Fleischmann et al. (1999) studied the influence of excess weight on mortality and hospital stay in 1346 hemodialysis patients and reported that overweight and obese patients ($\text{BMI} \geq 27.5$) had a significantly better 12-months survival than underweight ones ($\text{BMI} < 20$) and patients with normal weight ($\text{BMI} 20–27.5$). Further analysis of the data, demonstrated that for every unit increase in BMI the relative risk (RR) of mortality was reduced by 10%. In multivariate analyses, higher BMI remained as a significant factor for better survival even after adjusting for a number of variables commonly linked to dialysis patient’s survival.

Marsha Wolson (1999) studied malnutrition is not uncommon in patients with end stage renal disease treated with maintenance dialysis. The presences of several abnormal parameters of nutritional status are reported to be predictive of poorer outcomes in these patients, compared to dialysis patients without evidence of malnutrition. His study describes methods that may be used to recognize the presence of malnutrition in end-stage renal disease patients and the management of protein and energy intake. Whether the correction of malnutrition will improve outcomes, such as morbidity and mortality, is unknown.

Desbrow (2000) in their study it was found that about 80% of patients on hemodialysis were well-nourished, 20% were moderately malnourished, and none were assessed as severely malnourished.

K/DOQI (2000) compiled a list of diagnostic indices for malnutrition, focusing on four laboratory measures, serum albumin, prealbumin, creatinine (and creatinine index) and cholesterol as markers of visceral protein pools, two
methods for direct estimation of dietary intake (dietary interviews and diaries and normalized protein nitrogen appearance, nPNA) and two methods for assessment of body composition (subjective global assessment, SGA, and anthropometry).

Koppel JD et al. (2000) studied the relationship between the weight-for-height and survival among 12,965 MHD patients (both sexes). They found that in both men and women, the mortality rate decreased progressively as the patients' weight-for-height increased. MHD patients who weighed more than normal had the lowest mortality rate. It was concluded that body weight-for-height is an independent predictor of high mortality in those patients who are in the lower 50th percentile for this measurement. It has been suggested that a BMI of 23.6-24 is the best range for survival in MHD patients.

Koppel JD et al. (2000) studied protein energy malnutrition wasting are common problems among patients with end-stage renal disease (ESRD). These patients with ESRD are routinely treated with hemodialysis. In hemodialyzed patients, nutritional status is strongly associated with morbidity and mortality.

Sharma RK (2000) observed that nutritional assessment can be done by anthropometric measurements, laboratory parameters, subjective global assessment, and dialysis malnutrition score. Subjective global assessment is currently the most accepted one and classifies patients into three nutritional categories: Well nourished, moderately malnourished, and severely malnourished. Prevention of malnutrition by proper dietary counseling and adequate dietary intake starting from redialysis days is probably the most effective therapeutic approach. Other therapeutic approaches include adequate dialysis delivery, avoidance of acidaemia, aggressive treatment of catabolic illnesses and food supplements.

Jane A (2001) Studied at baseline assessment, 28% of patients had evidence of malnutrition by SGA criteria. The malnourished group of patients had a significantly lower creatinine clearance (18.9 ± 9.8 v 36.5 ± 14.0 mL/min/1.73 m2, mean ± SD, P < .001) A significant association was observed between baseline nutritional status and
subsequent admission to hospital and baseline glomerular filtration rate and progression to end-stage renal failure.

**GEORGE A (2001)** cross-sectional studies have shown an inverse correlation between serum C-reactive protein (CRP) and serum albumin concentration in hemodialysis patients. Results show proxies of inflammation and dietary protein intake exert competing effects on serum albumin and creatinine in hemodialysis patients. These data provide a rationale for prospective testing of dietary protein supplementation in hemodialysis patients with biochemical evidence of ongoing inflammation and “malnutrition.”

**Mehrotra and Kopple (2001)** demonstrated the prevalence of malnutrition in patients on hemodialysis is high (15% to 89%), the average is about 40%. It was demonstrated that 40% of hemodialysis patients were malnourished (34.7% with mild malnutrition, and 5.3% with severe malnutrition), whereas 60% of patients were classified as well-nourished.

**Port (2002)** in their study 45,967 hemodialysis patients were confirmed the association between body mass index and survival, patients with the lowest BMI had a 42% higher mortality risk than patients in the highest BMI (BMI were divided into three groups, <23.2, 23.2-27.8, and >27.8). A higher BMI might in turn be an indication of better nutritional status, as biochemical markers of better nutrition co-aggregate with larger body mass.

**Pupim et al. (2002)** studied the investigation of dialysis patients by the author. In this issue of the JCI shows why such consequences of kidney failure result from mechanisms more complex than malnutrition. Their results show that a sharp increase in protein and calorie intake during dialysis produces only a transient benefit, even for end-stage renal disease (ESRD) patients with few signs of abnormal protein metabolism.

**Chumlea WC (2003)** examined chronic hemodialysis patients for at least 3 months, receiving hemodialysis thrice in a week and with a residual renal clearance of <
1.5 mL/min were examined. Differences in nutritional status by sex, race, duration of dialysis, and comorbid disease were found among these patients enrolled in the HEMO Study.

