

National Renal Nutrition Practice Guidelines for Adults



June 2018

National Department of Health Directorate: Nutrition



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Health
REPUBLIC OF SOUTH AFRICA





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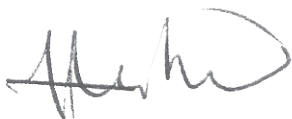
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DATE:

ACRONYMS

ACE	Angiotensin converting enzyme
AIDS	Acquired Immunodeficiency Syndrome
AKI	Acute kidney injury
AKIN	Acute kidney injury network
ARF	Acute renal failure
BEE	Basal energy expenditure
BMI	Body mass index
BP	Blood pressure
BUN	Blood urea nitrogen
CAPD	Continuous ambulatory peritoneal dialysis
CKD	Chronic kidney disease
CRP	C-reactive protein
CRRT	Continuous renal replacement therapy
DRI	Dietary reference intake
DPI	Dietary protein intake
EPO	Erythropoietin
ESRD	End-stage renal disease
GFR	Glomerular filtration rate
HB	Harris Benedict Equation for determining basal energy expenditure
HD	Hemodialysis
ICU	Intensive care unit
IHD	Intermittent hemodialysis
IBW	Ideal body weight
KDOQI	Kidney disease outcome quality initiative
LDL	Low density lipoproteins
NKF KDOQI	National Kidney Foundation Kidney Disease Outcome Quality Initiative
PCR	Protein catabolic rate
PD	Peritoneal dialysis
pmp	Per million population
PTH	Parathyroid hormone
RIFLE	Risk, injury, failure, loss, end stage renal disease
RRT	Renal replacement therapy
SGA	Subjective global assessment
TE	Total energy
TG	Triglycerides
TPN	Total parenteral nutrition
UUN	Urinary urea nitrogen (g/day)
VLDL	Very low density lipoproteins



SCOPE AND PURPOSE

These guidelines aim to provide nutritional recommendations based on current evidence for best practice in the management of acute and chronic renal disease. The guidelines are targeted at nutrition professionals that play a role in the prevention and treatment of renal disease in adult patients attending public health facilities for care.

BACKGROUND AND MOTIVATION

Acute kidney injury (AKI) is increasingly prevalent in both developed and developing countries and associated with severe morbidity and mortality. Worldwide, one in five adults experience AKI during a hospital episode of care, which should raise concern and awareness amongst healthcare workers^{1, 2}.

Efforts should focus on minimising the causes of AKI, providing guidance on preventive strategies and early recognition and management. It is said that prevention is the key to avoid the heavy burden of mortality and morbidity associated with AKI^{3, 4}.

Chronic kidney disease (CKD) affects mainly adults aged between 20 and 50 years in Sub-Saharan Africa and is primarily due to hypertension and glomerular diseases. Hypertension (especially in black patients) and diabetes (especially in whites and Asians) are the main causes of chronic kidney disease in South Africa.

Human immunodeficiency virus (HIV) infection is an epidemic, however there is very little data available on HIV-related glomerular disease. This is due to patients presenting late for treatment and usually already in need of dialysis. The availability of renal replacement therapy (RRT) is limited due to high costs and shortage of skilled employees. Dialysis rates are 4.5 per million population (pmp) for hemodialysis and 23 pmp for continuous ambulatory peritoneal dialysis (CAPD) in South Africa. The transplant rate averages 4.7 pmp in South Africa⁵. Thus, screening of high risk populations for CKD is a strategy that should be implemented, directed at patients with hypertension, diabetes mellitus, proteinuria, HIV infection and a family history of CKD⁶.

In addition, medical nutrition therapy plays a vital role in both the prevention and management of both non-communicable and renal disease. Thus, a team approach is suggested with a registered dietitian taking the key role in providing appropriate nutrition care.

SECTION A: ACUTE KIDNEY INJURY

1. DEFINITIONS

Acute kidney injury (AKI)

Recently acute kidney disease has been referred to as acute kidney injury.⁷AKI is an abrupt and sustained reduction in kidney function due to isolated kidney dysfunction or it may be a complication of severe illness⁸and it is defined as:

- an increase in serum creatinine by $\geq 26.5 \mu\text{mol/l}$ ($\geq 0.3\text{mg/dl}$) within 48 hours or
- an increase in serum creatinine to ≥ 1.5 times baseline, which is known or presumed to have occurred within the prior seven days, or
- urine volume $< 0.5\text{ml/kg/h}$ for six hours

1.1 Classification of AKI

1.1.1 Risk, injury, failure, loss, end stage renal disease (RIFLE) and acute kidney injury network (AKIN) classifications
The widest used classification for AKI is the RIFLE model (acronym for risk, injury, failure, loss, end stage renal disease).^{9,10} Also commonly used is the Acute kidney injury network (AKIN) staging system, which is a modification of the RIFLE classification. Both models are based on serum creatinine and urine output, and both have been validated. In clinical practice, oliguria appears to be the main factor considered by clinicians when deciding to initiate RRT.

The RIFLE classification is defined in **Table 1**.⁸

Table 1: RIFLE classification

Class	S* creatinine or glomerular filtration rate (GFR) criteria	Urine output criteria
Risk (stage 1)	Serum creatinine x 1.5 or GFR decreased by >25%	<0.5ml/kg/hr x 6hr
Injury (stage 2)	Serum creatinine x 2 or GFR decreased by >50%	<0.5ml/kg/hr x 12hr
Failure (stage 3)	Serum creatinine x 3 or s creatinine 354mmol/L (³ 4mg/dL) with an acute rise 44mmol/L (>0.5mg/dL)	<0.3ml/kg/hr x 24hr Or anuria x 12hr
Loss	Persistent AKI = complete loss of kidney function > 4wks	
End stage kidney disease	End stage kidney disease > 3 months	

- AKIN criteria
The AKIN criteria have similar urine output criteria to the RIFLE classification, but differ in the serum creatinine levels as illustrated in **Table 2**.

Table 2: AKIN staging system¹¹

Stage	Serum creatinine	Urine output
1*	Increase in serum creatinine of more than or equal to 26.4 $\mu\text{mol/l}$ (0.3 mg/dl) or increase to more than or equal to 150% to 200% (1.5- to 2-fold) from baseline	Less than 0.5 ml/kg per hour for more than 6 hours
2	Increase in serum creatinine to more than 200% to 300% (> 2- to 3-fold) from baseline	Less than 0.5 ml/kg per hour for more than 12 hours
3#	Increase in serum creatinine to more than 300% (> 3-fold) from baseline (or serum creatinine of more than or equal to 354 $\mu\text{mol/l}$ (4.0 mg/dl) with an acute increase of at least 44 $\mu\text{mol/l}$ (0.5 mg/dl)	Less than 0.3 ml/kg per hour for 24 hours or anuria for 12 hour

* =Modified from RIFLE (Risk, Injury, Failure, Loss, and End-stage kidney disease) criteria. The staging system proposed is a highly sensitive interim staging system and is based on recent data indicating that a small change in serum creatinine influences outcome. Only one criterion (creatinine or urine output) has to be fulfilled to qualify for a stage.

= Given wide variation in indications and timing of initiation of RRT, individuals who receive RRT are considered to have met the criteria for stage 3 irrespective of the stage they are in at the time of RRT.

2. NUTRITIONAL ASSESSMENT

Nutritional assessment of the AKI patient is comparable to the routine nutrition assessment of normal individuals.

2.1 Anthropometry

Use actual body weight if normal body mass index (BMI).

Use ideal body weight if overweight and critically ill.

2.2 Biochemistry (if available and/or indicated as part of routine monitoring)

- full blood count
- Na, K, Cl, urea, creatinine
- calcium, magnesium, phosphate
- serum triglycerides
- serum glucose
- c-reactive protein
- albumin

2.3 Clinical

- signs and symptoms of fluid overload
- abdominal distension and discomfort
- stools (frequency and consistency)
- temperature
- blood pressure (BP)

2.4 Diet history

Dietary intake assessment can be completed as indicated using traditional choices of 24-hour recall, food diary, food frequency questionnaires.¹²

- food/medication allergies or intolerances
- dietary intake prior to hospital admission
- period nil per mouth within hospital/when was last meal taken
- special dietary needs/interventions
- medicine-nutrient interactions
- herbal/supplement use

2.5 Urinary analysis (dipsticks and microscopy)

- glucose
- protein
- urea and creatinine

2.6 Blood gasses

- PH
- PO₂/PCO₂
- TCO₂/HCO₃

Nutritional support of AKI patients particularly demands an integrated and overall view on energy, protein, fluid, electrolyte metabolism, and a careful and accurate assessment of nitrogen and electrolyte balances.¹³ Nutritional support in AKI should be started very early after injury.¹³ Nutritional support varies considerably between individual patients, depending on the degree of renal failure, co-morbid illness and medical management. Therefore, there is no standard dietary regimen that can be used for all patients.¹⁴

3. NUTRITIONAL RECOMMENDATIONS

3.1 Summary

Note: Recommendations vary according to reference used. Clinical judgement remains important.

