	1065	168	763
Frosty	393	8.5	16.0	53.3	45	248	278	475

From: Computrition, Inc. 1989. Nutrient Analysis Database

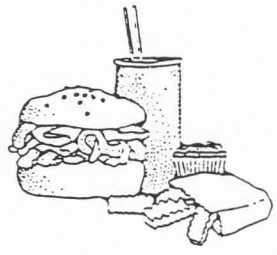


Hardee's

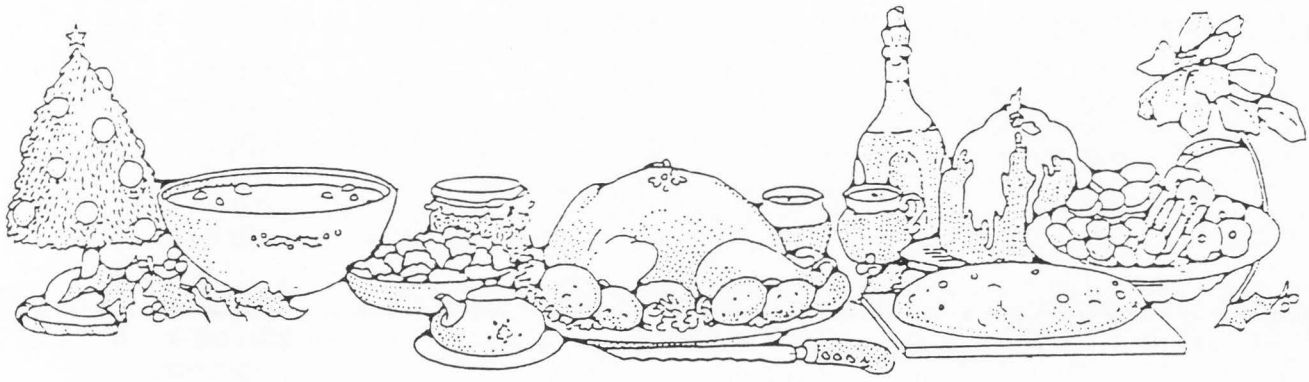
Breakfast								
Rise 'N Shine Biscuit	320	5	18	34	0	740		80
Cinnamon 'N Raisin	320	4	17	37	0	510		80
Sausage Biscuit	490	13	28	34	25	1100		190
Sausage & Egg Biscuit	490	18	31	35	170	1150		240
Bacon Biscuit	360	10	21	34	10	950		140
Bacon & Egg Biscuit	410	15	24	35	155	990		180
Bacon, Egg & Cheese	460	17	28	35	165	1220		200
Ham Biscuit	320	10	16	34	15	1000		170
Ham & Egg Biscuit	370	15	19	35	160	1050		210
Ham, Egg & Cheese	420	18	23	35	170	1270		230
Country Ham Biscuit	350	11	18	35	25	1550		210
Country Ham & Egg	400	16	22	35	175	1600		260
Canadian Rise 'N Shine	470	22	27	35	180	1550		280
Steak Biscuit	500	15	29	46	30	1320		240
Steak & Egg Biscuit	550	20	32	47	175	1370		280
Chicken Biscuit	430	17	22	42	45	1330		260
Big Country (sausage)	850	33	57	51	340	1980		670
Big Country (Bacon)	660	24	40	51	305	1540		530
Big Country (Ham)	620	28	33	51	325	1780		620
Big Country (Ctry Ham)	670	29	38	52	345	2870		710
Hash Rounds	230	3	14	24	0	560		400
Biscuit 'N Gravy	440	9	24	45	15	1250		210
Three Pancakes	280	8	2	56	15	890		240
Pancakes & Sausage	430	16	16	56	40	1290		350
Pancakes & Bacon	350	13	9	56	25	1110		290
Syrup	120				0	25		10
Margarine/Butter blend	35	0	4	0	5	40		1