**Lee & Nieman (2003)** Studied a food frequency questionnaire is less often used to measure dietary intake due to the large amount of time and energy it requires of the respondent. Food records are commonly used as a dietary assessment tool. A food record requires the respondent to record their dietary intake at the time of consumption. The food entries include a detailed description of each food item along with food amounts using household measures. Food records can range anywhere from 1 to 7 days with more days having greater representation of a person's usual intake.

**Axelsson et al. (2004)** studied related with the inflammatory biomarkers (Median IL-6) concentration with truncal fat mass in 197 patients with end stage renal disease, before the beginning of dialysis and found a significant positive association (P<0.01) suggesting truncal fat mass as a contributor to inflammation in end stage renal disease.

**F. Asgarani (2004)** in their study 71 hemodialysis patients were assessed by a dialysis malnutrition score (DMS) instead of conventional SGA and compared the results with laboratory and anthropometric measurements of malnutrition. Consequently, this revealed that DMS significantly correlated with the anthropometric measurements and an important laboratory parameter, serum transferrin level.

**Fathima L. (2004)** concluded a literature states that the diet is important for patients on hemodialysis. Goals of nutritional therapy are to minimize uremic symptoms and fluid and electrolyte imbalances, to maintain good nutritional status through adequate protein, calorie, vitamin and mineral intake, and to enable the patient to eat a palatable and enjoyable diet. Ignorance of dietary restrictions will lead to life threatening complications such as hyperkalemia and pulmonary edema.

**Raza H (2004)** examined patients with hypoalbuminemia, hyperkalemia, hyperphosphatemia, and more than three kilograms inter-dialytic weight gains were
identified and were given active nutritional counseling. The above parameters were followed over a seven-month period. Active nutritional counseling resulted in significant decrease in the prevalence of hyperkalemia as well as high inter-dialytic weight gains (p < 0.001). However, the prevalence of hypoalbuminemia and hyperphosphatemia remained unchanged over the study period.

Saxena A (2004) studied anthropometric techniques are more appropriate for epidemiological, clinical or hospital settings. However, the accuracy of these estimates is limited by intra and inter examiner error, changes in subcutaneous and internal fat distribution between males and females of different ages, and difficulty in using these measurements in ill patients.

Schulman G (2004) multiple lines of evidence have indicated that the dose of hemodialysis impacts upon patient outcome. All of the methods of determining dialysis adequacy are based on assessing the removal of toxic substances retained in renal failure, the majority of which are derivatives of protein metabolism. Both inadequate and optimal levels of hemodialysis dose have been identified by prospective, randomized clinic trials utilizing Kt/V(urea) as the index of adequacy. The impact of urea kinetics on nutritional status during thrice-weekly hemodialysis is discussed. Recently, in an attempt to improve outcome beyond that achievable with thrice-weekly hemodialysis, alternative regimens, consisting of daily treatments, have received increasing interest. In order to compare the dose of hemodialysis associated with these regimens with conventional thrice-weekly regimens in terms of removal of small molecular weight substances, standard Kt/V(urea), a parameter that combines treatment dose with treatment frequency, and thus allows for various intermittent therapies to be compared to continuous therapy, must be used.

Bednarek & Skublewska A (2005) studied There is a close relationship between inflammation, malnutrition and atherosclerosis in chronic hemodialysis patients. This process is closely related to poor clinical outcomes including morbidity and mortality,
especially in elderly patients. The studied elderly hemodialysis patients are more malnourished than younger ones.

**Bossola et al. (2005)** measured the actual dietary energy and protein intake in stable MHD patients, it was found that the mean dietary energy and protein intakes were 24.9 ±10.1kcal/kg/day and 0.64 + .04 g pro/kg/day respectively. According to the KDOQI guidelines, 70.2% of study subjects had energy and protein intakes that were lower than the recommended amount for MHD patients.

**Current Dietary Guidelines-(2005)** High sodium intake can increase blood pressure and the risk for heart disease and stroke. According to the Dietary Guidelines for Americans, 2010, persons in the United States aged 2 years should limit daily sodium intake to 2,300 mg. Subpopulations that would benefit from further reducing sodium intake to 1,500 mg daily include and persons aged 51 years, persons with hypertension, diabetes, or chronic kidney disease.

**Morais AAC (2005)** assessed malnutrition by objective global assessment, undernourished, 29.6% moderately malnourished, and 2.3% severely malnourished. Total calorie intake was devoid of associations, but protein, carbohydrate, and lipid input positively correlated with triceps skinfold (P=.02).

**Ohkawa S et al. (2005)** examined muscle mass, fat mass and fat distribution differed significantly with age in both HD patients and controls, without significant differences in BMI. In both male and female HD patients, TMA and AMA showed significant negative correlations with age. All measures of subcutaneous fat-including TSFA, ASFA and the triceps skinfold thickness, were inversely associated with age in the female patients. In contrast, both IMFA and AVFA showed significant positive correlations with age in both male and female patients.

**Janeen B et al. (2006)** conducted study on 180 patients with baseline albumin levels less than 3.7 g/dL (<37 g/L) at 44 long-term hemodialysis facilities. At baseline, patients had similar albumin levels, dietary intakes, levels of inflammatory markers, and
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numbers of nutritional barriers. After 12 months, had greater increases in albumin levels compared with control patients (0.21 versus 0.06 g/dL [2.1 versus 0.6 g/L]; P < 0.01), as well as greater increases in energy intake (4.1 versus 0.6 Kcal/d/kg; P < 0.001) and protein intake (0.13 versus 0.06 g/d/kg; P < 0.001).