Table 3: Nutritional recommendations for acute kidney injury ^{7,9,15,16,17,18,19,20,21,22,23,24,25}

	Conservative (non-dialysed)	Hemodialysis
Protein (g/kg/d)	0.6 – 1.0	IHD 1.2-1.5 CRRT 1.7 Hypercatabolic 1.7 (maximum 2g/kg)
Glutamine	Glutamine is contraindicated in patients with multi-organ failure and where GFR is less than 30 ml/min.	
Note: In CRRT, approximately 0,2g amino acid is lost per litre of filtrate, resulting in a total loss of 10 to 15g amino acid (protein) per day.		
Energy (kcal/kg/d)	20-30 (TE)	1-30 (TE)
Note: Internationally, the recommended energy requirement for AKI is 25 to 35kcal/ kg/ day (total energy). In practice, 20 to 30kcal/kg/day is more achievable.		
Fat (%TE)	30-35 IV 0.8-1.2 g/kg	30-35 IV 0.8-1.2 g/kg
Note: It is important to monitor serum TG and to reduce or stop fat /simple sugar intake, if TG exceeds 4.52 mmol/L (400mg/dL).		
CHO (mg/kg)	50-60 % (TE) 4-7 (critically ill)	50-60% (TE) 4-7 (critically ill)
Note: In AKI critically ill patients with elevated blood sugars, infusion insulin therapy targeting plasma glucose at 6.1 to 8.3mmol/L, is recommended.		
Sodium (mg/d)	2000-3000	2000-3000 Increased need to replace losses with diuresis
Fluid (ml/d)	Output PLUS 500-750 (maintain balance) Increase fluid during diuresis	Output PLUS 500-750 PLUS 1000ml (maintain balance), Increase fluid during diuresis and CRRT
Potassium (mg/d)	2000-3000	2000-3000 Needs may increase with dialysis, diuresis, anabolism
Calcium (mg/d)	Maintain normal levels	Maintain normal levels
Phosphate (mg/kg/d)	10-15 May need P-binders	10-15 May need P-binders Needs may increase with CRRT, return of kidney function, anabolism
Zinc (mg/d)	Unknown	Unknown
Copper (µg/d)	-	300-500 CRRT
Note: Copper should be withheld from nutritional support when the total bilirubin is greater than 51.3 µmol/L (3mg/dL).		
Thiamine (mg/d)	1.1-1.5	25-100 CRRT
Selenium(µg/d)	-	100 CRRT
Folate (mg/d)	1.0	1.0
Vit C (mg/d)	<100	IHD 100 CRRT 100-200
Vit A (µg/d)	700 -900	700 - 900
Note: Vitamin A toxicity (hypervitaminosis A) due to increased plasma retinol levels as a result of the loss of renal degradation of retinal binding protein in renal failure, occurs in patients on prolonged RRT.		
Vit D (µg/d)	Unknown	Unknown
Note: Risks of vitamin D supplementation (>10 000 to 40000 IU per day) taken for extended periods, include hypercalcaemia, hypercalciuria and acute kidney injury. Optimal vitamin D supplementation for critically ill patients with AKI has not yet been established.		
Vit E(mg/d)	0-15 (Individualise)	0-15 (Individualise)
Vit K(µg.d)	DRI	DRI

***Using ideal body weight (ESPEN enteral guidelines, 2006)²⁶**

Note: Refer to anthropometry section for the appropriate weight to use in calculations

4. NUTRITIONAL INTERVENTION

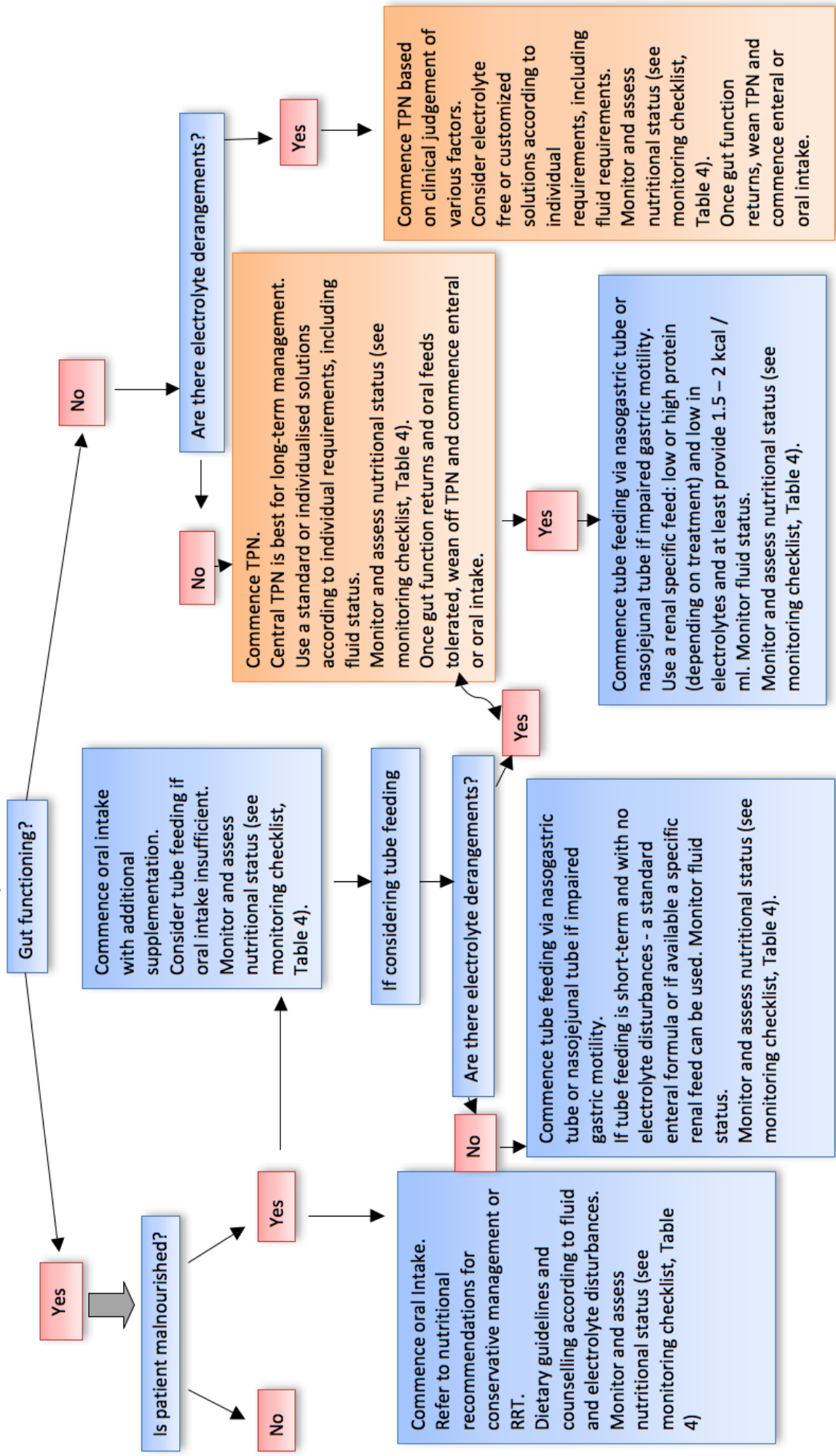
Prescribe an appropriate renal diet based on modality of treatment, patient's tolerance and fluid restrictions. Patients with poor oral intake should be supplemented accordingly or be considered for enteral feeding. Critically ill patients with AKI would often require enteral feeding. Enteral feeding of AKI critically ill patients may be challenging due to impaired gastrointestinal motility and decreased absorption of nutrients secondary to bowel oedema. AKI is a major risk factor for gastrointestinal haemorrhage. Enteral feeding may potentially exert a protective effect in reducing the risk of stress ulcers or bleeding.¹⁵

When sufficient enteral feeding cannot be achieved, the combination of enteral and parenteral feeding may be required to achieve successful nutritional support. The two routes of feeding should be considered complementary, and not mutually exclusive.¹⁸ Enteral nutrition is the preferential route in the first 24 to 48 hours upon intensive care unit (ICU) admission, and if adequate enteral nutrition cannot be achieved between three and five days, parenteral nutrition should be introduced.¹⁵

At the onset of AKI, when few patients can tolerate oral feedings because of vomiting and diarrhoea, intravenous (IV) preparations can be used to reduce protein catabolism. Some patients can be managed with enteral feedings, depending on the degree of severity of symptoms, but in most AKI patients, IV feedings e.g. total parenteral nutrition (TPN) must be used. The preferred treatment is illustrated in **Figure 1**.

Acute kidney injury²⁰

Figure 1: AKI flow chart



5. MONITORING

5.1 Nutritional assessment monitoring and follow-up

Table 4 summarises measurements and laboratory tests used to monitor the effectiveness of therapy for the patient with AKI. The frequency of testing will vary on an individual basis or as indicated.

