NUTRITION FOR PEOPLE ON DIALYSIS

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SG.2025.61530.NEP.1 (v1.1)

Content

What do kidneys do?

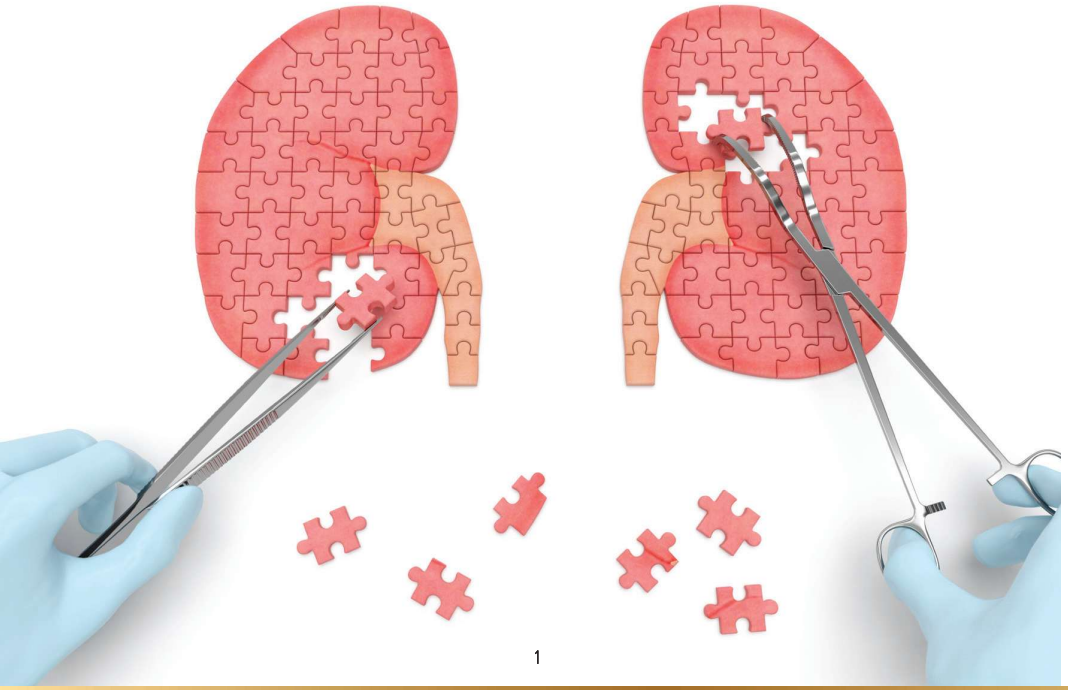
A key function of the kidneys is to remove waste products and excess fluid from the body through urine.

When the protein we eat is digested, a waste product called urea is formed.

Urea and other wastes are combined with water in the kidneys to form urine.

The kidneys also perform other important functions in the body, such as:

- Maintaining the body's balance of water, minerals (e.g. calcium & phosphorus) and electrolytes (e.g. sodium & potassium)
- Releasing hormones which stimulate red blood cell production and help regulate blood pressure
- Producing an active form of Vitamin D that helps to keep bones strong



What is chronic kidney disease (CKD)?

Chronic kidney disease (CKD) refers to a gradual loss of kidney function. Damaged or diseased kidneys do not filter enough waste products from the blood, causing them to build up in the blood and act like poison. People with CKD may also develop complications like high blood pressure, anemia, weak bones, poor nutritional status and nerve damage. CKD also increases the risk of having heart and blood vessel diseases over time.

Common causes of CKD include diabetes, high blood pressure, glomerulonephritis (inflammation and damage to the kidney's filtering units) and hereditary kidney diseases. Individuals can lose more than half their normal kidney function before they start to notice symptoms of kidney disease. Some of these symptoms are:

- **Nausea**
- **Vomiting**
- **Tiredness**
- **Loss of appetite**
- **Itchiness**
- **High blood pressure**
- **Shortness of breath**
- **Swelling in hands, face and feet**

When kidney disease progresses, it may eventually lead to kidney failure. Dialysis or a kidney transplant is then needed to maintain life.