	Energy Kcal	Pro (gms)	Fat (gms)	Carb (gms)	Chol (mg)	Sodium (mg)	Potas-sium (mg)	Phos-phorus (mg)
Sandwiches								
Hamburger	270	13	10	33	20	490		200
Cheeseburger	320	16	14	33	30	710		210
Quarter-Pounder	500	29	29	34	70	1060		350
Big Deluxe	500	27	30	32	70	760		390
Bacon Cheeseburger	610	34	39	31	80	1030		460
Mushroom 'N Swiss	490	30	27	33	70	940		370
Big Twin	450	23	25	34	55	580		280
Regular Roast Beef	260	15	9	31	35	730		260
Big Roast Beef	300	18	11	32	45	880		320
Hot Ham 'N Cheese	330	23	12	32	65	1420		300
Turkey Club	390	29	16	32	70	1280		460
Fisherman's Fillet	500	23	24	49	70	1030		410
Chicken Fillet	370	19	13	44	55	1060		290
Grilled Chicken	310	24	9	34	60	890		410
All Beef Hot Dog	300	11	17	25	25	710		180
Other								
Side Salad	20	2		1	0	15		170
Garden Salad	210	14	14	3	105	270		430
Chef Salad	240	22	15	5	115	930		590
Chicken 'N Pasta	230	27	3	23	55	380		620
Chicken Stix (6)	210	19	9	13	35	680		260
Chicken Stix (9)	310	28	14	20	55	1020		390
Regular French Fries	230	3	11	30	0	85		350
Large French Fries	360	4	17	48	0	135		560
Crispy Curls	300	4	16	36	0	840		370
Shake (Vanilla)	400	13	9	66	50	320		470
Shake (Chocolate)	460	11	8	85	45	340		520
Shake (Strawberry)	440	11	8	82	40	300		380
Cool Twist Cone (Van.)	190	5	6	28	15	100		105
Cool Twist Cone (Choc)	200	4	6	31	20	65		220
Sundae (Hot Fudge)	320	7	12	45	25	270		280
Sundae (Caramel)	330	6	10	54	20	290		220
Sundae (Strawberry)	260	5	8	43	15	115		150
Apple Turnover	270	3	12	38	0	250		75
Big Cookie	250	3	13	31	5	240		45

From: Hardee's Nutrition. What's In It For You? 1990.



HOLIDAY RECIPES FOR RENAL DIETS



Molded Vegetable Relish

Serves 6.

A colorful accompaniment to your meal.

1 (3-ounce) package lemon or lime flavored gelatin
1/4 tsp salt
1 cup boiling water
3/4 cup cold water
2 TBSP white vinegar
2 tsp grated onion
dash of white pepper
3/4 cup finely chopped cabbage
3/4 cup finely chopped green pepper
2 TBSP diced pimento

1. Dissolve gelatin and salt in boiling water. Add cold water, vinegar, grated onion, and pepper. Chill until thickened.
2. Fold remaining vegetables into thickened gelatin. Pour into large mold or small individual molds. Chill until firm, about 3 hours. Unmold.

Approximate analysis per serving (1/6 recipe)

Protein:	*1.5 grams*	*Sodium:*	*142 milligrams*
Fat:	*negligible*	*Potassium*	*141 milligrams*
Carbohydrate:	*13 grams*	*Calcium:*	*14 milligrams*
Calories	*54*	*Phosphorus*	*23 milligrams*

Suggested Use in Diet: 1 serving as 1 medium potassium vegetables; change 1 regular starch to unsalted during the day. **For diabetic use** substitute one 4-serving size package sugar free gelatin for the flavored gelatin (carbohydrate 5 grams); 1/6 recipe as 1 medium potassium vegetable, change 1 regular starch to unsalted during the day.

Glazed Carrots and Apples

Serves 6.
Use as substitute for candied yams.

4 carrots, pared
4 TBSP unsalted margarine
2 TBSP water
2 medium apples, pared and sliced
2 TBSP brown sugar
1/4 tsp nutmeg
1/8 tsp marjoram

1. Cut pared carrots into matchsticks or coins.
2. Melt margarine in a heavy skillet: add water and carrots, cover and cook over low heat for 10 minutes or until carrots are just tender.
3. Add apple slices to carrots. Sprinkle with brown sugar and spices. Cover and cook until apples are tender.

Approximate analysis per serving (1/6 recipe):

Protein:	*6 grams*	*Sodium:*	*19 milligrams*
Fat:	*8 grams*	*Potassium:*	*207 milligrams*
Carbohydrate:	*15 grams*	*Calcium:*	*19 milligrams*
Calories:	*119*	*Phosphorus:*	*27 milligrams*

Suggested Use in Diet: 1 serving as 1 medium potassium vegetable. **For Diabetic use:** 1 low potassium vegetable and 1/2 medium potassium fruit.

Honey-Berry Sauce

Makes 1 1/4 cups
A tart 'n spicy cranberry sauce for your turkey dinner!

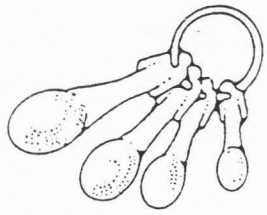
2 cups fresh cranberries
2 TBSP water
2 TBSP grated orange rind (available in jars)
1/2 tsp ground cinnamon
1/8 tsp ground cloves
1/4 tsp ground ginger
1/2 cup honey

1. Cook cranberries in water until cranberry skins pop (about 8 minutes).
2. Stir in remaining ingredients. Serve warm or cold.