**Afshar R (2007)** in their study significant correlation was found between the protein catabolic rate (nPCR) and the mortality rate (regression analysis, p = 0.016); lower values of nPCR were associated with increased mortality. Our study suggests that the MS is a reliable, precise, and rapid method for estimating the nutritional status in patients on HD. The nPCR can be used as a predictor of increased mortality.

**Ali A (2007)** his study was conducted on 61 chronic renal failures (29 Male and 32 female) who had going maintenance dialysis. The mean intake of the energy was 194±6.8kcal/kg/body wt. notably 95% of patient had energy intake below the recommended for hemodialysis patients. (35kcl/Kg/body wt). The mean intake of protein was 0.8 gm/kg/body wt which was substantially less than recommended protein for dialysis patients. HP (1.2-1.4 gm/kg/body wt). About 82 % patients had the protein intake was below the 1.2 gm/kg/body wt.

**Azar AT (2007)** study showed there was a significant improvement in mean URR and Kt/V from the baseline to the intervention group. The intervention group had a considerably higher rate than the baseline group for all nutritional and biochemical outcome parameters. The study showed a strong positive correlation between nPCR and Kt/V (p = 0.0001) and also a strong positive correlation between serum albumin and Kt/V (p = 0.00001). No correlations were found between Kt/V and biochemical outcomes such as hemoglobin (p = 0.4922), calcium (p = 0.650), phosphate (p = 0.508), and phosphatase (p = 0.091).

**Christelle Raffaitin, et al. (2007)** studied to specify the nutritional outcome in patients with chronic kidney disease (CKD) and well controlled diabetes. The nutritional status of diabetic patients affected by CKD does not deteriorate and even improves before
the onset of hemodialysis, when their glucose concentrations, blood pressure, cholesterol and AER are controlled according to recommendations. In contrast, deterioration is detectable in patients who must start hemodialysis.

**Matthew D & Beekley et al. (2007)** the following table represents the recommended nutritional parameters according to the stage of chronic kidney disease and dialysis.

**Table 2.1** – Guidelines for individualization to patient's own metabolic status and coexisting metabolic conditions is essential for optimal care.

<table>
<thead>
<tr>
<th>Nutritional Parameter</th>
<th>Stages 1-4 CKD</th>
<th>Stage 5 Hemodialysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calories (kcal/kg/d)</td>
<td>35 &lt; 60 yrs</td>
<td>35 &lt; 60 yrs</td>
</tr>
<tr>
<td></td>
<td>30-35 ≥ 60 yrs</td>
<td>30-35 ≥ 60 yrs</td>
</tr>
<tr>
<td>Protein (g/kg/d)</td>
<td>0.6-0.75</td>
<td>1.2</td>
</tr>
<tr>
<td>Sodium (mg/d)</td>
<td>2000</td>
<td>2000</td>
</tr>
<tr>
<td>Potassium (mg/d)</td>
<td>Match to lab values</td>
<td>2000-3000</td>
</tr>
<tr>
<td>Fluid (mL/d)</td>
<td>Unrestricted w/ normal urine output</td>
<td>1000 + urine</td>
</tr>
</tbody>
</table>

*Source* - *Journal of Nephrology and Renal Transplantation (JNRT) 2007.*

**NKF/DOQI (2007)** the National Kidney Foundation's (NKF) Kidney Disease Outcomes Quality Initiative (K/DOQI(TM)) released its evidence-based clinical practice guidelines for diabetes mellitus (DM) (NKF, 2007). These guidelines emphasized the management of DM for patients with chronic kidney disease (CKD) Stages 1 to 4, stating that evidence for management in Stage 5 was lacking.

**Pedrini (2007)** his study showed that there is no single measurement that can be used to determine the presence of malnutrition. Therefore, a panel of measurements is recommended, including measures of body mass (body mass index) and composition, a measure of dietary protein and energy intake, and at least one measure of serum protein status.
**Reema F (2007)** In their study compared the degree of malnutrition in male and female by anthropometric and biochemical parameters, SGA suggested 50% female were malnourished and 75% male were moderately to severely malnourished, anthropometric variables showed significant decrease in both male and female, except triceps skinfold thickness. In biochemical parameters there was significant decrease in hemoglobin, serum albumin, total protein in males, in female only hemoglobin were significantly decreased with advanced malnutrition.

**Cho JH, Hwang JY (2008)** observed diabetes mellitus was the main cause of ESRD (45.5%). The diabetic ESRD patients showed higher BMI and less HD adequacy than non-diabetic patients. Diabetic patients also showed lower HDL-cholesterol levels. Diabetic ESRD patients had less energy from fat and a greater percentage of calories from carbohydrates. In conclusion, active nutrition monitoring is needed to improve the nutritional status of HD patients. A follow-up study is needed to document a causal relation between diabetes and its impact on morbidity and mortality in ESRD patients.