What is dialysis?

Dialysis is an artificial filtering procedure which acts like the normal kidney to remove extra water and waste products that have built up in the body.

There are two kinds of dialysis – hemodialysis and peritoneal dialysis.

Hemodialysis (HD)

HD is the process of removing toxins and excess fluid from the body by continually circulating the blood through a filter called dialyzer. This filter is used with a dialysis machine 3 to 4 times a week.

Peritoneal Dialysis (PD)

In PD, the abdominal cavity is filled with a cleansing solution called dialysate. The walls of the abdominal cavity are lined with a membrane called peritoneum, which allows waste products and extra fluid to pass from the blood into the dialysate. The dialysate typically stays in the peritoneum for 4-5 hours, before it is drained and replaced.

What is albumin and why is it important?

Albumin is a type of protein in the blood. On a regular basis, your albumin level will be measured. Low albumin levels in patients CKD have been associated with poor health outcomes.

Consult your doctor to find out what your target albumin level should be and talk to your dietitian about nutritional options to help you reach that target.

Weighty issues

A person with healthy kidneys may urinate up to seven times a day. Most people on dialysis, however, make little to no urine, because their kidneys can no longer remove wastes and extra fluid from the body effectively. Without urination, fluid builds up in the body and can cause swelling, shortness of breath and weight gain. Dialysis filters the blood to remove excess fluid but it cannot do the job as effectively as healthy kidneys which work around the clock.

Your weight without the excess fluid that builds up between dialysis is called dry weight. It is the lowest weight you can safely reach after dialysis without developing symptoms of low blood pressure such as cramping, which can occur when too much fluid is removed. In general, you should not gain more than 5% of estimated dry weight between dialysis sessions.

Nutrition and dialysis: A basic guide

The dietary needs of people on dialysis may vary depending on factors such as body size, activity level and blood test results. If the individual is following a diet plan for diabetes or other health conditions, he or she has to continue on it as well.

It can be challenging for dialysis patients to manage their diet, hence they are strongly encouraged to consult a dietitian for personalized guidance on food intake to meet dietary goals.

Getting the right nutrition through your prescribed diet and appropriate nutrition supplements can help improve your condition and make you feel stronger. Importantly, it can also help improve the effectiveness of your dialysis treatments as well as reduce risk of health complications.

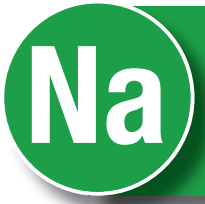
Dietary goals at a glance

Calories
You have to eat enough calories to supply your body with the energy to function properly and carry out daily activities.

Protein
You need more protein than before to replace the protein you lose during dialysis. Eating the right amount of protein will help in building muscle.

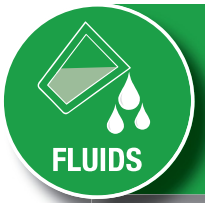
Potassium
High potassium levels in the blood can cause irregular heartbeat or a heart attack. Foods which are high in potassium, such as certain type of fruit and vegetables may need to be limited or avoided. Soaking and cooking these food items with extra water and draining it off, may help lower potassium content as well.

Phosphorus
The build-up of phosphorus in the blood can draw calcium out of your bones, making them weak. Foods high in phosphorus such as dairy products, organ meats, fish with edible bones, whole-grains and beans may need to be reduced.



Sodium
Consuming too much sodium can lead to fluid retention, causing swelling of the legs and feet and increasing blood pressure. Restriction of sodium intake can help to maintain normal fluid balance.

Vitamins
Some vitamins need to be supplemented, while the intake of others should be controlled.



Fluids
Excess fluid intake can result in shortness of breath, swelling and increased blood pressure. Getting the right amount of fluid will help you feel your best. Consult your doctor, dietitian or nurse about your daily fluid allowance.

Calories

You need to have sufficient calories in the diet to supply your body with energy to function properly and carry out daily activities. If too few calories are consumed, the body may break down muscles for energy and also utilize dietary protein as an energy source. This is not desirable as protein then cannot perform the valuable function of building body tissues.