Approximate analysis per 2 TBSP:

Protein	*.2 grams*	*Sodium:*	*1 milligram*
Fat:	*negligible*	*Potassium:*	*26 milligrams*
Carbohydrate:	*17 gram*	*Calcium:*	*6 milligrams*
Calories	*62*	*Phosphorus:*	*3 milligrams*

Suggested Use in Diet: use up to 3 TBSP per day free! **Diabetic use** is 2 TBSP as 1 low potassium fruit.



Creamy Corn Pudding

Makes 6 servings.
An alternative to bread stuffing.

3 TBSP unsalted margarine
3 TBSP flour
1 TBSP sugar
3/4 cup non-dairy creamer
1 (17-ounce) can unsalted cream-style corn
3 eggs

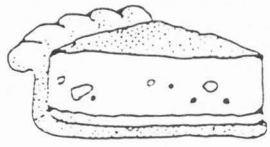
1. Melt margarine in heavy saucepan over low heat; add flour and sugar, stirring until smooth. Cook 1 minute, stirring constantly.
2. Gradually add non-dairy creamer to flour mixture; cook over medium heat, stirring constantly, until thickened and bubbly. Remove from heat, and stir in corn.
3. Beat eggs well. Gradually stir about 1/4 of hot corn mixture into beaten eggs; add to remaining hot corn mixture, stirring constantly.
4. Pour mixture into a greased 1 1/2-quart casserole that has been sprayed with no-stick vegetable coating such as Pam. Bake at 350°F for 1 hour.

Approximate analysis per serving (1/6 recipe):

Protein:	*5.1 grams*	*Sodium:*	*48 milligrams*
Fat:	*12 grams*	*Potassium:*	*184 milligrams*
Carbohydrate:	*22 grams*	*Calcium:*	*19 milligrams*
Calories:	*207*	*Phosphorus:*	*107 milligrams*

Suggested Use in Diet: 1 serving as 1/2 meat and 1 low potassium vegetable. Diabetic use is 1/2 meat, 1 low potassium vegetable, 1 low sodium starch, and 2 unsalted fat.

Apple Butter Pumpkin Pie



Yields one 9" pie.
A blending of flavors for a holiday favorite.

One 1-crust 9" pie shell, unbaked; do not prick
1 cup apple butter
1 cup canned pumpkin
1/8 tsp ginger
3/4 tsp cinnamon
3/4 tsp nutmeg
1/2 cup brown sugar
2 TBSP flour
2 eggs
1 cup hot scalded non-dairy creamer

1. Combine apple butter, pumpkin, brown sugar, flour, cinnamon, nutmeg, and ginger.
2. Stir in unbeaten eggs. Add hot scalded non-dairy creamer gradually; mix thoroughly. Pour into pie shell.
3. Bake at 425°F for 15 minutes, then at 375°F for 20-25 minutes or until mixture sets. Cool pie prior to serving.

Approximate analysis per slice (1/8 Pie):

Protein	*3.7 grams*	*Sodium:*	*202 milligrams*
Fat:	*13 grams*	*Potassium:*	*252 milligrams*

Suggested Use in Diet: 1 slice (1/8 pie) as 1 1/2 regular starch and 1 medium potassium vegetable. **Diabetic use is** 1/10 pie as 1 regular starch, 1 low potassium fruit, 1 low potassium vegetable, 1 regular fat, and 1 unsalted fat.

Burgundy Cornish Hen

Serves 4.

Richly glazed alternate to turkey or roast chicken.

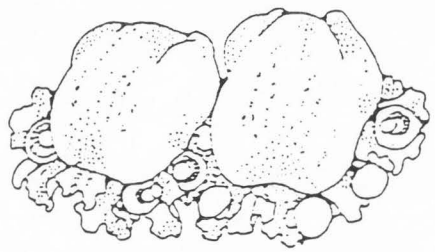
2 Cornish hens, about 1-1 1/2 lbs each
1/2 cup red Burgundy wine
1/2 cup red currant jelly
2 TBSP unsalted margarine
1 TBSP lemon juice
2 tsp cornstarch
2 tsp Worcestershire sauce
1/2 tsp ground allspice
dash of pepper

1. Rinse hens; dry. Close opening with skewer. Place breast up on rack in shallow pan. Roast loosely covered at 375°F for approximately 1 1/2 hours or until done. Uncover and baste often with Burgundy Glaze during the last hour of roasting.
2. To prepare glaze: Combine all other ingredients in a saucepan. Cook until mixture thickens and bubbles. Use to glaze hens during roasting; pass remaining as a sauce.

Approximate analysis per 1/2 hen:

Protein	*24.8 grams*	*Sodium:*	*109 milligrams*
Fat:	*12 grams*	*Potassium:*	*300 milligrams*
Carbohydrate:	*28 grams*	*Calcium:*	*25 milligrams*
Calories:	*338*	*Phosphorus:*	*176 milligrams*

Suggested Use in Diet: 1/2 hen as 3 meat. **For Diabetic Use:** substitute low sugar grape jelly for the red currant jelly (carbohydrate - 14 grams); use 1/2 hen as 3 meat and 1 low potassium fruit.



