

C A S E R E P O R T

Medical nutrition therapy in renal disease. A clinical dietetic-based case study

Rabbia Younas Awan

Department of Food Sciences & Human Nutrition, Kinnaird College for Women, Lahore, Pakistan - E-mail: mdyawan@yahoo.com

Summary. This paper explains the significance of medical nutrition therapy and its application in clinical dietetic practices with the help of nutrition care plan. It contains a case study of an indoor patient diagnosed with chronic kidney disease, diabetes mellitus and hypertension. A whole nutrition care process was formulated. The pre-interventional results of nutrition intervention plan were compared with the post-interventional results. A visible improvement in all categories of assessment was observed. The BMI was reduced with 0.1 kg/m², blood haemoglobin and calcium levels were raised, and BUN, BGL, creatinine, sodium and potassium were reduced noticeably. The dietary consumption trends were also altered towards the recommended ones. Proceeding through all four steps of nutrition care process i.e. nutrition assessment, nutrition diagnosis, nutrition intervention and nutrition monitoring, a complete execution of medical nutrition therapy was observed.

Key words: medical, nutrition, therapy, renal disease, clinical dietetic

Introduction

Medical nutrition therapy (MNT) is the basis of clinical dietetic practices. MNT is the actual nutrition services provided by a clinical dietitian to the patients referred by their physicians¹. With a collaboration of medical and paramedical staff, a clinical dietitian assesses the nutritional needs of a patient and develops a nutrition care process. MNT helps the patients with multiple illnesses and medical conditions to lead a healthy life. In addition to short term dietary interventions based upon current nutritional needs, MNT also includes long term interventions including behavioural modifications and lifestyle changes influencing eating habits and health².

The core functions of MNT can be precisely described with the concept of nutrition care process NCP^{1,2}. According to the Standards of Professional Performance (SOPPs) defined by American Dietetic Association (ADA), NCP is a well-ordered process

that performs all tasks of MNT in four distinct steps³. These steps are nutrition assessment, nutrition diagnosis, nutrition planning/intervention and nutrition monitoring and evaluation. The practical application of NCP ensures the completion of whole MNT^{2,3}. This paper contains a case study developed by a clinical dietetic practitioner, in which complete MNT of a renal patient is done with the help of NCP methodology.

Pathophysiology

In this study, the chief medical diagnosis was renal disease, generally known as chronic kidney disease (CKD), on its fourth stage. According to National Kidney Foundation (NKF), definition of CKD is “abnormalities of kidney structure or function, present for more than 3 months, with implications for health⁴.” It is classified on the basis of glomerulus filtration rate (GFR). When GFR value lies within 15-29 ml/min,

CKD is classified as stage 4⁵. In the respective case, like most of the others, CKD was comorbid with diabetes mellitus (type-2) and hypertension (stage-1)⁴.

Diabetes mellitus (type-2) is an autoimmune disorder characterized by insulin resistance developed in body cells⁶. Its fundamental etiology lies in genetics but it may also be caused by unhealthy dietary patterns, sedentary lifestyle and obesity^{6,7}. Hypertension is related with increased blood pressure, and stage-1 is due to its peak values i.e. 140/90 mmHg⁸. It is a secondary medical condition in contemporary with diabetes.

In this case, initially diabetes was reported; within a year, hypertension was detected; after duration of five years with uncontrolled blood glucose levels and high blood pressure, chronic kidney disease was diagnosed. Along these lines, the development of renal disorder was indirectly linked with unhealthy dietary patterns and sedentary lifestyles.

Patient Profile

The patient RS, a 50 yr old female, was a housewife having four teenage kids, with middle socioeconomic status. She had a medical history of diabetes type 2 and hypertension for past five years. No major surgery or accident had been reported. At hospital, she was received with complain of oliguria, severe lower back pain and dizziness. On checking vital signs, 140/90 mmHg blood pressure and 205 mg/dl random blood glucose level was observed. Physical examination showed edema and visible extreme obesity.