To help make up your daily calorie needs, you need to eat your prescribed diet which includes approved food items from each of the food groups. Adding more fat and sugar (such as margarine, oils, honey and jam) to the diet can help you increase energy intake. Discuss with your dietitian on how you can ensure adequate calorie intake while making appropriate food choices. This is especially important if you have diabetes and need to maintain good sugar control (see section on “Dialysis and diabetes”).

Protein

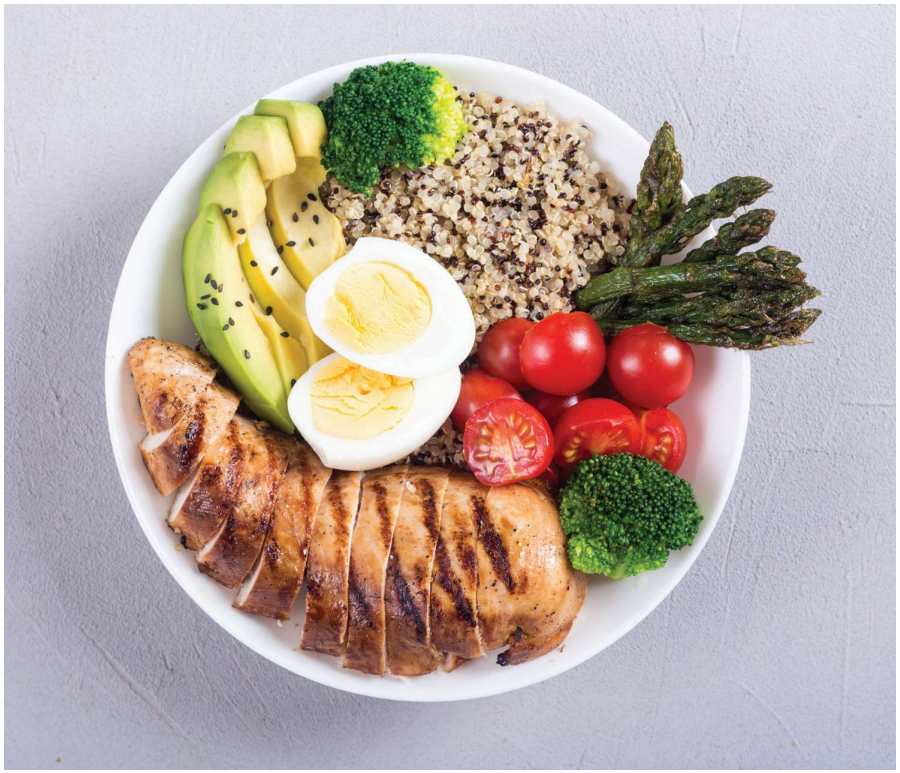
You may have been on a low protein diet before dialysis, but now your body needs more protein to replace the protein you lose during dialysis treatment. The key is to eat the right amount of protein – neither too little nor too much.

With the right amount of protein, your body can build muscles and you can improve the body’s immune system. This helps to reduce the risk of health complications like infections and malnutrition.

Protein is found in both animal and plant foods:

1. Animal protein- meat, poultry, fish and other seafood, eggs, milk and milk products
2. Plant protein- beans and bean products (e.g. tofu), nuts, lentils, bread, rice

Protein from animal sources is the best in quality, which means they are efficiently used by the body and so should make up most of the protein in the diet.



Protein Exchanges

Each food in the protein exchange list below contains 7g of protein. Protein exchange helps provide variety in choosing suitable protein sources in your diet.

Please consult your dietitian to learn more and find out the number of protein exchanges you require in a day.

ANIMAL PROTEIN:	
Egg	1 (medium)
(Cooked) Fish Chicken Mutton Beef Pork	30g or 1 matchbox size
Prawn	4 (medium)

MILK & MILK PRODUCTS*+:	
Fresh Milk or UHT	1 cup (200ml)
Milk Powder	4 tablespoons (150g)
Yoghurt	1 small tub (150g)
Cheese*	1½ slice (30g)

LEGUMES*+:	
Beans/Lentils (cooked)	½ cup (120g)
Taukua	½ square firm (60g)
Tofu	½ large block soft (150g)

NUTS/SEEDS*+:	
Nuts and Seeds	½ cup (30g)
Peanut Butter	2 dessert spoons (30g)

* High in sodium
\+ High in phosphate

USEFUL TIP
Spread out the intake of protein evenly throughout the day for better utilization by the body.