Glazed Pork Tenderloin

Yields 6-10 servings.
Boneless pork tenderloins have little waste and are easy to prepare.

2 TSBP unsalted margarine, melted
1 tsp dried whole rosemary, crushed
1 tsp dried whole thyme
1 large clove garlic, minced
2 (1-1 1/2 pound) pork tenderloins
1/3 cup orange marmalade
2 TBSP brandy

1. Combine melted margarine, rosemary, thyme, and garlic; brush tenderloins with margarine mixture. Place tenderloins, fat side up, on rack in a shallow roasting pan. Insert meat thermometer into thickest part of meat, making sure it does not touch fat. Drizzle remaining margarine mixture over meat. Bake at 375°F for 15-20 minutes.
2. Combine marmalade and brandy; brush over roast. Bake an additional 15-20 minutes or until meat thermometer registers 160°F (20-30 minutes per pound).

Approximate analysis per 3 ounce portion:

Protein:	*24.2 grams*	*Sodium:*	*58 milligrams*
Fat:	*13 grams*	*Potassium:*	*329 milligrams*
Carbohydrate:	*12 grams*	*Calcium:*	*19 milligrams*
Calories: 267		*Phosphorus:*	*243 milligrams*

Suggested Use in Diet: 3 ounces as 3 meat. **For diabetic use** substitute low sugar orange marmalade (carbohydrate - 5 grams): 3 ounces as 3 meat.

Zucchini Pancakes

Yield 15 pancakes.
A lower potassium alternative to the traditional potato latkes.

1/2 cup flour
1 cup shredded zucchini
1/4 cup finely chopped onion
2 eggs, separated
1/8 tsp pepper
Oil

1. In small bowl mix flour, zucchini, onion, pepper, and egg yolks.
2. In another bowl beat egg whites until stiff but not dry; fold into zucchini mixture.
3. Drop by heaping tablespoonfuls into about 1/4 inch hot oil in skillet and brown on both sides. Serve immediately. Top with sour cream, if desired.

Approximate analysis per pancake:

Protein:	*1.5 grams*	*Sodium:*	*81 milligrams*
Fat:	*3 grams*	*Calcium:*	*8 milligrams*
Carbohydrate:	*4 grams*	*Potassium:*	*60 milligrams*
Calories:	*34*	*Phosphorus:*	*22 milligrams*

Suggested Use in Diet: 2 pancakes as 1 regular starch and 1 low potassium vegetable. **Diabetic use** is 2 pancakes as 1/2 regular starch, 1 low potassium vegetable, 1 unsalted fat.

Lemon Rice with Vegetables
Makes 5 servings.
An elegant rice for your holiday meal.

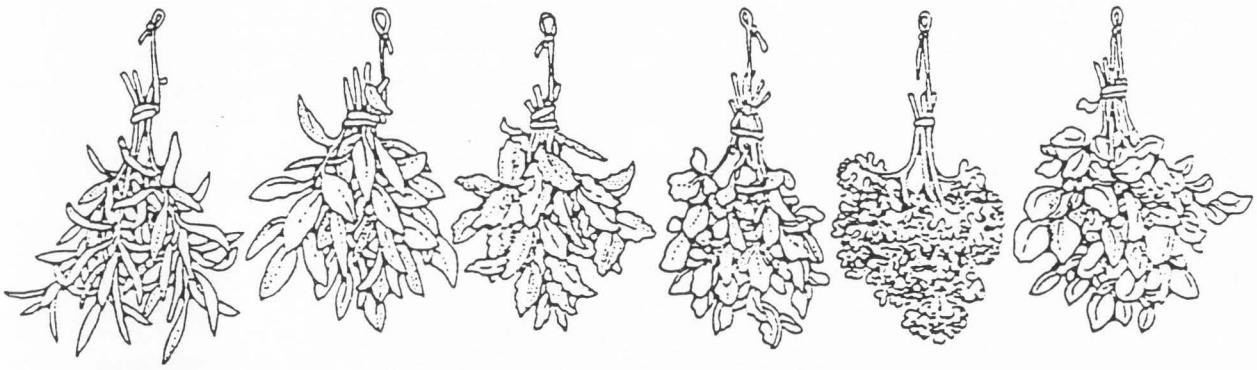
1/2 cup sliced celery
1/4 cup chopped onion
3 TBSP unsalted margarine, melted
1 1/4 cups water
1 tsp grated lemon rind
2 TBSP lemon juice
1/8 tsp dried whole thyme
dash of pepper
1/2 cup + 2 TBSP uncooked long-grain white rice
1/4 pound fresh mushrooms, thinly sliced