**José M et al. (2008)** studied conducted on hemodialysis patients treated with ESAs who maintained the recommended Hb range of 11–13 g per 100 ml over 3 months and were not admitted to hospital, did not require transfusion, and did not experience any major clinical event during this period were followed prospectively for 1 year. We studied 420 patients (63% males, mean age 61 years), 222 received short-acting erythropoietin (EPO) and 198 long-acting darbepoetin. A total of 4654 blood samples (mean 11.1 per patient-year) were analyzed. Only 3.8% of patients were maintained within the target Hb levels (11–13 g per 100 ml) during 1 year. Results shows that Hb values are rarely maintained within the recommended guidelines even in more stable hemodialysis patients. Hb variability is frequently associated with clinical events or ESA dose changes. Long-acting darbepoetin achieved better Hb stability than short-acting EPO.
Manandhar DN (2008) studied malnutrition score of the study population was 15.82 +/- 3.76 (range 9-24). Female patients were having higher MS than males (16.5 +/- 4.11 vs. 15.06 +/- 3.55). Based on MS, 22 patients (84.6%) had mild to moderate malnutrition, 2 (7.7%) patients were having severe malnutrition and remaining 2 (7.7%) had normal nutrition score. Females were having lower BMI, MAC and MAMC but higher value of TSF. Significant negative correlation was present between MS and weight, BMI, MAC and MAMC.

Małgorzewicz S (2008) Thirteen of 22 (59%) patients were of good nutritional status, and 9/22 (41%) were malnourished, including 1 person with severe malnutrition. In dialyzed patients compared with control subjects, a decreased concentration of essential and nonessential AAs was observed (P < .05). Concentrations of the majority of studied AAs (16 out of 20) were lower in patients dialyzed for a period >2 years, compared with patients dialyzed for a shorter time.

Martin K. (2008) reviewed the discrepancies in reported prevalence of Malnutrition in ESRD populations are most likely due to differences in parameters used for assessment of nutritional status and for definition of malnutrition. Since malnutrition is a dynamic process, characterized by a progressive change in body composition, it may be hypothesized that diagnostic timing as well as accuracy of malnutrition may be improved by the application of bioimpedance-based methods for longitudinal measurements of whole-body or segmental muscle mass.

Park KA & Choi-Kwon S (2008) studied the older hemodialysis patients (OHPs) had a lower appetite, lower physical activity, and lower educational level compared with the younger hemodialysis patients (YHPs). Dietary compliance with phosphorus restriction and with sodium and fluid restriction was higher in the OHPs than in the YHPs (P < .01 and P < .05, respectively), whereas compliance with potassium restriction did not differ between groups. The knowledge scores concerning potassium (P < .05) and phosphorus (P < .01) restriction diets were lower in OHPs than in YHPs, whereas no differences were found for knowledge scores concerning sodium and fluid restriction.
diets. Mortality was higher in the OHPs than in the YHPs ($P < .001$). The OHPs with higher mortality had higher dietary compliance with sodium and fluid restriction ($r = 0.248, P < .05$), and lower nutritional status ($r = -0.342, P < .05$).

Schatz, and Sharon R (2008) in their study it was found that diabetes is present in the majority of patients who dialyze. If comprehensive care is to be delivered, the enormity of diabetes and its non-renal complications need to be appreciated. These influences on the treatment process, medical nutrition therapy, and glycemic control all interact with one another to determine dialysis adequacy, nutritional status and degree of glycemic control. By gaining a further understanding of these dynamics, care management strategies can be improved and more thorough patient education provided to achieve better outcomes for this high-risk population.

Tayyem RF (2008) studied anthropometric measurements showed some significant increase between pre-hemodialysis and post-hemodialysis weight and body mass index in private hospitals; this was not unexpected. There were no statistically significant differences in the measured mean levels of eight different biochemical parameters, with the exception of plasma phosphorus and sodium levels. The prevalence of malnutrition and the quality of treatment in our two groups of participants were similar.

Teixeira Nunes F (2008) concluded that Malnutrition in End Stage Kidney Disease (ESKD) patients is very common affecting ~10.0-70.0% of hemodialysis (HD) patients.

Anne-Elisabeth Heng (NDT Plus, 2009) concluded the causes of anorexia in hemodialysis patients. Factors of anorexia in maintenance hemodialysis:

- Frequent hospitalization, multiple medications.
- Comorbidities.
- Depression, Low social status.
- Uncontrolled anaemia.
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- Restrictive regimens: fluid, phosphorus, sodium, potassium.
- Dysgeusia: metal flavour (often associated with zinc deficiency), dry mouth.
- Inadequate dialysis.
- Exocrine pancreatic insufficiency and reduced mucosal enzyme activities.
- Gastroparesia.
- Altered plasma amino acids and neurotransmitters synthesis.
- Inflammatory cytokines: plasma TNF-alpha, leptin.
- Uremic toxins: middle size molecule.
- Insulin resistance inducing increases in serotonin synthesis.

Azar R, Al-Moubarak I (2009) studied early recognition and treatment of malnutrition is essential to improve the outcome of these patients. Nutritional status may be assessed by several clinical markers including dietary records, anthropometric measurements and subjective global assessment. Among biochemical parameters, albumin is the most commonly used and prealbumin the most useful. Protein catabolic rate reflects dietary protein intake.