Potassium

Potassium is a mineral that helps your nerves, muscles and heart work properly. For people with CKD, the kidneys can no longer remove excess potassium.

Choose foods which are low or moderate in potassium more frequently and consume in moderation. Foods which are high in potassium should be limited or avoided.

Fruits – limit to 2 servings per day

Low < 150mg potassium per serving		Medium 150 – 250mg potassium per serving		High > 250mg potassium per serving	
Apple	1 small	Cherry	10 medium	Apricots	4 small
Blueberries	½ cup	Chiku	1½ medium	Avocado	1 medium
Cranberries	100g	Duku	10 medium	Banana	1 small
Durian	2 seed	Langsat	10 medium	Custard apple	1 medium
Dragon fruit	½ fruit	Lychee	6 medium	Dates	2 pieces
Grapes	10 small	Orange	1 small	Figs	2 small
Grapefruit	½ fruit	Papaya	1 slice	Honeydew	1 slice
Guava	½ fruit	Passion fruit	3½ medium	Jackfruit	2 seed
Lemon	1 small	Peach	1 medium	Kiwi	1 medium
Lime	1 whole	Persimmon	1 medium	Mango	½ medium
Longan	10 medium	Plum	2 small	Nectarine	1 medium
Mangosteen	4 medium	Pomelo	3 segment	Pomegranate	½ medium
Pear	1 small	Raspberries	1 cup	Prunes	4 pieces
Pineapple	1 wedge	Strawberries	1 cup	Rockmelon	1 slice
Rambutan	4 medium	Tangerines	1 medium	Soursop	1 slice
Water apple	4 medium	Dried fruit e.g. Raisins	20g		
Watermelon	1 wedge				
Canned fruit (juices drained)	½ cup				

Source: National Kidney Foundation

Vegetables – limit to 2 servings per day
1 serving = 100g (¾ cup) cooked; 100g raw non-leafy; 150g raw leafy

Low < 200mg potassium per serving	Medium 200 – 350mg potassium per serving	High > 350mg potassium per serving
Bean sprouts	Asparagus	Bamboo shoot
Brinjal	Chinese cabbage	Broccoli
Cabbage	Cauliflower	Mustard green/Chye Sim
Capsicum	Carrot	Chick peas
Carrot (frozen/boiled)	Celery	Fern shoot (pucuk paku)
Cucumber	Chives	Fresh mushroom
French bean	Chili (green/red)	Kale (Kai Lan)
Gourd – all types	Ladies finger	Lotus root
Kangkung	Leeks	Petai
Lettuce	Lentils (boiled/dhal)	Potatoes
Long bean	Lima bean	Seaweed
Mushroom	Peas (raw/dried)	Spinach
– Canned, drained	Snow peas	Sweet potato
– Dried, soaked and drained	Pumpkin	Sweet potato leaves
Onion	Sweetcorn (frozen/boiled)	Tomato (paste/puree)
Peas (frozen/boiled)	Tomato (raw, canned)	Water chestnut
Spring onion		
Turnip		
Winter melon		

Source: National Kidney Foundation

Beverages

Low	Medium	High
Syrup-based drinks	Barley	Strong coffee or tea
	Chinese tea	All fresh/canned fruit & vegetable juice
	Non-cola beverage	Herbal medicine drinks
	Sugar cane juice	Cocoa & malted beverage
		Milk
		Wine

USEFUL TIP

1. To remove some of the potassium from vegetables:
   - Cut vegetables into smaller pieces
   - Soak vegetables in water for 1-2 hours
   - Drain water before cooking
2. Drain juice or syrup from canned fruits and vegetables
3. Use whole rather than ground spices

Source: National Kidney Foundation

Phosphorus

When the kidneys are not working properly, phosphorus can build up in your blood. A high phosphate level tends to attract calcium from the bones, making them weak and brittle. It also results in the deposition of hard calcium phosphate salts in the soft tissues, leading to conditions like skin itchiness, joint pains and eye irritation.