Table 4: Monitoring checklist for the patient with AKI^{27, 28}

Parameter	Frequency of assessment	
	Unstable patient*	Stable patient
Anthropometry		
Weight	1-2x/week Depending on how stable the patient is.	1x/week Ideally daily to monitor changes in fluid status.
Biochemistry #		
Serum potassium, sodium	Daily	Daily
Serum urea and creatinine	Daily	Daily
Serum phosphorus, calcium and magnesium	Daily	3x/week
Full blood count	Daily	1x/week
Blood glucose	4 hourly	Daily
Serum albumin	3x/week	1x/week
C-reactive protein (CRP)	2x/week	1x/week
Clinical		
Abdominal distension and discomfort	Daily	Daily
Fluid intake and output	Daily	Daily
Signs and symptoms of oedema or dehydration	Daily	Daily
Stool output and consistency	Daily	Daily
Urine (dipstix and microscopy)	As indicated	As indicated

Practices related to frequency of assessments may vary amongst hospitals but minimum requirements should be according to internal hospital protocols.

*Note: Haemodynamically unstable patients may require more frequent assessments.

5.2 Complications related to AKI

Table 5 presents complications related to treatment and possible causes thereof in the patient with AKI.

Table 5: Complications related to hemodialysis and possible causes thereof in the patient with AKI²⁹

Complication	Cause
Protein and electrolyte loss leads to, e.g.: Malnutrition Poor rehabilitation Fatigue Anaemia Infection	Inadequate protein and or calorie intake due to anorexia and uraemia, altered taste, metabolic acidosis, inflammation, and reduced dietary intake
Hypotension	Taking anti-hypertensive medication before dialysis Heart disease Septicaemia Anaemia Dehydration Anaphylaxis Air embolism Eating/drinking during dialysis Dialyzer reaction
Muscle cramps	Removal of large amounts of fluids; changes in electrolytes
Nausea and vomiting	Hypotension Uraemia Disequilibrium syndrome
Headache	Hypertension Too much fluid removal Disequilibrium syndrome
Chest pain	Ischemia
Hypertension	Fluid overload prior to dialysis. Non-compliance with blood pressure medications patients not taking medication Anxiety

5.3 Medication commonly used in acute kidney injury and potential side effects

Listed in this section are the commonly prescribed renal specific medications used in AKI, similar to chronic kidney disease, displaying their indication, action and side-effects limited to nutrition and gastrointestinal function. It includes various diuretics, anti-hypertensives, phosphate binders (not routinely used) and certain immuno-suppressive medication, etc.

Table 6: Medication commonly used in AKI and Potential Side Effects^{30, 31,32,33}

Medication	Indication	Action	Nutritional side-effects
Furosemide	Oedema, fluid overload	Loop diuretic	Urinary loss of potassium, zinc, magnesium, calcium, sodium dehydration
Thiazide Diuretics	Hypertension	Potent diuretic, prevent re-absorption of sodium, potassium, chloride	Nausea, anorexia, hyponatraemia, hypokalaemia, hyperuricaemia, hyperglycaemia
Spirinolactone	Hypertension, fluid overload	Aldosterone antagonist, potassium-sparing diuretic, which blocks exchange of sodium with potassium and hydrogen	Hyperkalaemia, dry mouth, nausea, vomiting, gastritis, diarrhoea
Calcium	Hyperphosphataemia, hypocalcaemia	Calcium supplement and phosphate binder. If used as a supplement, do not use with food	Constipation, increased Ca-P product, hypercalcaemia, calcium citrate increases aluminium absorption, nausea and vomiting
Aluminium hydroxide suspension	Hyperphosphataemia	Binds the phosphorus from ingested food in the gut (Ca-P complex), preventing absorption. Take with meals while restricting phosphate intake	Constipation, aluminium toxicity, increase thiamine requirements, impaired iron and folate absorption
Sevelamer Hydrochloride	Hyperphosphataemia	Non-calcium, non-aluminium phosphate binder, ionic and hydrogen bonding of phosphate	Increased calcium absorption if taken with calcium, diarrhoea, nausea, vomiting, dyspepsia, peripheral oedema, decrease LDL, increase HDL
Sodium polystyrene sulfonate	Hyperkalaemia	Sodium and potassium exchange in the gut; potassium containing resin is excreted in the stool	Sodium and fluid retention, diarrhoea, nausea and vomiting, constipation, hypokalaemia, hypocalcaemia, hypomagnesaemia
Angiotensin converting enzyme (ACE) inhibitors	Hypertension, renoprotection, heart failure	Inhibits the production of angiotensin (vasoconstrictor) Slows the degradation of bradykinin (vasodilator) Avoid natural liquorice	Hyperkalemia
Beta blockers	Hypertension	Adrenergic inhibitor, blocks sympathetic effects on heart and results in reduced arterial pressure and cardiac output	Abdominal discomfort, flatulence, masking if insulin-induced hypoglycaemia, lowering of HDL-cholesterol, increase total-cholesterol and triglycerides
Alpha Blocker	Hypertension	Adrenergic-receptor blocking norepinephrine action	Modest lowering of LDL-cholesterol, dryness of mouth
Corticosteroids (Prednisone, Methylprednisolone)	Immuno-suppressant used during kidney transplantation and treatment of many kidney diseases	Anti-inflammatory, immunosuppression	Hypertension, sodium and fluid retention, increased appetite weight gain, diabetes mellitus, dyslipidaemia, hypokalemia, hypocalcemia, osteoporosis, osteonecrosis, hypophosphataemia, protein hypercatabolism, urinary losses of zinc, potassium, calcium, vitamin C and nitrogen, gastrointestinal ulceration, impaired wound healing, pancreatitis, impaired growth in children
Cyclophosphamide	Used to treat auto-immune disorders	Interfere with DNA replication	Nausea, vomiting, diarrhoea, mouth sores, syndrome of inappropriate ADH

5.4 Patient education

(For specific patient treatment e.g. fluid, potassium, sodium and protein refer to patient education in CKD)

Patient education is only applicable when the patient is discharged and is taking in food orally. The patient education guidelines are summarised in **Table 7**.

Table 7: Patient Education (AKI) General Guideline³⁴

Treatment	Conservative		Dialysis (HD/CRRT)	
Factor	Initial intervention (within 72 hours of referral)	Follow-up (daily/as needed)	Initial intervention (within 72 hours of referral)	Follow-up (daily/as needed)
<i>Self-management skills</i>	Discuss the role and effect of diet and medication on renal function.	Review and reinforce self-management skills, including daily intake and output and relevant feedback thereof.	Discuss the role and effect of diet and medication on renal function and dialysis treatment.	Review and reinforce self-management skills, including daily intake and output and relevant feedback thereof.
	The importance of blood pressure control and, if relevant, blood glucose control.	Provide feedback on changes in weight/nutritional status, blood pressure control.	The importance of blood pressure control and, if relevant, blood glucose control.	Provide feedback on changes in weight/nutritional status, blood pressure control.
	Ensure optimal caloric, protein and nutrient intake e.g. sodium, potassium, phosphorous.	Recommend changes in nutrient intake that may improve outcome, depending on the stage of AKI e.g. maintenance or recovery stage.	Ensure optimal caloric, protein and nutrient intake e.g. sodium, potassium, phosphorous and vitamins according to type of dialysis (HD / CRRT).	Recommend changes in nutrient intake that may improve outcome, depending on the stage of AKI e.g. maintenance or recovery stage and type of dialysis.
	Basic dietary guidelines as indicated and reinforce temporary nature of recommendations.	Provide specific mineral restriction guidelines according to lab results and reinforce temporary nature of recommendations.	Basic dietary guidelines as indicated and reinforce temporary nature of recommendations.	Provide specific mineral restriction guidelines according to lab results and reinforce temporary nature of recommendations.
	Discuss fluid intake and restrictions, if indicated.	Review fluid status and recommendations.	Discuss dry weight, fluid intake and fluid restrictions, as indicated.	Review fluid status and recommendations.
	Discuss laboratory results e.g. sodium, potassium, phosphate, calcium, magnesium and the significance of thereof.		Discuss laboratory results e.g. sodium, potassium, phosphate, calcium, magnesium and the significance of thereof.	Review dialysis adequacy and changes in dialysis modality.
	Discuss medicine-nutrient interactions as indicated.	Review medication prescribed, any changes and medicine-nutrient interactions.	Discuss medicine-nutrient interactions as indicated.	Review medication prescribed, any changes and medicine-nutrient interactions.
	Implement nutritional plan as per individual requirements i.e. oral intake, enteral feeding, intradialytic parenteral nutrition (IDPN) or TPN.	Re-assess nutritional plan.	Implement nutritional plan as per individual requirements i.e. oral intake, enteral feeding, IDPN or TPN.	Re-assess nutritional plan.
	Assess comprehension of education and projected compliance.	Assess comprehension of education and projected compliance.	Assess comprehension of education and projected compliance.	Assess comprehension of education and projected compliance.
	Provide relevant educational material. Consider exchanges if renal function does not resolve.	Provide and review educational material during hospitalisation and on discharge.	Provide relevant educational material. Consider exchanges if renal function does not resolve.	Provide and review educational material, especially with changes in dialysis modality during hospitalisation and on discharge.
<i>Behavioural</i>	Identify short-term achievable goals.	Reset short-term achievable goals and review long-term goals.	Identify short-term achievable goals.	Reset short-term achievable goals and review long-term goals.
	Establish follow-up plan.	Establish follow-up plan.	Establish follow-up plan.	Establish follow-up plan.