Thomas D (2009) examined health related quality of life in test group showed a consistent improvement of 2% in six months. Improvement of awareness by patient counseling was also improved. Conclusion: As part of medication therapy management (MTM), patient counseling focusing on dialysis compliance, diet and medications are an effective way to improve health-related QoL and awareness in ESRD. Such services should be made mandatory by law in India to improve outcomes in chronic illness.

Lacquaniti A (2009) estimated that one-third of all dialysis patients have mild to moderate malnutrition, while 6-8% have severe malnutrition, which is associated with increased morbidity and mortality rates and numerous pre-existing factors directly correlated with, or existing prior to, replacement hemodialysis. However, moderate to severe malnutrition (present in 10-30% of dialysis patients) is a prevalent cause of death among the elderly. Malnutrition can occur secondary not only to erroneous dietary
choices or uremia, but it may also depend on the patient's level of tolerance to dialysis and on the dialysis modality.

**Sameh (2009)** in their study, 200 hemodialysis patients were registered, 108 males and 92 females of mean age 50±16 years. 4% of patients were underweight, 49% had average weight, 27.5% were overweight, 14% were obese, and 5.5% had morbid obesity. Regarding diet changes, 89% has minimal or no change in their diet, while 9% had mild to moderate decrease in their diet. Subjective Global Assessment (SGA) classified patients into 68% normal, 24% mild to moderately malnourished, and 8% with severe malnutrition. Severe malnutrition by SGA was significantly correlated with male sex, P value of 0.04. The mean duration of dialysis were 23 months, ranged from 6 to 300 months.

**Segall L (2009)** studied age was found to be positively correlated with BMI (P = 0.001), and inversely correlated with % BCM (P = 0.013). Patients with A-category SGA were significantly younger (50.1 versus 63.7 years) than those with B-category SGA. Patients with diabetes had lower %BCM (32.9 versus 35.9%; P = 0.035) and PhA (5.5 versus 6.9 degrees; P = 0.0007) than those without diabetes.

**Ashabia (2010)** studied the nutritional status of the patients was determined by subjective global assessment and their dietary intake were assessed using a 4days dietary recall (2 dialysis and 2 non dialysis days). The prevalence of mild to moderate and severe PEM based on SGA was 60.5% and 1% Tehran hemodialysis patients, respectively. The study shows according to type of PEM was as follows 20.5% (inadequate energy or protein intake without inflammation) 14% type 2b (adequate energy or protein intake without inflammation). 3.5% not suffering from PEM, type 1a normal nutritional status (adequate energy or protein intake without inflammation) 34% type 2b normal nutritional status (inadequate energy or protein intake without inflammation), 55.5% type II a normal nutritional status (inadequate energy or protein intake, with
inflammation); and 7% type II b normal nutritional status (adequate energy and protein intake, with inflammation.

Noori N & Kopple JD (2010) studied protein wasting (PW) or protein-energy wasting (PEW) occurs commonly in patients with diabetes mellitus who have end-stage renal disease (ESRD) and are undergoing maintenance dialysis (MD) therapy. Some but not all studies indicate that PW or PEW is more prevalent in diabetic when compared with nondiabetic MD patients and that diabetic patients commencing maintenance hemodialysis (MHD) are more likely to lose fat-free, edema-free weight than are incident nondiabetic MHD patients. The causes of PW and PEW in diabetic MD patients are probably largely similar to those of nondiabetic MD patients.

De Castro MC (2010) suggested that serum urea ≤ 90 mg/dL, creatinine ≤ 6.5 mg/dL, phosphorus ≤ 4.2 mg/dL, and Kt/V ≥ 1.6 can be used for screening patients with malnutrition. However, using these cutoffs the parameters tend to overestimate the number of patients with malnutrition.

Fatima Hukicl (2010) examined all patients were determined by chematological and biochemical parameters were determined along with concentration of complete hemogram. All hematological profile examined patients on HD is giving us essential information for planning and leading an adequate erythropoietin therapy. Determination of hemoglobin content in reticulocyte has attributes that can provide an ideal test of iron status in HD patients specified for iron deficiency diagnosis. For maximal effect of rhEPO therapy, adequate compensation of iron is necessary. With chronic kidney patients, transfusion of erythrocytes should be avoided. For treatment of renal anemia an optimal dialysis is crucial.

Hyerang (2010) assessed nutritional status and diet quality of 63 HD patients (age: 55.3 ± 11.9 yrs; men/women ratio: 49.2%/50.8%) using Subjective Global Assessment (SGA) and 3-day diet recall methods, respectively. Patient’s daily energy intake (DEI) and protein intake (DPI) were 21.9 ± 6.7 kcal/BW/day and 0.9 ± 0.3
g/BW/day, respectively. About 70% of HD patients appeared to have lower daily energy and protein intake compared to recommended amount. More than 50% of HD patients had lower intake of vitamin C, B1, B2, niacin, folate, calcium, and zinc below 75% of Dietary recommended intakes.