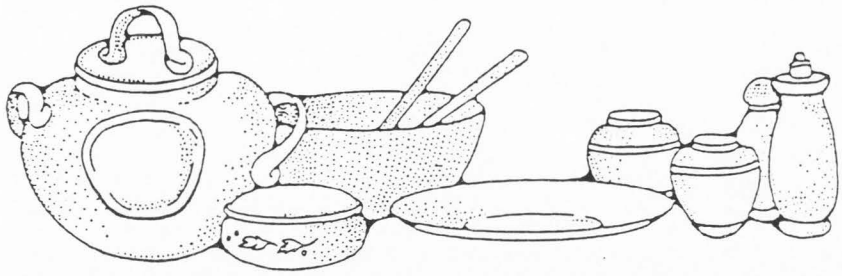
1. Saute sliced celery and chopped onion in 4 1/2 tsp melted margarine in a large skillet.
2. Stir in water, lemon rind, lemon juice, thyme, and pepper; bring mixture to a boil. Add rice; cover, reduce heat, and simmer 20 minutes or until rice is tender and liquid is absorbed.
3. Saute mushrooms in 4 1/2 tsp melted margarine in a small skillet until they are tender; drain. Add mushrooms to rice mixture; stir well.

Approximate analysis per serving, about 1/2 cup (1/5 recipe):

Protein:	*2.4 grams*	*Sodium:*	*15 milligrams*
Fat:	*6 grams*	*Potassium:*	*167 milligrams*
Carbohydrate:	*21 grams*	*Calcium:*	*17 milligrams*
Calories:	*157*	*Phosphorus:*	*58 milligrams*

Suggested Use in Diet: 1 serving as 1/2 low sodium starch and 1 medium potassium vegetable.
Diabetic Use is 1 low sodium starch, 1 medium potassium vegetable, and 1 unsalted fat.





Apple Crunch Salad

Serves 8.

Crunchy and tart with an overtone of honey.

2 unpeeled, diced Granny Smith (green) apples
2 stalks celery, thinly sliced
1/2 cup grated carrot
1/3 cup golden raisins
1/3 cup chopped toasted pecans

1. Combine apples, celery, carrot, raisins and pecans in large bowl.
2. Combine all dressing ingredients in small bowl and stir well with wire whisk.
3. Pour dressing over apple mixture; toss gently to combine. cover and chill for 2-3 hours.

Dressing:

1/2 cup sour cream
4 1/2 tsp safflower, sunflower or canola oil
2 TBSP honey
1 TBSP white wine vinegar
1 1/2 tsp Dijon mustard
1/8 tsp white pepper

Approximate analysis per serving (1/8 recipe):

Protein:	*1.3 grams*	*Sodium:*	*33 milligrams*
Fat:	*9 grams*	*Potassium:*	*201 milligrams*
Carbohydrate:	*20 grams*	*Calcium:*	*32 milligrams*
Calories:	*165*	*Phosphorus:*	*45 milligrams*

Suggested Use in Diet: 1 serving as 1 medium potassium vegetable OR 1 low potassium vegetable and 1 low potassium fruit. **Diabetic use** is 1 serving as 1 low potassium fruit, 1 low potassium vegetable and 2 unsalted fat.

Cranberry Pecan Pie

Yield one 9" pie.
A variation of a Southern classic.

1 unbaked 9" pie crust, single crust
3 eggs
1/4 cup flour
1 cup dark corn syrup
1/2 cup sugar
1 TBSP unsalted margarine, melted
1 cup cranberries, chopped
3/4 cup dried pecan halves

1. Beat eggs and flour to blend. Stir in corn syrup, sugar, and melted margarine.
2. Sprinkle cranberries over bottom of pie shell.
3. Pour egg mixture over cranberries. Top with pecan halves.
4. Bake at 325°F for 5 minutes of until set.

Approximate analysis per slice (1/8 pie):

Protein:	*5 grams*	*Sodium:*	*212 milligrams*
Fat:	*17 grams*	*Potassium:*	*90 milligrams*
Carbohydrate:	*60 grams*	*Calcium:*	*40 milligrams*
Calories:	*403*	*Phosphorus:*	*90 milligrams*

Suggested Use in Diet: 1 slice (1/8 pie) as 1/2 meat and 1/2 regular starch; change 1 regular starch to unsalted during the day. **NOT recommended for diabetic use**; try making diet raspberry gelatin with chopped cranberries and a SPRINKLING of chopped pecans.

Orange Cookies

Makes 4 1/4 dozen
A very light cookie that uses marmalade instead of sugar.