The patient was admitted to general ward and her blood and urine samples were taken for biochemical analysis. The biochemical results stated high values for renal function test, abnormal serum electrolytes levels, low levels for complete blood count (CBC) and increased protein levels in urine. With the help of some other diagnostic procedures, patient was diagnosed with chronic kidney disease. Her calculated GFR value was about 28 ml/min so chronic kidney disease was declared at its fourth stage. In the meanwhile, medical treatments including insulin injections, diuretic therapy and later on, bicarbonates were introduced to the patient.

Medical Nutrition Therapy

After nine days of admission to hospital, the case was handed over to the clinical dietetic practitioner. In order to execute MNT, NCP was applied to the respective case which lasted till discharge. According to the nutrition care process, following procedures were performed step-wise:

Figure 1: An Outline of Nutrition Care Process (NCP)⁹

Nutrition Assessment

Nutritional assessment includes four parameters of ABCD; where A – anthropometrics, B – biochemical analysis, C – clinical examination of nutrition-related physical signs and symptom, and D – dietary history^{1,2,3,9,10}. The table 1 shows the results of ABCD assessment of RS taken before applying any nutrition intervention. In addition to this, the patient was constipated i.e. one stool passed in three consecutive days. One vomit was also report in her nine days stay in hospital. She also complained of reduced appetite and bitter mouth taste (Tab. 1).

According to the information provided in table 1, at the time of assessment, patient was extreme obese. BMI was calculated by taking height and weight of patient using analog-weighting machine with height-measuring rod. The patient was deficient in blood haemoglobin and calcium, and had exceeded levels of random blood glucose, blood urea nitrogen (BUN), creatinine and potassium. These values were obtained from the biochemical analysis in laboratory reports of blood samples. The clinical examination results of pallor eyes and skin reveal iron deficiency anemia, and white tongue and lower eyelid shows dehydration. The

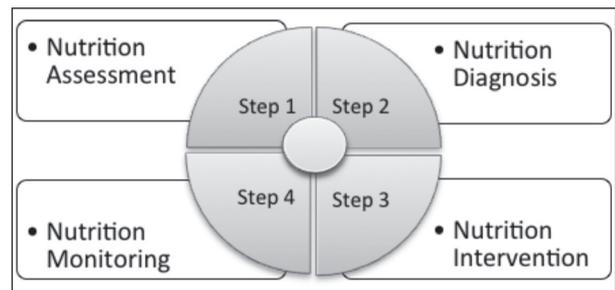


Figure 1. Nutrition Assessment

Table 1. RS's pre-interventional results according to ABCD parameters of nutrition assessment

Categories	Tools	Normal Ranges	Results	Interpretation
A	BMI ^a	19-24.5 kg/m ²	37 kg/m ²	Morbid Obese – Stage I
B	Haemoglobin	11.1-14.5mg/dL	8.5 mg/dL	Below normal range
	BGL	110-130 mg/dL	208 mg/dL	Above normal range
	Calcium	8.8 – 10.5 mg/dL	6.5 mg/dL	Below normal range
	Sodium	135-148mmol/l	146mmol/l	Within upper range
	Potassium	3.5-5mmol/l	7.2mmol/l	Above normal range
	BUN	5-18 mg/dL	80 mg/dL	Above normal range
	Creatinine	0.5-1.3 mg/dL	15.1 mg/dL	Above normal range
C	Eyes	White	Pale	Iron deficiency
	Lower Eyelid	Pink	White	Dehydration
	Skin	Normal reddish	Pale/dry	Anemia/dehydration
	Nails	Pink/white	White	Normal
	Tongue	Pink/smooth	White/rough	Dehydration
D ^b	Energy	1500-1600 kcalsc	1060 kcalc	Inadequate intake
	Protein	55-60 gmd	39gm	Inadequate intake
	Carbohydrates	200-220gme	110gm	Inadequate intake
	Fats	70gmf	36gm	Inadequate intake
	Sodium	2.0gmg	3.9gm	Excess intake
	Potassium	1.0gmh	2.7gm	Excess intake
	Phosphorus	1.0gmi	1.4gm	Excess intake
	Fiber	20gm ⁱ	10.5gm	Inadequate intake
	Fluid	1000ml ^k	1200ml	Excess intake ^a Body Mass Index ¹¹