Atefeh Ashabi et al. (2011) this study conducted on 291 patients were randomly selected. Dietary intakes of these patients were assessed using a 4-day dietary recall. Biochemical parameter was measure as serum urea, creatinine, albumin, phosphorus, calcium, potassium, and high sensitive C-reactive protein levels. Dietary intakes of energy, protein and fiber were lower than recommended intakes in 88%, 84.5%, and 99% of HD patients, respectively. There were significant associations between dietary energy intake with the patient's age (p < 0.05), and HD vintage (P < 0.001). In addition, a significant association was found between dietary protein intake and sex (P < 0.05). Intakes of vitamins B1, B2, B3, B6, B12, C, E, folic acid, and of the minerals calcium and zinc (from both the diet and supplements) were lower than recommended.

British Dietetic Association (2011) concluded the protein requirements for maintenance hemodialysis patients. Following the searches, 44 HD papers were collected in full text for duplicate assessment of inclusion using an in/out form. Of these 44 studies, 25 were excluded prior to full review. 19 studies were reviewed in depth using the SIGN methodology. All the included studies were based on adults on maintenance (of at least three months duration) hemodialysis and therefore the results can be generalized to the target population.

Table 2.2 - Summary of Individual Studies In Relation To Protein Requirements during Maintenance Hemodialysis

<table>
<thead>
<tr>
<th>TF Reference</th>
<th>Summary in Relation to Protein Requirements for MHD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bossola 2005</td>
<td>Higher albumin and BMI with protein intake &gt; 1.2g/Kg/day</td>
</tr>
<tr>
<td>Beddhu 2005</td>
<td>Improved mortality with protein intake &gt; 1.2g/Kg body weight/day</td>
</tr>
<tr>
<td>Reference</td>
<td>Summary in Relation to Protein Requirements for MHD</td>
</tr>
<tr>
<td>---------------------------</td>
<td>----------------------------------------------------</td>
</tr>
<tr>
<td>Shinaberger 2006</td>
<td>Best survival with protein intake 1.0-1.4 g/Kg ideal body weight/day</td>
</tr>
<tr>
<td>Araujo 2006</td>
<td>Best survival with protein intake &gt; 1.0g/Kg/day (and &gt; 25 Kcals/Kg/day)</td>
</tr>
<tr>
<td>Ichikawa 2007</td>
<td>Protein intake unimportant if energy intake &gt;35 Kcals/KgIBW/day</td>
</tr>
<tr>
<td>Thijssen 2007</td>
<td>May need protein intake &gt; 1.05g/Kg IBW/day for normal albumin</td>
</tr>
<tr>
<td>TF Reference</td>
<td></td>
</tr>
<tr>
<td>Lu Q 2008</td>
<td>Need 1g protein/Kg IBW/day (and 30Kcals/Kg IBW/day).</td>
</tr>
<tr>
<td>Stojanovic 2008</td>
<td>Best survival with protein intake 1.16g /Kg IBW/day.</td>
</tr>
<tr>
<td>Rambod 2008</td>
<td>Protein intake 1.16g /Kg IBW/day correlated with higher serum pre albumin</td>
</tr>
<tr>
<td>Sahin 2009</td>
<td>Protein intake not related to SGA.</td>
</tr>
<tr>
<td>De Mutsert 2009</td>
<td>Protein intake did not contribute to mortality after adjustment for inflammation.</td>
</tr>
<tr>
<td>Segall 2009</td>
<td>Best survival with protein intake &gt; 1.2g /Kg/day.</td>
</tr>
<tr>
<td>European Best Practice Guideline on Nutrition in Haemodialysis 2007</td>
<td>Recommends at least 1.1g protein/Kg ideal body weight/day</td>
</tr>
</tbody>
</table>

*Source - The British Dietetic Association. Jun 2011*

**B.A Odifuwa (2011)** examined the nutritional status of the patients has serious impacts on the prognosis of the disease. Also, clinical symptoms such as nausea, vomiting, diarrhea, and edema were common among the subjects. The study, however, recommends that the public should be enlightened on the causes of renal failure, healthy eating-habit. It also calls on government to subsidize the cost of health care for the
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patients undergoing hemodialysis. Dieticians were also sensitized to improve the energy and micronutrient intake of patients undergoing maintenance hemodialysis.

**Calegari A (2011)** studied fifteen men and three women, aged 56.4 ± 15.6 years-old, nine in each group. The Intervention Group showed an improvement in the subjective global assessment (p = 0.04). There were differences in role physical and bodily pain domains of SF-36, with improvement in the Intervention Group and worsening in the Control Group (p = 0.034 and p = 0.021). Comparisons before and after intervention for all patients showed improvement in the subjective global assessment (16.18 ± 4.27 versus 14.37 ± 4.20, p = 0.04), and in the six-minute walking test (496.60 ± 132.59 versus 547.80 ± 132.48 m; p = 0.036). The nutritional supplement was well tolerated by all patients, and it did not cause side effects.

**Gülperi Çelik (2011)** studied 50 adult hemodialysis patients for the comparison of nutritional biochemical parameters, prealbumin levels, and bioimpedance analysis parameters of adult and elderly hemodialysis (HD) patients. Mean age of patients was 57.4±15.1 years (range: 30-83 years) and mean dialysis duration was 68.3 ± 54.5 months (range: 3-240 months). In the elderly patients (age ≥65), body fat mass, illness marker, BMI, BFMI were higher compared to adult patients (age <65). Additionally, in the elderly patients, prealbumin, BUN, creatinine, albumin, nPCR, ICW/ total body weight, lean body weight, lean dry weight, basal metabolism and FFMI were lower than adult patients.