Phosphorus is mainly found in animal foods and dairy products. Some plant food such as whole-grain and nuts contains high phosphorus as well. Limit the intake of foods high in phosphorus.

FOODS HIGH IN PHOSPHORUS

- Milk
- Yoghurt
- Cheese
- Legumes (e.g. tofu, soybean milk)
- Nuts and products (e.g. peanut butter)
- Seeds and products (e.g. sesame oil)
- Coconut and products (e.g. coconut milk)
- Cola drinks/dark colored soda
- Malted and cocoa-based drinks
- Cheese, nut and chocolate-based biscuits
- Chocolate
- Keropok (fish and prawn cracker)
- Bones (chicken wing or feet soup stocks)
- Fish with edible bones (sardines)
- Organ meat (e.g. liver, kidney)
- Egg yolk
- Extracts (Marmite/Bovril)
- Anchovies (ikan bilis)
- Dried prawn
- Dried fish
- Dried mushroom
- Seaweed
- Oats
- Muesli/Weet-Bix
- Brown rice
- Wholemeal
- Wholegrain bread/biscuits

Source: National Kidney Foundation

USEFUL TIP

Don't forget to take phosphate binders (e.g. calcium carbonate) with meals! If prescribed, these pills bind phosphate from food and prevent their absorption into the blood. Taking them without a meal makes them ineffective.

Sodium

Sodium is a major part of table salt and can be commonly found in sauces, condiments, preservatives, preserved foods and canned foods. Too much sodium increases thirst and causes fluid build-up in the body, which increases blood pressure and can hurt your heart.

Here are some steps to help reduce your sodium intake.

1. Most sodium comes from processed food and is present in many different forms. Read the ingredient labels. The product is likely to be high in sodium if the first three ingredients contain any of these:
   - Sodium chloride/table salt
   - Monosodium glutamate (MSG)
   - Rock/sea/iodized salt
   - Baking powder
   - Sodium nitrite
   - Sodium benzoate
2. Avoid the use of lower sodium salts as they usually contain potassium.

USEFUL TIPS

- Limit sodium-rich processed food such as luncheon meat or hot dogs and choose fresh vegetables, poultry and meat.
- When cooking at home, use whole spices, lemon juice or natural seasonings such as shallots, onions, garlic and parsley to spice up your cooking instead of adding table salt.
- Only add salt or sauces sparingly after cooking. Taste the food before salt is added.
- Avoid having pickles, sambal belachan, papadum or chutneys with your meal.
- Minimize the number of times you eat out as most food sold outside is highly salted.
- When dining out, ask for less gravy, avoid drinking the soup and limit preserved foods such as 'ikan bilis'. Remember to request for freshly cooked items without salt, MSG or soy sauce.
- When purchasing foods, choose foods that have the 'Healthier Choice' symbol or those labelled in 'Low In Sodium' or 'No Added Salt'.
- Read food labels to compare similar foods per 100g and choose the lower sodium version.

Vitamins

People on dialysis often need to take a renal multivitamin supplement with the right balance of vitamins. This is because some vitamins are lost during dialysis (e.g. vitamin B6 & B12), and following a dialysis diet could also mean that you are not getting enough of certain vitamins. On the other hand, some vitamins should not be supplemented because levels will build up in the body as the kidneys stop working (e.g. Vitamin A).

If a vitamin supplement is not prescribed, you should ask your doctor or dietitian for a recommendation before taking one.

Fluids

When you drink or consume too much fluid, you may get:

- Cramps during your dialysis session
- High blood pressure
- Shortness of breath
- Increase in blood pressure
- Heart problems, e.g. fast pulse, weakened heart muscles and an enlarged heart
- Muscle cramping and drop in blood pressure after dialysis treatment, which can leave you feeling nauseated, dizzy and weak

Sources of fluid include liquids like water, tea, coffee, cordial drinks, milk and soup. Other food items can contribute fluid too, such as porridge, jelly, ice cube, ice cream and ice kacang.