SECTION B: CHRONIC KIDNEY DISEASE (INCLUDING RENAL TRANSPLANT)

1. DEFINITIONS

Acute glomerulonephritis: A group of diseases characterised by inflammation of the capillary loops of the glomerulus.

Azotemia: The accumulation in the blood of abnormal quantities of urea, uric acid, creatinine, and other nitrogenous wastes.

Chronic kidney disease: Abnormalities of kidney structure or function, present for more than three months with implications for health and CKD is classified based on cause, GFR category, and albuminuria category.³⁵

End-stage renal disease (ESRD): A disease characterised by the kidney's inability to excrete waste products, maintain fluid and electrolyte balance and produce hormones.

Erythropoietin (EPO): A hormone secreted chiefly by the kidney in the adult and by the liver in the foetus, which acts on stem cells of the bone marrow to stimulate red blood cell production.

Glomerular filtration rate (GFR): The quality of glomerular filtrate formed per unit in all nephrons of both kidneys.

Nephritic syndrome: The syndrome of haematuria, hypertension and mild loss of renal function that results from acute inflammation of the capillary loops of the glomerulus.

Nephrotic syndrome: A condition resulting from loss of the glomerular barrier to protein; characterised by massive oedema, proteinuria, hypoalbuminemia, hypercholesterolemia, hypercoagulability, and abnormal bone metabolism.

Oliguria: The condition of having urinary volumes of less than 500ml/day.

Pyelonephritis: Bacterial infection of the kidneys.

Renal osteodystrophy: Metabolic bone disease as a complication of ESRD.

Uraemia: A clinical syndrome of malaise, weakness, nausea, vomiting, muscle cramps, itching, metallic mouth taste and often neurological impairment, which is brought about by azotemia.³⁰

Prognosis / Classification of CKD:

Figure 2. Prognosis of CKD by GFR and albuminuria category (adapted from KDIGO 2012)³⁵

Prognosis of CKD by GFR and Albuminuria Categories: KDIGO 2012				Persistent albuminuria categories		
				Description and range		
				A1	A2	A3
				Normal to mildly increased	Moderately increased	Severely increased
				<30 mg/g <3 mg/mmol	30-300 mg/g 3-30 mg/mmol	>300 mg/g >30 mg/mmol
GFR categories (ml/min/1.73m ²) Description and range	G1	Normal or high	≥90			
	G2	Mildly decreased	60-89			
	G3a	Mildly to moderately decreased	45-59			
	G3b	Moderately to severely decreased	30-44			
	G4	Severely decreased	15-29			
	G5	Kidney failure	<15			

Green- low risk (if no other markers of kidney disease, no CKD); Yellow- moderately increased risk; Orange - high risk; Red - very high risk

2. NUTRITIONAL ASSESSMENT

The nutritional assessment of the CKD patient is comparable to a routine nutrition assessment of normal individuals, but with some modifications.

The ABCD (anthropometry, biochemistry, clinical and dietary) approach should be used when doing a nutritional assessment as discussed below.

In patients receiving renal replacement therapy, the focus should be placed on body composition rather than on weight loss in isolation to reduce metabolic demands on the kidney and as a result delay progression of ESRD. Thus BMI should not be used in isolation, but rather with other anthropometric indicators like waist circumference.

2.1 Anthropometry³⁶

Weight:
<ol style="list-style-type: none"> HD patients: Post dialysis weight CAPD patients: Post dialysate drainage weight Adjusted oedema free body weight (aBW_{ef}) <i>aBW_{ef}: only used if oedema-free body weight is <95% (underweight) or >115% (overweight/obese) of median standard weight (NHANES II data).</i> <i>If oedema-free body weight is between 95 and 115% of median standard weight, then actual oedema-free body weight is used</i> $\mathbf{aBW_{ef} = BW_{ef} + [(SBW - BW_{ef}) \times 0.25]}$ <p>where</p> <ul style="list-style-type: none"> BW_{ef} = actual oedema free body weight SBW = standard body weight (NHANES II) A higher BMI of 25 – 28 has been correlated to higher survival rates (interpreted together with body composition)³⁷.

2.1.1 Screening for over nutrition

Table 8. Classification of overweight and obesity by BMI, waist circumference and associated disease risk³⁸

	BMI, kg/m ²	Disease Risk* Relative to Normal Weight & Waist Circumference	
		Men ≤ 102cm Women ≤ 88cm	Men > 102cm Women > 88cm
Underweight	<18.5		
Normal	18.5 - 24.9		
Overweight	25.0 - 29.9	Increased	High
Obesity, class			
I	30.0 - 34.9	High	Very High
II	35.0 - 39.9	Very High	Very High
III	≥40	Extremely High	Extremely High

**Disease risk f or Type 2 Diabetes, Hypertension, & CVD*
From the Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Evidence Report: National Institutes of Health

2.12 Screening for under-nutrition^{39,40}

- Actual body weight < 85% of ideal body weight according to NHANES II.
- Unintentional weight loss ≥5% in 1 month or 7.5% in 3 months or ≥10% in 6 months, all considered significant
- BMI < 20kg/m²
- Subjective global assessment (SGA) is a mini-diagnostic examination using a standardized rating scale (Annexure 2). It has been recommended for routine monitoring of nutritional status changes.³⁹ Severe protein energy wasting (PEW) is classified as a score of 1-2, whereas as moderate malnutrition is classified as 4-5.

2.2 Biochemistry

Selected nutrition-related laboratory parameters for haemodialysis and peritoneal dialysis are shown in **Table 8**, based on K/DOQI recommendations.¹³

Table 9: Nutritional laboratory parameter outcome goals ³²

Nutritional laboratory parameter	Goal	Outcome prevention focus
S-Sodium (mmol/L)	136-145	Fluid and blood pressure control
S-Potassium (mmol/L)	4.0-5.5	Cardiac arrhythmia and cardiac arrest
S-albumin g/L	35-52	Protein-energy malnutrition
S-Urea (mmol/L)	22-29	Protein intake Malnutrition Dialysis adequacy
Pre-dialyses S-creatinine (µmol/L)	Pre ESKD 177-708 Small patient on dialysis 708-1062 Large patient on dialysis 1328-1770	Malnutrition
TCO ₂ (mmol/L)	>22	Metabolic acidosis
Kt/V or urea reduction ratio	>1.2 HD or >65% 1.7 PD	Dialysis adequacy
S-Phosphate (mmol/L)	0.8-1.4 Maintain in the normal range Stages 3-5 0.78-1.42	Soft tissue calcifications, bone disease
S-Calcium (mmol/L) corrected	2.05-2.45	Soft tissue calcifications, bone disease
S-Calcium-phosphate product mmol ² /L ²	≤5 or <4.4	Soft tissue calcifications, bone disease
PTH (ng/L)	Stage 5: 2-9x normal range (normal range 1.5-7.6) Stage 3-5 No optimal range	Hyperparathyroidism
Transferrin saturation	20-50%	
Serum Ferritin (µg/L)	200-500	

2.3 Clinical

Fluid overloading:

- oedema
- shortness of breath
- increased blood pressure
- oedematous gut, which could lead to irregular gut function
- swelling in legs and face
- need for oxygen

Uraemic symptoms:

- nausea, vomiting or dry retching
- anorexia
- taste changes
- bad smelling breath
- dizziness
- headaches
- irritable
- insomnia
- extreme exhaustion
- uraemic gut syndrome

Potassium symptoms:

- heart palpitations
- fainting
- heart attacks

Phosphate symptoms and side effects:

- itching
- red eyes
- body pains not related to gout
- CKD-MBD
- brittle bones
- regular bone breaks
- normal artery calcification
- hypertension
- nose bleeds

2.4 Diet history

Dietary intake assessment can be completed using traditional choices of diet recall, food diary, food frequency questionnaires or food exchanges.