1/2 cup unsalted margarine
1 cup orange marmalade
1 tsp vanilla
1 egg
1 TBSP grated lemon rind
1/2 tsp baking soda
2 cups flour
1/4 tsp salt
1/4 cup raisins

1. Cream margarine; add marmalade, beating well at medium speed of electric mixer until light and fluffy. Add egg and vanilla; beat well.
2. Combine flour, soda, salt, and lemon rind; stir well. Add to creamed mixture, mixing well. Stir in raisins.
3. Drop dough by rounded teaspoonfuls 2-inches apart onto ungreased cookie sheets. Bake at 350°F for 12-14 minutes or until cookies are lightly browned. Let cool completely on wire rack prior to serving.

Approximate analysis per cookie:

Protein:	*.7 grams*	*Sodium:*	*21 milligrams*
Fat:	*2 grams*	*Potassium:*	*15 milligrams*
Carbohydrate:	*9 grams*	*Calcium:*	*4 milligrams*
Calories:	*54*	*Phosphorus:*	*9 milligrams*

Suggested Use in Diet: 3 cookies as 1/2 regular starch + 1/2 low sodium starch. **Diabetic use** is 3 cookies as 1 low potassium fruit, 1 regular starch, and 1 unsalted fat.

Cut-out Sugar Cookies

Makes 40 medium-sized cookies.
Holiday cookie cutters change the use of this versatile recipe.

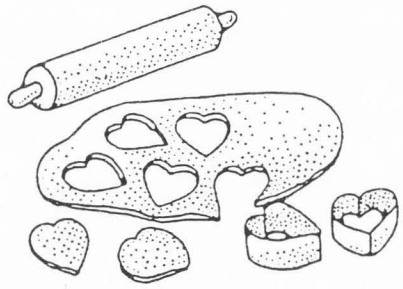
2 cups sifted flour	1 cup sugar
1 1/2 tsp baking powder	1 egg, well beaten
1/2 tsp salt	1 tsp vanilla
1/2 cup unsalted margarine	1 TBSP non-dairy creamer

1. Sift together 1 1/2 cups flour, baking powder, and salt.
2. Cream margarine; add sugar gradually and cream until light and fluffy. Add egg, vanilla, and non-dairy creamer. Add sifted dry ingredients, then gradually add remaining 1/2 cup flour until dough is still enough to handle. Chill at least 1 hour.
3. Roll 1/8 inch thick on lightly floured board and shape with floured cookie cutters. Place on ungreased cookie sheets. Sprinkle with plain or tinted sugar. Bake in 375°F oven for 8-10 minutes.

Approximate analysis per cookie:

Protein:	*.8 grams*	*Sodium:*	*40 milligrams*
Fat:	*3 grams*	*Potassium:*	*9 milligrams*
Carbohydrate:	*10 grams*	*Calcium:*	*9 milligrams*
Calories:	*63*	*Phosphorus:*	*11 milligrams*

Suggested Use in Diet: 3 cookies as 1 regular starch. **For diabetic use:** do not sprinkle tops with sugar; 4 cookies as 1 low potassium fruit, 1 regular starch, and 2 unsalted fat. (Dough can be tinted using food coloring).



No-Cook Mint Patties

Makes 44 patties.

for those who need extra calories without protein and a lot of potassium.

1/3 cup light corn syrup
1/4 cup unsalted margarine, softened
1 tsp peppermint extract (add a little more, if you prefer a mintier taste)
4 3/4 cups sifted powdered sugar
1 or 2 drops red or green food coloring (or tint per desired color)

1. In a mixing bowl combine corn syrup, margarine, and peppermint extract.
2. Add powdered sugar, about 1 cup at a time, stirring until well combined. Stir in food coloring.
3. Shape candy mixture into 1-inch balls. Place the balls 2 inches apart on a baking sheet lined with waxed paper. Gently flatten each ball with the tines of a fork or squash down with a glass covered with wax paper. Let candy stand at room temperature, about 3 hours, or until dry. Store in refrigerator in a tightly covered container.

Approximate analysis per patty:

Protein:	*negligible*	*Sodium:*	*2 milligrams*
Fat:	*1 gram*	*Potassium:*	*1 milligram*
Carbohydrate:	*13 grams*	*Calcium:*	*1 milligram*
Calories:	*58*	*Phosphorus:*	*1 milligram*

Suggested Use in Diet: use freely! **Not recommended for diabetic use.**

Easy Apple Dessert

Makes 6 servings.

Apple pie flavor with a crisp cake-like topping.