Daily allowance for fluid intake may vary from 500 to 1000 ml per day, depending on your urine output and activity levels. To know if you're in the correct fluid balance, you can weigh yourself daily to monitor sudden/rapid rise in weight, or check your legs for swelling.

Here are some ways to help control your fluid intake:

- Measure the fluid allowed for the day in a jug. Each time you consume any fluid, pour out the same amount from the container. When it runs out of water, you know you have reached your daily allowance
- Suck on an ice cube to moisten dry mouth (the fluid content should be accounted for)
- Rinse mouth with water but do not swallow it
- Limit salty food so you will feel less thirsty

Fluid Content Of Common Measures

Item	Volume (ml)
1 tablespoon	15
1 Chinese soup spoon	30
1 ice cube	20
1 Chinese bowl of porridge	100
1 tea cup	150
1 cup	250

Dialysis and diabetes

If you have diabetes, your doctor may adjust your medication to help optimize blood sugar control while on dialysis. Diet management also becomes even more important.

Carbohydrate foods affect blood sugar the most, so your carbohydrate intake would need to be adjusted to help manage your blood sugar levels. Carbohydrates include both starchy foods like rice, bread, noodles and fruits, as well as sugary foods like candies and sweet desserts.

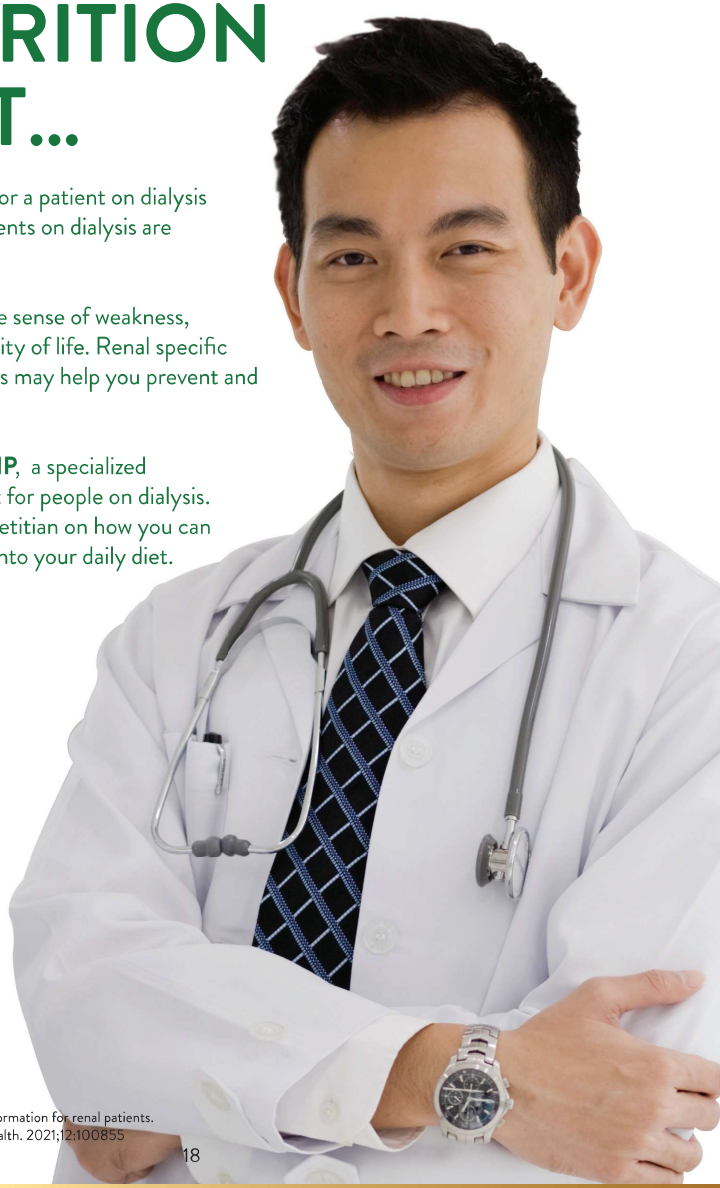
Consult your dietitian to find out the amount of carbohydrates that are sufficient to meet your needs and the type of carbohydrate foods to eat. If you are on peritoneal dialysis, the dietitian will also take into account the quantity of dialysate solutions you're using as the dialysate is usually a sugar-based solution.