^b Dietary history results of 24-hours recall²²; ^c Recommended daily energy intake, calculated by formula [body weight x 35]¹³; ^d Recommended daily protein intake, calculated by formula [body weight x 1.2]¹⁴; ^e Recommended daily carbohydrates intake, calculated by [total energy intake – energy intake by protein]¹⁵; ^f Recommended daily fats intake, calculated by [total energy intake – energy intake by protein + carbohydrate]¹⁶; ^g Recommended daily sodium intake, according to the recommendations of AHA for hypertension¹⁷; ^h Recommended daily potassium intake, according to the recommendations of NKF for CKD¹⁸; ⁱ Recommended daily phosphorus intake, according to the recommendations of NKF for CKD¹⁹; ^j Recommended daily fiber intake, according to ADA recommendations for diabetic patients²⁰; ^k Daily fluid allowance prescribed by doctor

dietary history data was collected using 24-hours recall questionnaire. Its results exhibit inadequate dietary intake of macronutrients and excess intake of sodium and fluid in accordance with prescribed restricted intake due to relevant medical conditions.

Nutrition Diagnosis

On the basis of nutrition assessment results, nutritional diagnoses were made in the form of PES (problem-etiology-sign & symptoms) statements. These statements focused on the nutritional problems instead of medical problems^{9,10}. The PES statements made for RS are following:

- Inadequate energy intake related to reduced appetite and difficulty in chewing evidenced by dietary history (1060 kcal/day).

- Inadequate protein intake related to lack of protein dietary sources in diet evidenced by dietary history.
- Inadequate carbohydrate related to the fear of increase in blood glucose levels evidenced by dietary history.
- Inadequate fat intake related to overall inadequate dietary consumption evidenced by dietary history.
- Increased need of dietary iron intake related to low blood haemoglobin levels evidenced by clinical examination of pallor eyes and skin.
- Excess sodium intake related to increased processed and packaged food consumption due to hospitalization as evidenced by 24 hours dietary recall.
- No fruits and vegetables intake related to inappropriate knowledge about recommended dietary consumption patterns in present medical conditions evidenced by dietary history.

- Uncontrolled intake of refined sugars related to poor nutritional knowledge about diabetic dietary management evidenced by dietary history.

Nutrition Interventions

On the basis of nutritional problems assessment and diagnosis, certain nutrition interventions were formulated and subjected to the patient¹⁰. These interventions included planning dietary modifications to address medical conditions, nutrition education, alteration in dietary behaviours towards healthy eating and making sure about implementation of intervention plan. Before planning a nutrition intervention, food availability and source is the major concern of a clinical dietetic practitioner. In the respective case, the food was prepared by the attendants at home and was brought to the hospital from the same city. Thus the two distinct processes involved in nutrition intervention step are planning and implementation²¹.

Planning

Planning of nutrition intervention comprises of setting targets to cater current nutrition problems. The core goals settled for dietary interventions of RS were as follows:

- To increase daily dietary energy intake upto 1600 kcals approximately
- To increase daily protein, carbohydrate and fats intake upto 60gm, 200gm and 70gm respectively
- To restrict dietary sodium intake below 2000 mg/day
- To limit dietary potassium and phosphorus intake to 1000mg/day for each
- To increase dietary iron and vitamin C intake upto 5mg & 60mg/day respectively
- To stick fiber intake between 18-20 gm/day (to avoid constipation)
- To maintain restricted fluid allowance i.e. 1000ml/day
- To improve appetite and control thirst
- To handle bitter mouth taste
- To ensure balanced diet consumption according to USDA²² diabetic and renal dietary guidelines

Implementation

In order o get above mentioned targets, following suggestions were made and practiced to the patient:

- Four progressive diet plans with gradually increasing energy and macronutrients intake were given to the

patient. The details of these plans are shown in figure 2. This helped her to meet the recommended energy intake without being burdened (Figure 2).