4 cups pared, sliced apples (I like using green apples)
1/4 cup sugar
1/4 tsp ground cinnamon
1 TBSP unsalted margarine
1/2 cup sugar
1 slightly beaten egg
1 tsp vanilla
1/2 cup sifted flour
1/2 tsp baking powder

1. Place apples in 8 or 9-inch pie plate that has been sprayed with no-stick vegetable coating such as Pam. Combine 1/4 cup sugar with cinnamon; sprinkle over apples. Cover with aluminum foil. Bake at 400°F for 20 minutes.
2. Cream margarine with 1/2 cup sugar, creaming well. Blend in egg and vanilla.
3. Sift together flour and baking powder. Blend into the creamed mixture. Spread mixture over the apples. Bake 20-25 minutes. Serve warm or cold. May top with non-dairy dessert topping, if desired.

Approximate analysis per serving (1/6 recipe):

Protein:	*2.2 grams*	*Sodium:*	*36 milligrams*
Fat:	*3 grams*	*Potassium:*	*105 milligrams*
Carbohydrate:	*43 grams*	*Calcium:*	*26 milligrams*
Calories:	*205*	*Phosphorus:*	*35 milligrams*

Suggested Use in Diet: 1 unsalted starch and 1 low potassium fruit. **Diabetic Use** is 1/8 recipe as 1 low sodium starch, 1 low potassium fruit, and 1/2 unsalted fat.

Red Cabbage with Pears

Serves 8.

This combines two seasonal shopping items in one dish!

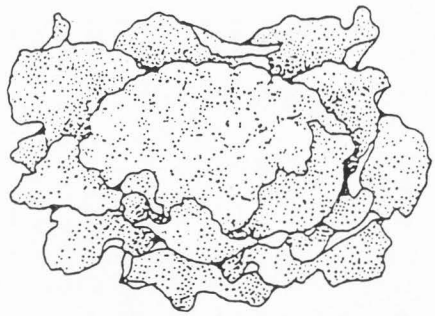
- 1 1/2 tsp oil (Sunflower, safflower, or canola)
- 2 cups coarsely shredded red cabbage
- 1/2 cup onion slices
- 1/4 cup water
- 2 TBSP cider vinegar
- 2 TBSP brown sugar
- 1 cup sliced, pared pears

1. Heat oil in large skillet. Add cabbage and onion; cook and stir over medium heat for 5 minutes.
2. Add water, vinegar, and brown sugar to cabbage; mix well. Cover; simmer for 15 minutes.
3. Add pears and bring mixture to a boil. Cook until pears are heated through. Serve hot.

Approximate analysis per serving (1/8 recipe):

Protein:	*.8 grams*	*Sodium:*	*8 milligrams*
Fat:	*2 grams*	*Potassium:*	*178 milligrams*
Carbohydrate:	*17 grams*	*Calcium:*	*32 milligrams*
Calories:	*81*	*Phosphorus:*	*26 milligrams*

Suggested use in Diet: 1 serving as 1 medium potassium vegetable or as 1 low potassium vegetable + 1 low potassium fruit. **Diabetic Use** is 1 serving as 1 medium potassium fruit (due to total carbohydrate) and 1/2 unsalted fat.



Cauliflower in Mustard Sauce

Serves 4.
Tasty and simple to make.

2 tsp Dijon mustard
1 tsp honey
1 TBSP + 2 tsp white-wine vinegar
2 TBSP olive oil
Dash black pepper
2 cups cauliflower flowerettes

1. Whisk together the mustard and honey; whisk in the vinegar and then the olive oil. Season with some black pepper. Set aside.
2. Add the cauliflower to boiling water and cook until tender. Drain well.
3. Toss the drained, cooked cauliflower with the dressing. Dan be served hot or cold as a salad.

Approximate analysis per 1/2 cup serving (1/4 recipe):

Protein:	*1.3 grams*	*Sodium:*	*37 milligrams*
Fat:	*7 grams*	*Potassium:*	*208 milligrams*
Carbohydrate:	*5 grams*	*Calcium:*	*20 milligrams*
Calories:	*82*	*Phosphorus:*	*24 milligrams*

Suggested Use in Diet: 1/2 cup as 1 medium potassium vegetable. **Diabetic Use**: 1/2 cup as 1 medium potassium vegetable and 1 unsalted fat.

Cranberry Meat Sauce

Makes 1 pint.
Serve with poultry or pork.