WHEN YOU NEED A NUTRITION BOOST...

Following a diet suitable for a patient on dialysis is hard. Almost 1 in 2 patients on dialysis are malnourished[1].

Malnutrition increases the sense of weakness, impairs recovery and quality of life. Renal specific oral nutrition supplements may help you prevent and overcome malnutrition.

Consider using **Nepro® HP**, a specialized medical nutrition product for people on dialysis. Consult your doctor or dietitian on how you can incorporate **Nepro® HP** into your daily diet.



This section contains product-specific information for renal patients.

[1] Rashid I, et al. Clin Epidemiol Global Health. 2021;12:100855

Nepro® HP supports your nutritional needs and helps to replace the protein and other nutrients you may have lost during dialysis

PROTEIN

HIGH IN PROTEIN
(17.82g/bottle) to help replace protein lost during dialysis

B6 28 B3

COMPLETE & BALANCED
With 28 vitamins and minerals including vitamins B3 & B6 to help produce energy and reduce tiredness

P K Na

LOW IN PHOSPHORUS, POTASSIUM, AND SODIUM
to help comply with current expert recommendations*

* European Best Practice Guidelines (EBPG), European Society for Clinical Nutrition and Metabolism (ESPEN), National Kidney Foundation KDOQI/KDIGO guidelines – when used as sole source of nutrition

OTHER FEATURES OF NEPRO® HP

401 Kcal

Rich in calories
To meet energy needs (401kcal/bottle)

REDUCED WATER 161ml

Reduced water content
(161ml/220ml bottle)

Suitable for people with Diabetes
Advanced, slow-digesting, low Glycemic Index (GI) carbohydrate complex

Ω

Contains Omega-3
& monounsaturated fatty acids (MUFA)

Nepro® HP has low Glycemic Index of 35, which makes it also suitable for people with diabetes on dialysis.

How to incorporate Nepro® HP into your diet?*

***Note:**

Suggestion only, consult your dietitian to ensure Nepro® HP is used appropriately and aligned with your specific nutritional needs and treatment plan.

Add variety to your diet with Nepro® HP recipes.

Hearty Rice Porridge

Servings: 2

Ingredients:

- 0.5 bottle vanilla Nepro® HP (220ml)
- 0.5 cup cooked white rice
- 1 cups water
- 1 whole apples (peeled, cored, sliced)
- 0.5 tbsp sunflower seeds

Directions:

1. Mix together rice, water and sugar in a saucepan. Cook until soft.
2. Add sliced apples and cook until tender. Remove from fire and add vanilla Nepro® HP.
3. Stir well and serve hot. Garnish with sunflower seeds.

Nutrition Facts

Amount per serving	
Kcal	200
Protein	6 g
Carbohydrate	29 g
Fat	7 g
Sodium	44 mg
Potassium	162 mg
Calcium	68 mg
Phosphorus	82 mg

Mushroom Soup

Servings: 4

Ingredients:

- 0.5 bottle vanilla Nepro® HP (110ml)
- 0.75 cups homemade chicken stock
- 150g fresh mushrooms
- 0.5 tbsp butter
- Salt and black pepper to taste

Directions:

1. Bring stock to boil in a pot. Add mushrooms and butter. Cook for about 10 minutes then remove a few mushrooms for garnish.
2. Use a hand-held blender and blend all ingredients in the pot until smooth. Add vanilla Nepro® HP and stir well.
3. Portion into bowls, garnish with mushrooms and serve immediately.