- Nutrition education about high and low sodium, potassium and phosphorus foods was provided, and intake of low sodium foods was encouraged by suggesting affordable and preferable food options.
- High biological value (HBV) protein food sources were suggested, to get increased protein utilization and also these foods are rich sources of dietary heme iron²³. To enhance iron absorption, these foods were suggested to be complimented with vitamin C enriched foods.
- For reduction in dietary fiber consumption, low fiber plus low glycemic food options were suggested.
- Foods with water content more than 50% were not suggested to consume.
- Food appearance, texture, color, aroma and taste were suggested to be improved.
- Food was suggested to be on hand at relatively low temperatures to lessen thirst.
- Dietary prescriptions were made in accordance with USDA diabetic and renal dietary guidelines²³. These prescriptions are shown in figure 3.
- In addition to dietary prescriptions, certain lifestyle modification guidelines were also advised, but their implementation was long term i.e. after hospitalization period.

Nutrition Monitoring

The fourth and last step of NCP, nutrition monitoring, is further classified into three phases, monitor,

Diet Plan 1	Diet Plan 2
<ul style="list-style-type: none"> •Energy : 1000 kcals •Protein : 40 gm •Carbohydrate: 150 gm •Fats: 40 gm 	<ul style="list-style-type: none"> •Energy : 1200 kcals •Protein : 50 gm •Carbohydrate: 170 gm •Fats: 50 gm
Diet Plan 3	Diet Plan 4
<ul style="list-style-type: none"> •Energy : 1500 kcals •Protein : 55 gm •Carbohydrate: 180 gm •Fats: 60 gm 	<ul style="list-style-type: none"> •Energy : 1600 kcals •Protein : 60 gm •Carbohydrate: 200 gm •Fats: 70 gm

Figure 2. Boxes showing four progressive diet plans given to the patient to reach targeted energy intake 1600 kcals/day

DIETARY PRESCRIPTIONS

1. Take diet from all food groups: cereals, fruits, vegetables, meat, dairy and fats.
2. Adjust the amount of daily food intake according to the suggested diet plan.
3. Take three meals and one snack a day with a time difference between 2 – 4 hours.
4. Avoid spices, sugars and salt in foods. Select natural food flavoring options.
5. Avoid processed and packaged foods. Select home-made food options.

Figure 3. Dietary prescriptions made for RS according to USDA Renal & Diabetic Dietary Guidelines

measure and evaluate¹⁰. In order to keep an eye over the compliance of implementation of nutrition intervention plan, continuous nutrition monitoring was done on daily basis. The patient was monitored during her complete hospitalization period i.e. 16 days. The researcher went through the vital signs charts, laboratory reports, fluid balance sheet, examined clinical signs and filled 24-hours recall questionnaire daily. For the purpose of measure, the monitoring indicators, that

are same as ABCD parameters of nutrition assessment, were regularly revised, and their interpretations reported perfect observance of nutrition intervention plan¹⁰. On the basis of monitoring outcomes, certain evaluation was derived by comparing the results of pre-interventional results of ABCD assessment and post-interventional results of ABCD assessment. A comparison between these two assessment results is shown in table 2.