2.5 Urinary analysis:

- glucose
- protein
- urea and creatinine

3. NUTRITIONAL RECOMMENDATIONS FOR CKD ^{42, 43,}

Table 10 summarises the macro and micro nutrient recommendations for CKD

Table 10: Nutritional recommendations for chronic kidney disease^{20,22,33,42, 43, 44,45,46,47,48}

Requirements	Conservative (non-dialysed)	Hemodialysis	Peritoneal dialysis	Transplant
Protein(g/kg/d)	0.6 - 0.75 At least 50% HBV Stage 1-3: 0.75 Stage 4-5: 0.6-.75 Nephrosis: 0.8-1.0 / 0.8 plus 1.2 (urine protein loss)	1.2 At least 50% HBV 10-12g amino acid loss per dialysis session	1.2-1.3 At least 50% HBV 5-15g protein loss per day	Initial: 1.3 – 2.0 Maintenance: 0.8-1.0 Chronic rejection (non-dial- ysed) 0.6-0.8
Energy(kcal/kg)	30-35	30-35	30-35 Includes energy from dialysate	Initial: 30-35 Maintenance: 25-30 Maintain desirable body weight
NOTE: This energy intake is needed to ensure a positive nitrogen balance. Obese patients requires <35 kcal /kg/d, while underweight patients would require more than 35kcal/kg/d. Use actual weight if falls within the 95 th -115 th percentile of standard weight or adjusted if actual body weight falls <95 th percentile (underweight) or > 115 th percentile (overweight/obese)these ranges.				
Carbohydrates (% TE)	50-60 of total energy (complex)	50-60 of total energy (complex)	50-60 of total energy (complex) Includes carbohydrates from dialysate (see sim- ple estimate formula)	50-60 of total energy (complex)
Fat (% TE)	25-35 of total energy	25-35 of total energy	25-35 of total energy	25-30 of total energy
Cholesterol (mg/d)	<300	<300	<300	<300
S/P/M/ ratio (%)	<7: ≤10: ≤10	<7: ≤10: ≤10	<7: ≤10: ≤10	<7: ≤10: ≤10
Fibre(g/d)	20-30	20-30	20-30	20-30
Fluid (ml/d)	Usually unrestricted with normal urine output Output PLUS 500-750	Output PLUS 500-750 New guidelines PLUS 1000ml	Monitored, 1500-2000	Unrestricted unless indicated
NOTE: Interdialytic weight gain should ideally not exceed 2-2.5kg or 4-4.5% of the dry weight.				
Minerals	Conservative	Hemodialysis	Peritoneal dialysis	Transplant
Sodium (mg/d)	1000-4000 (Individualise)	≤ 1L urine 2000-4000 ≤ 1L urine 2000 (Individualise)	2000-4000 (Individualise)	2000-4000 (Individualise)
Potassium (mg/d)	2000-3000 / 40mg/kg 1500-2700 if hyperkalaemic	2000-3000 / 40mg/kg	2000-4000	Unrestricted; unless hyperka- laemia
Calcium (mg/d)	<2000 (<1500mg/d from binders)	<2000 (<1500mg/d from binders)	<2000 (<1500mg/d from binders)	1200-1500
NOTE: Dietary calcium intake, including a calcium-based phosphate binder, should not exceed 2000mg/day to reduce the risk of hypercalcaemia and vascular calcifications.				
Phosphate (mg/d)	800-1000 / 10mg/kg / 10-12mg/g Protein P-binders	800-1000 / <17 mg/kg 10-15mg/g Protein P-binders	800-1000 / 10-15mg/g Protein P-binders	DRI
Magnesium (mg/d)	200-300	200-300	200-300	DRI, supplement if decreased levels
Iron (mg/d)	10-18 (Individualise)	10-18 (Individualise)	10-18 (Individualise)	DRI, individualise supplemen- tation

Requirements	Conservative (non-dialysed)	Hemodialysis	Peritoneal dialysis	Transplant
Zinc (mg/d)	Individualise	Individualise	Individualise	DRI
NOTE: Routine supplementation of Zinc, Selenium and Copper not recommended.				
Thiamine (mg/d)	1.1-1.5	1.1-1.5	1.1-1.5	DRI
Riboflavin (mg/d)	1.8	1.1-1.3	1.1-1.3	DRI
Panthenic acid (mg/d)	5	5	5	DRI
Niacin (mg/d)	14-20	14-20	14-20	DRI
Pyridoxine (mg/d)	5	10	10	DRI
NOTE: Decreased levels of pyridoxine are associated with hyperhomocysteinaemia.				
Vit B12 (µg/d)	2-3	2-3	2-3	DRI
Folate mg/d	1.0	1.0	1.0	DRI
NOTE: Vitamin B ₁₂ and Folate supplementation are required for normal erythropoiesis and an optimal response to the medications used to stimulate erythropoiesis.				
Vit C mg/d	60-100	60-100	60-100	DRI
NOTE: High doses of supplemented vitamin C of >200mg/day is not advised due to increased risk of oxalate deposition that may contribute to vascular disease.				
Vit A (µg/d)	No supplementation	No supplementation	No supplementation	DRI
NOTE: Vitamin A is known to accumulate during renal failure and therefore routine supplementation is not recommended during CKD.				
Vit D (µg/d)	Individualise	Individualise	Individualise	DRI
NOTE: Consider Vitamin D supplementation for the treatment of osteomalacia and hyperparathyroidism. Supplementation may be indicated. Vitamin D: Individualise means we need to consider the patients calcium, phosphate and parathyroid hormone (PTH) levels, if need start at 0.25ug of 25(OH)vitamin D and titrate upwards.				
Vit E mg/d	0-15 (Individualise)	0-15 (Individualise)	0-15 (Individualise)	DRI
NOTE: Vitamin E is known to accumulate during renal failure and therefore routine supplementation is not recommended during CKD. There is controversy regarding the optimal vitamin E dose to be supplemented.				
Vit K µg.d	Individualise	Individualise	Individualise	DRI
NOTE: The RDA for vitamin K is recommended except in cases with altered coagulant activity and long-term treatment with antibiotics.				

Carbohydrates absorbed from the peritoneal dialysate should be taken into account when calculating the calorie requirements. The 'Simple Estimate Formulae' can be used.^{49, 50}

The Simple Estimate Formulae:

Estimate of calories absorbed from PD with 60% absorption rate⁵⁰ (absorption rate ranges between 60-70%):

$$1.5\% \text{ 1L} = 15\text{g} \times 3.4 = 51 \times 60\% = 31 \text{ kcal / L}$$

$$2.5\% \text{ 1 L} = 25\text{g} \times 3.4 = 85 \times 60\% = 51 \text{ kcal / L}$$

$$4.25\% \text{ 1L} = 42.5\text{g} \times 3.4 = 144.5 \times 60\% = 86.7 \text{ kcal / L}$$

Concentration of dextrose absorbed²⁷

Dialysate dextrose concentration	Grams of dextrose/L	kcal/L from dextrose	kcal/L with CAPD (60%)*
1.50%	15g	51kcal	31kcal
2.50%	25g	85kcal	51kcal
4.25%	42.5g	144.5kcal	86.7kcal

*60% dextrose absorbed with CAPD

**each gram of dextrose = 3.4kcal

E.g. Energy/L x Total Volume

Note: In usual practice the dialysate bags are two litres in volume, used four times per day, giving eight litres in total per day.

Table 11: Nutritional recommendations for diabetic nephropathy^{45,51,52, 53,54,55,56}

Requirements	Conservative	Hemodialysis	Peritoneal dialysis
Protein (g/kg/d)	0.6-0.8	1.2	1.2-1.3
High biologic value protein %	50 (at least)	50 (at least)	50 (at least)
Energy (per day)	H-B ^a kcal or 30-35 kcal/kg	H-B ^a kcal or 30-35 kcal/kg	H-B ^a kcal or 30-35 kcal/kg
Carbohydrates (%TE)	50-60	50-60	50-60
Fat (%TE)	≤30	≤30	≤30
Saturated fatty acids (% TE)	≤10	≤10	≤10
Polyunsaturated fatty acids (%TE)	6-8	6-8	6-8
Monounsaturated fatty acids (%TE)	≤15	≤15	≤15
Cholesterol (mg/day)	<200	<200	<200
Fibre (g/d)	20-30	20-30	20-30
Fluid (ml/d)	Output + (500-750)	Output + (500-750)	1500-2000
Minerals	Conservative	Hemodialysis	Peritoneal dialysis
Sodium (mg/d)	<2300	2000-4000	2000-4000
Potassium (mg/d)	1500 - 2700 (restrict if raised)	2000-3000	2000-4000
Calcium (mg/d)	<2000-2500 (including binder)	<2000-2500 (including binder)	<2000-2500 (including binder)
Phosphate (mg/d)	800-1000 / 10mg/kg / 10-12mg/g Prot P-binders	800-1000 / <17 mg/kg 10-15mg/g Prot P-binders	800-1000 / 10-15mg/g Prot P-binders
Iron (mg/d)	10-18 (Individualise supplementa- tion)	10-18 (Individualise supplementation)	10-18 (Individualise supplementation)
Zinc (mg/d)	12-15 (male) 10-12 (female)	12-15 (male) 10-12 (female)	12-15 (male) 10-12 (female)
Selenium (µg/d)	55	55	55