**Kadiri Mel (2011)** studied the patients were subdivided into two groups based on body mass index: group I, normal nutritional status (71%) and group II, malnutrition (29%). The clinical factors associated with malnutrition included advanced age and cardio-vascular diseases (CVD), decreased fat mass (FM) measured by DEXA, low Salb and prealbumin, and severe anemia. The Salb level was not only a predictor of nutritional status, but also was independently influenced by age and SCRP, which was more common in malnourished patients than in patients with normal nutritional status.
Milan D. Stosovic et al. (2011) serum albumin was only weakly correlated with mid-arm circumference \((r=0.12)\), mid-arm muscle circumference \((r = 0.15)\), and fat-free mass \((r = 0.12)\). Common factor analysis of nutrition parameters uncovered latent variables, but serum albumin was not associated strongly with them. The sensitivity of albumin in detecting malnutrition was 24%, with a specificity of 88% and a predictive value of 74%. Graphic analysis showed disagreement in albumin levels with percentage of body fat and mid-arm muscle circumference.

Moncef El M' Barki Kadiri (2011) studied 37 HD patients treated with thrice weekly sessions for at least two weeks. Global nutritional status was evaluated by the dual-energy X-ray absorptiometry (DEXA) scan. Body weight and several laboratory values. The patients were subdivided into two groups based on body mass index: group I, normal nutritional status (71%) and group II, malnutrition (29%). The clinical factors associated with malnutrition included advanced age and cardio-vascular diseases (CVD), decreased fat mass (FM) measured by DEXA, low Salb and prealbumin, and severe anemia. The Salb level was not only a predictor of nutritional status.

Nur Zakiah Mohd et al. (2011) conducted under go hemodialysis patients in Kuala Lumpur, Malaysia to determine the association between dialysis dose and demographic factors and assessed the association between biochemical blood parameter and the demographic factors. The biochemical blood parameters were serum albumin, creatinine, cholesterol and hemoglobin. It showed that all Indians and 54% of Chinese patients achieved the required dialysis dose. However only 29% of Malay patients attained the effective dialysis dose. The study found the biochemical blood parameter and dialysis dose were not influenced by the demographic factors.

Particia (2011) studied the body mass index \((24.2 \pm 4.4 \text{ kg/m}^2)\) and the percentage of standard value for mid-arm muscle circumference were within the normal limits \((102.6 \pm 13\%)\). When assessing the nutritional status by use of SGA, most patients \((80\%, n = 12)\) were malnourished, and SGA was the method that identified the highest number of patients with PEW.
Stosovic MD (2011) mentioned serum albumin was only weakly correlated with mid-arm circumference ($r = 0.12$), mid-arm muscle circumference ($r = 0.15$), and fat-free mass ($r = 0.12$). Common factor analysis of nutrition parameters uncovered latent variables, but serum albumin was not associated strongly with them. The sensitivity of albumin in detecting malnutrition was 24%, with a specificity of 88% and a predictive value of 74%. Graphic analysis showed disagreement in albumin levels with percentage of body fat and mid-arm muscle circumference.

Vasntha Janardhan (2011) obtained from this study confirmed that a high degree of malnutrition was prevalent in patients on hemodialysis, as shown by anthropometric assessment, biochemical markers of malnutrition and Subjective Global Assessment-Dialysis Malnutrition Score.

Wu TT (2011) studied nineteen out of 318 HD patients were vegetarians. The nPCR was lower in the vegetarian group ($1.20 \pm 0.24$ vs. $1.10 \pm 0.29$ g/kg per day, non-Veg vs. Veg, $P < 0.05$). The serum albumin and prealbumin were similar in vegetarian and non-vegetarian HD patients. The body mass index (BMI) and mid-arm muscular circumference (MAMC) were lower in vegetarian patients ($P < 0.05$). The haematocrit of vegetarians can be maintained at a level similar to that of non-vegetarian patients but erythropoietin doses needed were higher in vegetarian patients ($P < 0.05$). The muscle strength evaluated by the hand-grip test, SGA and activities of daily living were similar in vegetarians and non-vegetarians.

Alharbi (2012) assessed 269 HDP for MN through a questionnaire, SGA and anthropometric and biochemical measurements. Correlation coefficients were determined between SGA and anthropometric and biochemical measurements as well as the relative odds of MN. Statistical significance was $P < 0.05$. These HDP were 48.7% moderately and 6.3% severely malnourished. Albumin, BMI, TSF and MAMC correlated positively with the seven-point SGA.
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Cupisti A et al. (2012) suggested that nutritional knowledge of hemodialysis patients, although higher than the general population, is lower for phosphorus with respect to the other nutrients, such as protein, sodium, and potassium. This occurs even in patients with hyperphosphatemia or those taking phosphate binder medications. Nurses showed the best scores; however, improvement is necessary, especially with regard to knowledge of phosphorus. Training programs on nutrition for nurses and on information for patients should be implemented. They can contribute to achievement of a more effective control of phosphate balance, reduction of costs, and improvement of the quality of care for hemodialysis patients.