Table 2. A comparison between the pre-interventional and post-interventional results according to ABCD parameters of nutrition assessment of patient RS

Categories	Tools	Pre-intervention	Post Intervention	Interpretation
A	BMI	37 kg/m ²	36.9 kg/m ²	2 kg weight loss
B	Haemoglobin	8.5 mg/dL	10.8 mg/dL	Raised
	BGL	208 mg/dL	139 mg/dL	Declined
	Calcium	6.5 mg/dL	9.8 mg/dL	Raised
	Sodium	146mmol/l	140mmol/l	Declined
	Potassium	7.2mmol/l	3.8mmol/l	Declined
	BUN	80 mg/dL	21mg/dL	Declined
	Creatinine	15.1 mg/dL	3.9 mg/dL	Declined
C	Eyes	Pale	Lesser Pale	Iron deficiency reduced
	Lower Eyelid	White	Light Pink	Dehydration recovered
	Skin	Pale/dry	No more pale	Iron deficiency reduced
	Nails	White	White	Remained normal
	Tongue	White/rough	Pink/smooth	Dehydration recovered
D	Energy	1060 kcals	1600 kcals	Increased
	Protein	39gm	60gm	Increased
	Carbohydrates	110gm	200 gm	Increased
	Fats	36gm	70gm	Increased
	Sodium	3.9gm	2.1gm	Decreased
	Potassium	2.7gm	1.2gm	Decreased
	Phosphorus	1.4gm	0.9gm	Decreased
	Fiber	10.5gm	20gm	Increased
	Fluid	1200ml	1000ml	Decreased

Discussion

The comparison of pre-interventional and post-interventional results of nutrition assessment of the patient revealed that nutrition interventions brought out a remarkable difference in all for parameters. In anthropometric measurements, a loss of 2 kg weight was observed. In biochemical analysis, the lab values for hemoglobin and calcium showed a raised trend, while lab values for BUN, creatinine, sodium, potassium and BGL showed a declined trend.

Physical examination for clinical nutrition-specific signs and symptoms also showed improvement. Dietary data is also switched towards the recommended statistics. Hence, NCP is successfully applied to the respective case study, and the core job of MNT is also fulfilled accurately. In this way, this case study is an example to follow for the up-coming researchers in the field of medical nutrition therapy.

Conclusion

Nutrition care process is a practical approach towards the observance of medical nutrition therapy in a clinical setting. The study had come up with a positive impact of nutrition care process along with the presence of constraints like limited time duration, chances of misreporting of dietary data by patient and attendants and simultaneous drug therapy.

Acknowledgement

Gratitude is extended to the faculty of Department of Food Sciences & Human Nutrition at Kinnaird College for Women, Lahore. The authors appreciate the support and co-operation of Asst. professor Mahnaz Nasir Khan, Head of Department of Food Sciences and Human Nutrition. The authors also wish to thank Professor Aizaz Mand Ahmad, Head of Department of Nephrology at National Institute of Kidney Disease, Sheikh Zayed Hospital, Lahore.