Nutrition Facts

Amount per serving	
Kcal	139
Protein	6 g
Carbohydrate	10 g
Fat	9 g
Sodium	147 mg
Potassium	140 mg
Calcium	62 mg
Phosphorus	67 mg

Strawberry Smoothie

Servings: 2

Ingredients:

- 1 bottle vanilla Nepro® HP (220ml) (chilled)
- ½ cup frozen strawberries
- 4 tbsps water

Directions:

1. Combine the ingredients in the jar of a blender.
2. Blend on 'high' until smooth.
3. Serve immediately.

Nutrition Facts

Amount per serving

Kcal	213
Protein	9 g
Carbohydrate	19 g
Fat	11 g
Sodium	87 mg
Potassium	193 mg
Calcium	123 mg
Phosphorus	88 mg

Cranberry Crunch Muffins

Serves: 2

Serving Size: 1 muffin

Ingredients:

- 1/3 cup all-purpose flour
- 1/3 tsp baking powder
- 1/24 cup wheat germ
- 1/24 cup sliced almonds
- 1/12 tbsp unsalted butter
- 1/6 bottle vanilla Nepro® HP (36.67ml)
- 1/6 large egg
- 1/18 cup vegetable oil
- 1/12 tsp pure vanilla extract
- 1/6 tbsp fresh orange zest
- 1/12 cup chopped dried cranberries

Directions:

1. Preheat the oven to 400°F. Line a 12-cup muffin tin with paper liners. Set aside.
2. In a large mixing bowl, combine the flour, baking powder, artificial sweetener and wheat germ. Remove ¼ cup of the flour mixture and place in a separate smaller bowl.
3. To the ¼ cup flour mixture, add the sliced almonds and butter. Using a fork, combine this mixture until it is crumbly. Set aside almond crunch mixture.
4. Whisk together the vanilla Nepro® HP, egg, vegetable oil, vanilla extract, and orange zest. Pour the mixture into the remaining flour mixture and fold together (just to combine). Add the dried cranberries and gently fold into batter. Do not over-blend the batter.
5. Spoon the batter into the prepared muffins pan. Sprinkle almond crunch mixture (see step #3) evenly over each cup. Bake for 14 to 16 minutes. Remove the muffins from the pan immediately and transfer them to a wire rack to cool. Serve warm. Muffins can be cooled, wrapped individually in airtight bags, and frozen up to 1 month.

Nutrition Facts

Amount per serving

Kcal	148
Protein	5 g
Carbohydrate	24 g
Fat	8 g
Sodium	79 mg
Potassium	67 mg
Calcium	143 mg
Phosphorus	197 mg

Your Meal Plan

Consult your dietician for a personalized CKD-friendly meal plan tailored to meet your nutritional needs.

Meal	Time	Food Item/portion	Remark
Breakfast			
Snack			
Lunch			
Snack			
Dinner			

Talk to your dietitian on what your daily nutrition targets should be.

Calories

Target calories per day _____

Protein

Target grams per day _____

Phosphorus

Target milligrams per day _____

Potassium

Target milligrams per day _____

Fluids

Target milliliters per day _____

Dry Weight

Target kilograms per day _____

Ask your dietitian how you can include Nepro® HP in your daily meal plan.

Your Health Chart

Name: ______________________ Date of Birth: ____________

Height: ________ cm Gender: Male/Female

			Date of Examination		
Key measurements	Units	Range	/ /	/ /	/ /
Weight	kg				
BMI		18.5 - 23			
Blood Pressure (BP)	mmHg	120/80			
Renal Profile					
Potassium	mmol/L	3.5–5.5			
Sodium	mmol/L	135-150			
Chloride	mmol/L	96 - 108			
Bicarbonate	mmol/L	>20 <24			
Pre Creatinine	Variable on body mass and gender				
Post Creatinine	µmol/L	442			
Pre Urea	mmol/L	>20 <40			
Post Urea	mmol/L	< 6.67			
Bone Profile					
Calcium	mmol/L	2.2–2.60			
Phosphate	mmol/L	< 1.18			
Lipid Profile					
Total Cholesterol	mmol/L	< 6.1			
Triglycerides	mmol/L	< 2.3			
HDL-cholesterol	mmol/L	1.0–2.0			
LDL-cholesterol	mmol/L	< 3.334			
Albumin	g/L	> 35g			
Endocrine Function					
HbA1c	%	4.6–6.4			
Glucose Random	mmol/L	4.0–9.0			

Date of Examination					
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