NKF KDOQI: National Kidney Foundation Kidney Disease Outcome Quality Initiative

^aH-B: Harris Benedict Equation for determining Basal Energy Expenditure

TE: Total energy

All calculations are based on Ideal Body Weight

HBV: high biological value

3.1 Nutrition management of HIV/AIDS in CKD

- Individualised assessment and management
- Integrate specific nutrition challenges of HIV/AIDS with appropriate guidelines for CKD
 - wasting
 - lipodystrophy syndrome
 - nausea, vomiting, anorexia
 - diarrhoea
 - malabsorption
 - hormonal imbalances
 - metabolic abnormalities
 - side effects of medication
- Management
 - individualise
 - integrate guidelines for renal failure and HIV/AIDS
 - energy 10 – 15% extra for HIV/AIDS, till 25% (with active weight loss) 30-35kcal/kg up to 45-50kcal/kg in severely catabolic patients
 - protein – to be individualised 1.2-1.5 g/kg²² up to 2g/kg in severely catabolic patients. The lower range of protein is for conservative patients that are not catabolic, increasing for dialysis and degree of acute illness
 - Na – 2000-4000mg/day
 - potassium – 2000-3000mg/day
 - calcium – 1000-1500
 - 10-12 mg/g of protein
 - fluid- output plus 1000-1200ml
 - iron – individualise to maintain iron stores
 - be aware of nephrotoxic effects of anti-retroviral and tuberculosis medications

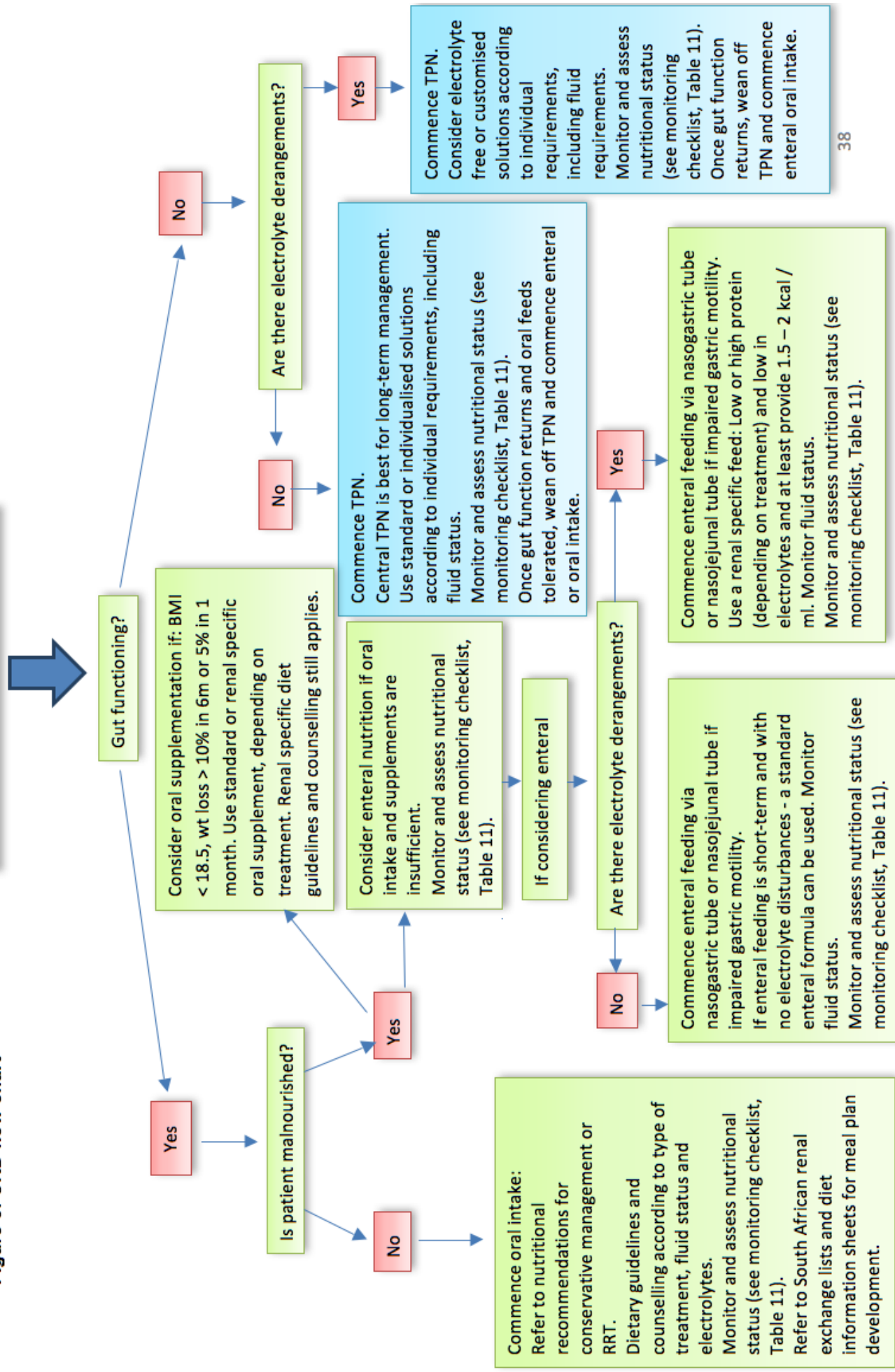
4. NUTRITIONAL INTERVENTION

Since protein-energy malnutrition has shown to be one of the most important risk factors for increased morbidity and mortality, every effort should be made to preserve optimal nutritional status in CKD patients. **Figure 3** summarises the nutritional interventions for patients with CKD.

Refer to **Annexure 1** for enteral formulation guidelines.

Chronic kidney disease ²⁰

Figure 3: CKD flow chart



5. MONITORING

Practices vary amongst hospitals but minimum requirements should be according to internal hospital protocols.

5.1 Nutritional assessment, monitoring and follow-up

Table 12: Monitoring checklist for the hospitalised patient with chronic kidney disease (CKD) – conservative, RRT (HD and CAPD) ^{27, 52}

Parameter	Frequency of assessment	
	Conservative	RRT
Anthropometry		
Weight	Daily To monitor changes in fluid status.	Daily To monitor fluid, including pre- and post-dialysis weight.
*Biochemistry		
Serum potassium, sodium	Daily	Daily
Serum urea and creatinine	Daily	Daily
Serum phosphorus, calcium and magnesium	Weekly	Weekly
Full blood count	Weekly	Weekly
Blood glucose	Daily (if indicated)	Daily (if indicated)
Serum albumin	Weekly	Weekly
Transferrin/RBS//Ferritin	As needed	As needed
CRP	As needed	As needed
Clinical		
Signs and symptoms of oedema or dehydration	Daily	Daily
Stool output and consistency	Daily	Daily

Practices may vary amongst hospitals (guided by resources and costing) but minimum requirements should be according to internal hospital protocols.

Table 13: Monitoring checklist for the out-patient with chronic kidney disease (CKD) – conservative, RRT (HD and CAPD) ^{27, 41, 57}

Parameter	Frequency of assessment	
	Conservative (pre-dialysis)	RRT
Anthropometry		
Weight	1- 3 monthly	Monthly (PD) / 3x per week (pre- and post-HD)
BMI	1 -3 monthly	4 – monthly
SGA (subjective global assessment)	1 – 3 monthly	6 – monthly
Biochemistry #		
Serum sodium	1 - 3 monthly	3 times a year
Potassium		6 times a year
Serum urea	1 - 3 monthly	
Serum urea pre/post dialysis		Monthly
Creatinine	1 - 3 monthly	3 times a year
Serum phosphorus	1 - 3 monthly	6 times a year
Serum calcium	1 - 3 monthly	6 times a year
Parathyroid hormone		3 times a year
Vitamin D		Once a year
Bicarbonate (CO ₂ or HCO ₃)		6 times a year
White cell count and platelets	1 - 3 monthly	Quarterly
Haemoglobin	Monthly	Monthly
Iron		Quarterly
Ferritin		Quarterly
Transferrin saturation		Quarterly
Serum albumin	1 - 3 monthly	Quarterly
Glucose (random)		2 times a year
HbA1C (diabetic patients only)		2 times a year
Lipogram fasting		Once a year
Total cholesterol only		Once a year

Clinical		
Signs and symptoms of oedema or dehydration	1 - 3 monthly	Monthly
Stool output and consistency	1 - 3 monthly	Monthly
Urine		
Glucose	1 - 3 monthly	As needed
Protein	1 - 3 monthly	As needed

Practices may vary amongst hospitals (guided by resources and costing) but minimum requirements should be according to internal hospital protocols.

5.2 Complications related to dialysis treatment (HD and PD)

Many patients have pre-existing malnutrition prior to the initiation of dialysis, due to anorexia and uremia, altered taste, metabolic acidosis, inflammation, and reduced dietary intake. Once dialysis therapy begins, uremic symptoms are reduced and the diet is liberalised, some patients may show improved nutritional status.

Table 14: Examples of the effects of HD and PD on nutrition ^{27,57}.