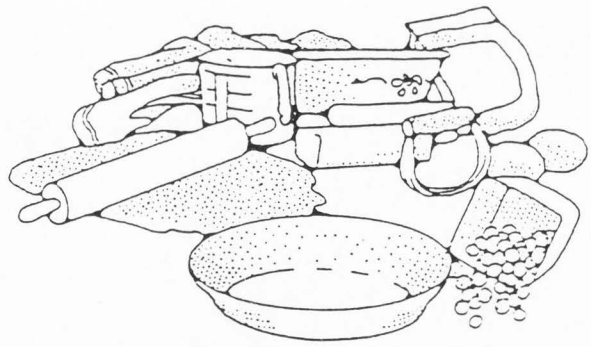
4 cups fresh or frozen cranberries
1/2 cup finely chopped onion
3/4 cup white sugar
1/2 cup water
3/4 tsp each - ground cloves, ground cinnamon, and ground allspice
1/4 tsp pepper
1/2 cup white distilled vinegar

1. In large sauce pan combine cranberries, onion, and water. Bring to boil; then cover and simmer for 10 minutes. Puree the mixture in a blender or food processor.
2. Combine the cranberry puree with remaining ingredients. Bring to boil; simmer uncovered for 15-20 minutes. Stir to prevent sticking. Remove from heat and skim off the foam. Pour into jars rinsed with hot water. Keep tightly covered in refrigerator. May be served either heated or cold.

Approximate analysis per 1 TBSP:

Protein:	*.1 gram*	*Sodium:*	*1 milligram*
Fat:	*negligible*	*Potassium:*	*15 milligrams*
Carbohydrate:	*7 grams*	*Calcium:*	*3 milligrams*
Calories:	*26*	*Phosphorus:*	*2 milligrams*

Suggested Use in Diet: up to 2 TBSP per day free! **Diabetic Use** is 2 TBSP as 1 low potassium fruit.



Pear-Berry Pie

Yield one 9" pie.
A wonderful blending of flavors.

2-crust pie crust or use 2 frozen 9-inch deep-dish pie shells
4 cups sliced, peeled pears
1/2 cup firmly packed brown sugar
3 TBSP cornstarch
3/4 tsp ground cinnamon
1/4 tsp ground nutmeg
1 can (16-ounces) whole berry cranberry sauce

1. If using frozen pie shells, invert one shell to be used as crust onto waxed paper. Let thaw until flat. Preheat oven and cookie sheet to 400 °F.
2. In medium-sized bowl, combine pears, sugar, cornstarch, and spices. Gently stir in cranberry sauce. Fill bottom pie shell with pear mixture.
3. Cut flattened crust or top crust into 1/2-inch wide strips. Weave strips over filling to form a lattice. Crimp edges, sealing completely. Bake on preheated cookie sheet for 35-40 minutes, or until bubbly and brown. Remove to wire rack; serve warm or cool.

Approximate analysis per slice (1/8 pie):

Protein:	*3 grams*	*Sodium:*	*323 milligrams*
Fat:	*13 grams*	*Potassium:*	*191 milligrams*
Carbohydrate:	*68 grams*	*Calcium:*	*38 milligrams*
Calories:	*412*	*Phosphorus:*	*45 milligrams*

Suggested Use in Diet: 1 slice as 1 1/2 regular starch and 1 medium potassium fruit. **Not recommended for Diabetic use:** try baking fresh pear halves stuffed with chopped cranberries sweetened with a small amount of low sugar orange marmalade.

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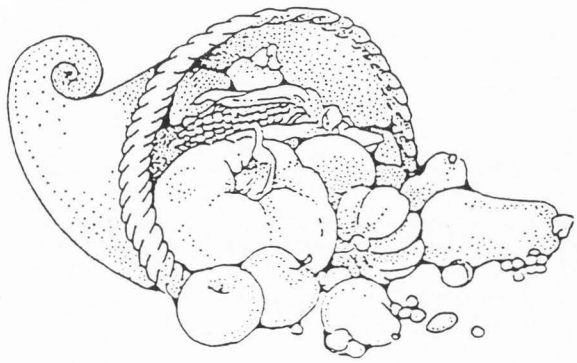

APPENDIX K. PERMISSION LETTERS

I, the undersigned, give Julianne Stewart (graduate student at Utah State University) permission to reprint the following sections from Nutrition: The Art of Good Eating 3rd edition, published by the Northwest Kidney Foundation.

Phosphate binder recipes (pp.95-96)
Seven-day meal plan (pp.97-100)
Seven-day meal plan for diabetics (pp.101-104)
Potassium and sodium guidelines (pp. 113-119)
Phosphorus and calcium guidelines (pp.121-127)

I understand that this information will be used in a research project to benefit dialysis patients. I also understand that the Northwest Kidney Foundation will be given credit for the reprinted information.

Sarah Swartz 1/22/91

signature date

Renal Dietitian

title

I, the undersigned, give Julianne Stewart (graduate student at Utah State University) permission to reprint the holiday recipes which were published in "Renal Recipes Quarterly". I understand that R & D Laboratories will be given credit for any reprinted information and that the information will be used to benefit dialysis patients.

signature date

Vice President

title

I, the undersigned, give Julianne Stewart permission to include a Computrition, Inc. individual intake analysis computer printout in her masters thesis.

Evelyn Bluso 11/02/92

signature date

Evelyn Bluso

name

President

title