References

1. Medical Nutrition Therapy (MNT). St. Jude Children's Research Hospital. 2015. <http://www.stjude.org/stjude/v/index.jsp?vgnextoid=f0681976d1e701110VgnVCM1000001e0215acRCRD>
2. Leonard K. Nutritional Therapy Successfully Used To Reverse MS. Food Matters Film TV. 2013. <http://foodmatters.tv/articles-1/nutritional-therapy-successfully-used-to-reverse-ms>
3. Robein K, Bechar L, Elliott L, et al. American Dietetic Association: Revised Standards of Practice and Standards of Professional Performance for Registered Dietitians (Generalist, Specialty, and Advanced) in Oncology Nutrition Care. *Journal of American Dietetic Association*. 2010; 310-317. doi: 10.1016/j.jada.2009.11.001
4. Brommage D, Karalis M, Martin C, et al. American Dietetic Association and the National Kidney Foundation Standards of Practice and Standards of Professional Performance for Registered Dietitians (Generalist, Specialty, and Advanced) in Nephrology Care. *Journal of Renal Nutrition*. 2009; 19(5). 345-356.
5. Mahan LK and Stump SE. Krause's food and nutrition therapy. London: Saunders Publishers; 2008.
6. Nelms M, Sucher KP, Lacey K, et al. Nutrition therapy & pathophysiology. London: Thomson Publishers; 2010.
7. Costanzo LS. BRS Physiology. Mumbai: Wolter Kluwer; 2014.
8. McNeil SJ, Shearer JB, Johnson RM, et al. American Dietetic Association Revised 2008 Standards of Practice for Registered Dietitians in Nutrition Care; Standards of Professional Performance for Registered Dietitians; Standards of Practice for Dietetic Technicians, Registered, in Nutrition Care; and Standards of Professional Performance for Dietetic Technicians, Registered. *Journal of American Dietetic Association*. 2008; 1538-1542. doi: 10.1016/j.jada.2008.07.001
9. Writing Group of the Nutrition Care Process/Standardized Language Committee. Nutrition Care Process Part II: Using the International Dietetics and Nutrition Terminology to Document the Nutrition Care Process. *Journal of the American Dietetic Association*. 2008; 108(8). doi: 10.1016/j.jada.2008.06.368
10. Writing Group of the Nutrition Care Process/Standardized Language Committee. Nutrition Care Process and Model Part I: The 2008 Update. *Journal of the American Dietetic Association*. 2008; 108(7). doi: 10.1016/j.jada.2008.04.027
11. BMI Tool: American Diabetic Association. 2015. <http://www.diabetes.org/food-and-fitness/weight-loss/assess-your-lifestyle/bmi-tool.html>
12. Gibson RS. Principles of Nutrition Assessment. London: Oxford University Press; 2005.
13. Boullata J, Williams J, et al. Accurate Determination of Energy Needs in Hospitalized Patients. *J Am Diet Assoc*. 2007; 107. 393-401.
14. Reeves M and Capra S. Predicting Energy Requirements in the clinical setting: are current methods evidence based. *Nutrition Reviews*. 2003; 61. 143-151.
15. Abcouwer SS and Souba WW. Modern nutrition in health and

- disease. Baltimore: Williams & Wilkins; 2008.
16. Robinson CH. Normal and Therapeutic Nutrition. Chennai: Macmillan Publishing Company; 1990.
 17. Whitney E, Pinna K and Rolfes SR. Understanding Normal and Clinical Nutrition. New York: Medical; 2011.
 18. Managing Blood Pressure with a Heart-Healthy Diet. American Heart Association. 2014. http://www.heart.org/HEARTORG/Conditions/HighBloodPressure/Prevention-TreatmentofHighBloodPressure/Managing-Blood-Pressure-with-a-Heart-Healthy-Diet_UCM_301879_Article.jsp
 19. NKF KDOQI Guidelines. National Kidney Foundation. 2007. http://www2.kidney.org/professionals/KDOQI/guideline_diabetes/guide5.htm
 20. NKF K/DOQI Guidelines. National Kidney Foundation. 2011. http://www2.kidney.org/professionals/KDOQI/guidelines_bp/guide_6.htm
 21. Writing Group of the Nutrition Care Process/Standardized Language Committee. Nutrition Care Process Part II: Using the International Dietetics and Nutrition Terminology to Document the Nutrition Care Process. Journal of the American Dietetic Association. 2008; 108(8). 1287-1289. doi: 10.1016/j.jada.2008.06.368
 22. Renal & Diabetic Dietary Guidelines. United States Department of Agriculture. 2015. <http://fnic.nal.usda.gov/diet-and-disease/diabetes> & <http://fnic.nal.usda.gov/diet-and-disease/kidney-diseases>
 23. Bruyne LD, Pinna K and Whitney E. Nutrition & Diet Therapy. New York: Medical; 2011.

Correspondence:

Rabbia Awan
Department of Food Sciences & Human Nutrition
Kinnaird College for Women - 93 – Jail Road
Lahore, Pakistan - Postal Code: 54800
Phone: 0092 042 756 9532
E-mail: mdyawan@yahoo.com