Effects of HD	Effects of PD
Pre-existing malnutrition due to anorexia, uremia, metabolic acidosis and inflammation as well as inflammation related to the dialysis procedure	Pre-existing malnutrition due to anorexia, uremia, metabolic acidosis and inflammation as well as inflammation related to the dialysis procedure
May induce catabolism which can result in malnutrition, increased susceptibility to infection and increased mortality	May induce catabolism which may lead to malnutrition
Protein 10-12 g lost through the dialysate	Protein 5-15g lost through the dialysate
Water soluble vitamin losses	Water soluble vitamin losses
Muscle cramps	Reduced appetite and abdominal distension and delayed gastric emptying
	Dextrose absorbed from the bag contributes energy and carbohydrate, which needs to be accounted for in the diet prescription
	Increased TG possibly due to the high dextrose content
	Weight gain

5.3 Medication commonly used in chronic kidney disease (CKD) and possible side effects

Listed in this section are the commonly prescribed medication used in chronic kidney disease displaying their indication, action and side-effects limited to nutrition and gastrointestinal function. It includes various diuretics, anti-hypertensive, phosphate binders, immuno-suppressive medication etc.

Table 15: Medication commonly used in renal disease (CKD) and possible side effects ^{30, 31,32,58}

Medication	Indication	Action	Nutritional side-effects
Furosemide	Oedema, fluid overload	Loop diuretic	Urinary loss of potassium, zinc, magnesium, calcium, sodium Dehydration
Thiazide Diuretics	Hypertension	Powerful diuretic, prevent re-absorption of sodium, potassium, chloride	Nausea, anorexia, hyponatraemia, hypokalaemia, hyperuricaemia, hyperglycaemia
Spirinolactone	Hypertension, fluid overload	Aldosterone antagonist, potassium-sparing diuretic, which blocks exchange of sodium with potassium and hydrogen	Hyperkalaemia, dry mouth, nausea, vomiting, gastritis, diarrhoea
Calcium	Hyperphosphataemia, hypocalcaemia	Calcium supplement and phosphate binder. If used as a supplement, do not use with food	Constipation, increased Ca-P product, hypercalcaemia, calcium citrate increases aluminium absorption, nausea and vomiting
Aluminium hydroxide suspension	Hyperphosphataemia	Binds the phosphorus from ingested food in the gut (Ca-P complex), preventing absorption Take with meals while restricting phosphate intake	Constipation, aluminium toxicity, increase thiamine requirements, impaired iron and folate absorption
Sevelamer Hydrochloride	Hyperphosphataemia	Non-calcium, non-aluminium phosphate binder, ionic and hydrogen bonding of phosphate	Increased calcium absorption if taken with calcium, diarrhoea, nausea, vomiting, dyspepsia, peripheral oedema, decrease LDL, increase HDL

Active Vitamin D (calcitriol, alfacalcidol)	Hypocalcaemia, secondary hyperparathyroidism	Increase calcium absorption	Increased absorption of aluminium and phosphate, hypercalcaemia
Erythropoietin	Anaemia of chronic kidney disease	Recombinant human erythropoietin; support erythropoiesis	Increased appetite, iron, folate and vitamin B ₁₂ deficiency, increased blood pressure
Sodium polystyrene sulfonate	Hyperkalaemia	Sodium and potassium exchange in the gut; potassium containing resin is excreted in the stool	Sodium and fluid retention, diarrhoea, nausea and vomiting, constipation, hypokalaemia, hypocalcaemia, hypomagnesaemia
ACE inhibitors (Enalapril, Captopril)	Hypertension, renoprotection, heart failure	Inhibits the production of angiotensin (vasoconstrictor) Slows the degradation of bradykinin (vasodilator) Avoid natural liquorice	Hyperkalaemia
Beta blockers	Hypertension	Adrenergic inhibitor, blocks sympathetic effects on heart and results in reduced arterial pressure and cardiac output	Abdominal discomfort, flatulence, masking if insulin-induced hypoglycaemia, lowering of HDL-cholesterol, increase total-cholesterol and triglycerides
Alpha blocker	Hypertension	Adrenergic-receptor blocking nor-epinephrine action	Modest lowering of LDL-cholesterol, dryness of mouth
Iron	Iron deficiency	Support erythropoiesis	Constipation, nausea, vomiting, altered taste, dark stools
Corticosteroids (Prednisone, methylprednisolone)	Immuno-suppressant used during kidney transplantation and treatment of many kidney diseases	Anti-inflammatory, immuno-suppression	Hypertension, sodium and fluid retention, increased appetite weight gain, diabetes mellitus, dyslipidaemia, hypokalaemia, hypocalcaemia, osteoporosis, osteonecrosis, hypophosphataemia, protein hypercatabolism (PG), urinary losses of zinc, potassium, calcium, vitamin C and nitrogen, gastrointestinal ulceration, impaired wound healing, pancreatitis, impaired growth in children
Cyclosporine	Immuno-suppressant	Reduce IL-2 production, spare T-suppressor cells, grapefruit increases CsA blood levels – use with caution, be vigilant of medicine interactions	Hyperkalaemia, hypomagnesaemia, increased uric acid levels, hyperlipidaemia, hyperglycaemia, oedema and hypertension, anorexia and nausea, vomiting, diarrhoea (PG), gingival hypertrophy, bone resorption, gastro oesophageal reflux disease, dysmorphia, nephrotoxicity due to increased CsA levels
Muromonab-CD3 (Orthoclone OKT3)	Immuno-suppressant	Inhibits T-cell effector function	Severe fluid retention, hypertension, pulmonary oedema, nausea, vomiting, anorexia, diarrhoea, abdominal gas/pain (PG)
Mycophenolate	Immuno-suppressant		Gastrointestinal (GI) bleeding, abdominal pain, GI symptoms, hypertension, fluid retention, hyperlipidaemia, hypophosphatemia, hyperkalaemia (PG)
Sirolimus	Immuno-suppressant	Inhibits proliferation of immune cells	Dyslipidaemia, impaired wound healing, hypokalaemia
Azathioprine	Immuno-suppressant	Anti-proliferative	Increased risk of infection, pancreatitis
Tacrolimus	Immuno-suppressant	Inhibits IL-2 synthesis and release	Hyperglycaemia, hyperkalaemia, hypomagnesaemia, hypertension, gastrointestinal disturbance
Statins (simvastatin, atorvastatin)	Dyslipidemia	HMG-CoA Reductase inhibitors	Diarrhoea, nausea, vomiting, constipation, fatigue, muscle pain, rhabdomyolysis, liver failure

5.4 Patient education (chronic kidney disease)

Please refer to patient education general guides (**Table 14**). The renal diet is complex and it can be challenging to educate patients, since some renal patients have low literacy levels when it comes to nutrition. Along with the nutrition guidelines given, the emphasis should be placed on health communication, focusing on providing clear and simple messages, not using medical jargon, using visual aids while focusing on one dietary aspect at a time and asking patients to teach back what they were taught⁵⁹.

5.4.1 Energy requirements

The energy intake of the patient must be sufficient to prevent protein from being used as an energy source. These energy requirements are determined according to the recommended guidelines for acute renal failure (ARF) and CKD and are usually high. In PD patients, the energy from the dextrose in the dialysate should be considered in calculations; therefore, the energy supplied by the diet would be less.

It is often difficult to achieve high energy requirements due to either low protein intakes or symptoms of uremia. Therefore, a slow but steady increase in energy requirements may be required. Oral supplementation may be needed, especially in malnourished patients if oral intake is insufficient.

Guidelines to enhance or maintain energy intake, based on individual requirements, include the following:

- include as many appropriate complex carbohydrates as the meal plan allows. Include simple carbohydrates within limits in the daily meal plan e.g. sugar, jam, sweets (clear boiled sweets, marshmallows, jelly babies, peppermints) and cold drinks (carbonated beverages and avoid cola flavoured drinks) to help meet their nutritional requirements (total energy). Avoid cola flavoured drinks as they are high in phosphate. Sports drinks may be included to increase energy intake. Mageu can be used as an energy drink in moderation
- the energy density of foods can be increased by adding margarine to porridge and vegetables
- to prevent an increase in blood lipids and lipoproteins, fat in the diet should be derived as much as possible from mono- and poly-unsaturated food sources. Cholesterol intake should be limited due to enhanced cholesterol absorption in ESRD⁶⁰

5.4.2 Protein requirements

A low protein diet is recommended for patients with ESRD (various requirements at different stages of renal failure), because protein increases glomerular pressure and thus leads to accelerated loss of renal function⁶¹. At least 50 per cent of the protein intake should be of high biological value (animal) protein e.g. milk, eggs, red meat, fish or chicken. For vegetarian patients or patients who do not have access to animal protein, a diet that includes grains, legumes, seeds, nuts and vegetables can still provide all the essential amino acids.⁶²

Patients on HD/PD have higher protein requirements, due to the protein lost during the dialysis process. Protein losing enteropathy also increases the requirements and should be accounted for according to the KDOQI guidelines.

5.4.3 Sodium restriction

A low sodium intake is necessary in patients with renal failure to control oedema and blood pressure. Low sodium foods are classified as less than 120mg of sodium per 100g. Foods with a moderate sodium content (120-600mg per 100g) should be used in moderation. High sodium foods (>600mg per 100g) should be avoided.