Kovesdy CP (2012) studied ongoing debate as to whether such surrogates as serum albumin or prealbumin concentrations are markers of nutritional status, inflammation, comorbidity, or other conditions has led to confusion and diagnostic and therapeutic nihilism. Irrespective of the cause of hypoalbuminemia in dialysis patients, evidence suggests that nutritional interventions can increase serum albumin in dialysis patients. Hence, we should continue assessing serum albumin and other surrogates of nutritional status to risk-stratify patients and to allocate nutritional therapy, while well-designed, large-scale, randomized, controlled trials of the effects of nutritional intake on clinical outcomes are awaited.

Lægreid IK (2012) examined cachexia in 6 (25%), 37.5% had a body mass index below 24, whereas according to SGA 91% were malnourished. BIS showed low lean tissue index in 46% and overhydration in 35% of the patients. Compared to non-cachectic and normohydrated, cachectic and overhydrated patients reported consistently poorer QoL. For cachectic patients, the differences were clinically significant for all SF-36. BIS was easily applicable when used before dialysis.

Mekki K (2012) their study showed the effect of hemodialysis (HD) duration on food intake and nutritional markers in patients with chronic kidney disease (CKD). Twenty CKD patients received maintenance HD over a 9-year period. At the
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beginning of the study (T0) and at 3-year intervals (T1, T2 and T3) during the 9-year follow-up. Nutritional status was assessed through food intake, nutritional markers (urea, uric acid, creatinine, cholesterol, total protein, and albumin), and anthropometric measurements (height, dry weight, and body mass index). HD duration was correlated with energy intake ($r = -0.89$, $P < 0.01$), protein intake ($r = -0.50$, $P < 0.05$), and body mass index ($r = -0.50$, $P < 0.05$). Albuminemia decreased over time. Reduced carbohydrate intakes were noted in patients at T1 (-8%), T2 (-38%), and T3 (-59%) with decreased fiber intakes. Long-term HD fails to correct undernutrition caused by CKD.

Molfino A (2012) in their study 14 patients (41%) was anorexic, and 20 patients (59%) were non-anorexic. Anorexic patients were hypophagic and presented with a decreased fat-free mass. After 12 and 24 month, cholesterol, albumin, lymphocyte count, and body mass index did not differ between the groups, whereas fat-free mass (percentage) in supplemented anorexic patients significantly improved in no longer differing from non-anorexic patients (65.8 ± 4.4 versus 65.4 ± 8.9, respectively, $P = NS$; 65.8 ± 4.4 versus 66.7 ± 10.78, respectively, $P = NS$).

Zabel R (2012) his study showed that appetite was measured using self-reported categories and a visual analog scale. Other nutritional parameters included Patient-Generated Subjective Global Assessment (PGSGA), dietary intake, body mass index and biochemical markers C-reactive protein and albumin. Appetite and other nutritional parameters were not as strongly associated with the Mental Health domain and Kidney Disease Component Summary Domains. Nutritional parameters, especially PGSGA score and appetite, appear to be important components of the physical health domain of QoL. As even small reductions in nutritional status were associated with significantly lower QoL scores, monitoring appetite and nutritional status is an important component of care for hemodialysis patients.

Beberashvili I (2013) studied malnutrition-inflammation score (MIS) and the geriatric nutritional risk index (GNRI), two nutritional scores for patients on maintenance
hemodialysis. GNRI had higher inter-observer agreement (weighted κ-score 0.98) than MIS (weighted κ-score 0.62). Longitudinally, a 1-unit increase in MIS was associated with a 0.41 kcal/kg per day reduction in daily energy intake (P<0.001) and with a 0.014 g/kg per day reduction in nPNA (P=0.02). GNRI did not correlate with the change over time of dietary intake.

Chen J (2013) examined the 75 hemodialysis patients for nutritional assessments. The average age was 62.70 ± 14.21 years. The mean duration of hemodialysis was 3.29 ± 1.08 years, 32% patients were well nourished, 60% were mild to moderately malnourished, and 8% were severely malnourished. Body mass index (BMI) (Mean ± SD; 21.6 ± 3.1 kg/m²) was also significantly negatively correlated with MQSGA (r = - 0.392; P = 0.001).

I. S. Hegazy (2013) identified malnutrition problems and assesses the effect of dietary counseling on improvement of health status of end-stage renal disease patients subjected to hemodialysis. 97.5% of the patients were considered mildly to moderately malnourished and multiple malnutrition problems were detected (protein–energy malnutrition, hypocalcaemia, and anaemia and hyperphosphataemia). Providing one-to-one nutrition counseling could be linked to improvements in the patients’ nutritional knowledge and practices and to their health status and performance in activities of daily life.

Jo-Ann Rene V. (2013) in their study nutritional status of maintenance hemodialysis was assessed by modified SGA, food intake recall and anthropometry. Results showed that 45% have moderate malnutrition and 36% have severe malnutrition. The severity of malnutrition was not associated with age and duration of dialysis while food intake and anthropometric variables are all weakly negatively correlated.

Trimarchi H (2013) studied BMI < 25, higher adiponectin, ghrelin, and Pro-BNP levels were associated with lower proteinuria and leptinemia. In obesity, hyperleptinemia and hyperinsulinemia associated with higher proteinuria; whether decreased adiponectin-
ghrelin-ProBNP and/or elevated leptin-insulin levels aggravate proteinuria remains to be determined.