Take into consideration when flavours are added to products, the sodium content increases.

Guidelines for sodium restriction:

- avoid processed foods very high in sodium such as tinned foods (baked beans, pilchards in tomato sauce), tomato sauce, chutney, meat extract, soya sauce, salted nuts, chips, instant soups, processed meats (viennas, smoked meat, polony, ham, biltong)
- avoid adding salt to food, unless recommended by the dietitian
- salt replacements are not recommended as they contain potassium
- use low fat cottage cheese more often and limit processed cheese e.g. cheddar or gouda and feta cheese
- advise on the flavouring of food using limited salt, for example, season foods with garlic, onion, chilli, curry powder, pepper, herbs and lemon juice
- the focus of lowering dietary sodium intake should be aimed at increasing whole food intake and limiting the intake of processed food, convenience foods from stores and take-aways⁶³.
- emphasis should be placed on reading labels

5.4.4 Fluid restriction

When fluid restriction is necessary, an intake equal to the daily urine volume plus 500ml should maintain water balance⁶¹ in a hot climate, an intake equal to daily urine plus 750ml may be needed.

Guidelines for fluid restriction:

- the following substances count as fluids and must be counted in the fluid allowance for the day: Cold drink, coffee, tea, cream, ice cream, sorbets and ices, gelatin puddings or dishes, soup and gravies, yoghurt, drinking yoghurt, custard, jelly, milk and milkshakes, wine and beer
- distribute the fluid intake evenly throughout the day
- suck on an ice cube
- chew sugar-free gum
- gargle with a mouthwash
- eat sweets within allowances
- use cold or cool liquids rather than room temperature
- freeze liquids – it takes longer to consume
- add lemon juice to water to make it more refreshing
- fluid restriction should be accompanied by a strict sodium restriction

5.4.5 Potassium (K) restriction

Depending on the level of renal function, the potassium intake of the patient may need to be reduced.

Guidelines for potassium restriction:

- individualise fruit and vegetable intake
- there are three different K lists for fruit and vegetables, low, moderate and high

- patients should be educated to choose mostly from the low to moderate K group, however they do not have to completely exclude the high K group, especially if their K levels are within range and they are on PD, which has a higher K requirement
- refer to **Annexure 3** for the new Renal exchange list of South Africa⁶²
- cooking methods and food preparation, such as leaching, boiling and chopping of vegetables and legumes, can aid in decreasing the potassium content
- leach potassium out of high-potassium vegetables by soaking vegetables in water before cooking, discarding the water used for soaking, boiling the vegetables in water and then discarding the water used for boiling as well
- if the potassium level of a patient is high, avoid foods with over 250mg potassium per serving and limit the daily intake to 1500-2700mg²
- generally, milk is limited to one portion for the day, due to the high potassium and phosphate content, however more can be allowed on an individual basis
- the focus of lowering dietary potassium intake should be aimed at increasing whole food intake and limiting the intake of processed food, convenience foods from stores and take-aways⁶³.
- take note that processed foods may contain an increase in potassium salt substitutes in an effort to decrease sodium content, regulated by legislation

5.4.6 Phosphate restriction

- Phosphate levels are usually high in renal failure patients due to altered bone metabolism.
- Patients should be educated about organic and inorganic phosphates and the bioavailability of phosphates from these sources.
- Meat and dairy products are the main animal sources of organic phosphate, found in membrane phospholipids and phosphoproteins, whereas in vegetable sources legumes, whole grains and nuts, it is found as phytate.
- The bioavailability from animal sources are 40 to 80 per cent. This can be higher if Vitamin D is present, vegetables have an absorption rate of 20 to 40 per cent, because most of the phosphate is found as part of phytate, which must be hydrolysed by phytase to be absorbed. Phytase is not found in the small intestine, which reduces absorption further.
- Inorganic phosphate is not found in foods in their natural state, but is usually added. They are mainly additives used to preserve food to improve palatability and shelf life of foods. The bioavailability is 90 per cent from the inorganic phosphate, which is the highest absorption rate of the phosphate types. Not all foods are labelled with phosphate content, which makes it more difficult to identify.⁶³
- Patients must be educated on limiting high phosphate meats e.g. cheese, eggs, sardines, pilchards or bacon to one exchange a day. Legumes and wholegrains are allowed (even though high in phosphate, the phosphate in legumes has reduced bioavailability)^{64,65}. Legumes would include peanut butter, soya beans, baked beans, lentils, dried beans and peas. Wholegrains would include breads, cereals and other wholegrain starches.
- The most suitable meat exchanges would come from the low phosphate meat groups including beef, lamb, chicken, fish, lean mince, low fat cottage cheese or tuna.
- Milk and dairy products are limited to one portion per day, due to the high potassium and phosphate content.
- Always check that patients are taking their phosphate binder correctly, i.e. chewing it in the middle of meals (not before/after eating).
- The focus of lowering dietary phosphate intake should be aimed at increasing whole food intake and limiting the intake of processed food, convenience foods from stores and take-aways⁶³.
- Emphasis should be placed on reading labels.

5.4.7 Fibre and the gut microbiome

Gut dysbiosis has recently been implicated in affecting the gut microbiota in CKD patients. This is due to the altered gut bacteria because of low fibre intake, which favours proteolytic fermentation instead of saccharolytic fermentation. This increases uremic toxins (p-cresyl sulphate, indoxyl sulphate and trimethylamine oxide (TMNO), which causes the progression of renal disease or worsens uremia as well as promoting inflammation.⁶⁶ **Saccharolytic** fermentation is achieved by adequate fibre in the diet. Studies have shown a reduction in urea and creatinine in CKD patients with fibre interventions⁶⁷.

- It is important to obtain sufficient fibre from a variety of sources, including soluble and insoluble fibres from fruit, vegetables and especially wholegrains.
- The phosphates in wholegrains have low bio-availability so it may be included within the portion control of the diet.
- Patients can be advised about fruits and vegetables, encouraging low to moderate potassium sources, however high sources do not have to be completely excluded.
- Although prebiotic supplements, synbiotics and probiotic studies have shown some benefit in the gut microbiome, it is not recommended at this stage due to insufficient evidence for its adverse effects. Most of these studies have been small. It is recommended that more research be done to understand the effects of diet, prebiotics, synbiotics and probiotics on the symbiotic environment and its relation to kidney function.⁶⁸

5.5. Transplant patient education

Please refer to the patient education general guidelines (**Table 16**) for additional information.

The post-transplant nutrition management can be divided into several phases; however, emphasis will be placed on the immediate post-transplant and intermediate to late post-transplant phase.

5.5.1 Early post-transplant phase

In the early post-transplant phase in an uncomplicated surgery, the main emphasis is to manage fluid balance, electrolytes and acid-base balance. The stress of surgery and the effects of high doses of steroids on nutrient metabolism necessitate increased energy and protein requirements. The main goals are to promote wound healing, prevent infections and provide adequate protein and energy to promote visceral protein stores and to correct electrolytes⁶⁹. Potassium needs to be monitored very carefully and patients should be advised to avoid high potassium fruits and fruit juices for the first week post-transplant (depending on patient's potassium levels). Certain immuno-suppressant medication has the effect of increasing potassium levels. Other symptoms may include diarrhoea, constipation, nausea and vomiting and needs to be managed accordingly.

5.5.2 Intermediate to late post transplant phase

- In the intermediate to late transplant phase, the goals are to prevent the complications of immuno-suppressant medications, such as obesity, diabetes, hypertension, bone disease, hyperlipidaemia, hyperkalaemia and malnutrition.⁵⁷.
- Dietary advice should focus on healthy diet advice and to avoid restrictions from pre-transplant diets.
- Diet, exercise and lifestyle modification has an important role to play in the reduction of insulin resistance, which can have harmful consequences, and to improve transplant outcomes⁶⁹.

5.5.3 Advice on discharge

Successful transplant patients should be counseled as follows:

- explain to patients why their dietary requirements have now changed and counsel them on appropriate healthy eating
- explain the need for adequate protein and why they should not follow a low protein diet
- counsel patients on following a low fat diet, with particular focus on low fat and cholesterol. Omega 3 fatty acids and the use of plant stanols and sterols can be beneficial⁴³
- discuss the importance of maintaining a healthy body weight
- patients should be warned that they have an increased risk of glucose intolerance and diabetes due to steroid use. Refined carbohydrates should be reduced and replaced with high fibre foods instead
- normal potassium requirements should apply once potassium levels have stabilised and normalised, and depending on the ongoing use of cyclosporine and blood levels
- salt should be used sparingly, while if low magnesium levels are present, supplementation and dietary food sources rich in magnesium should be recommended e.g. green leafy vegetables, nuts, seeds and whole grains
- include calcium rich foods in the diet e.g. low fat dairy products and vegetables e.g. broccoli to improve bone mineral density
- fluid restriction is usually not indicated
- exercise and lifestyle modification advice should be discussed
- place emphasis on hygiene principles and food safety

Figure 4: Patient education flow diagram^{27, 61, 69}

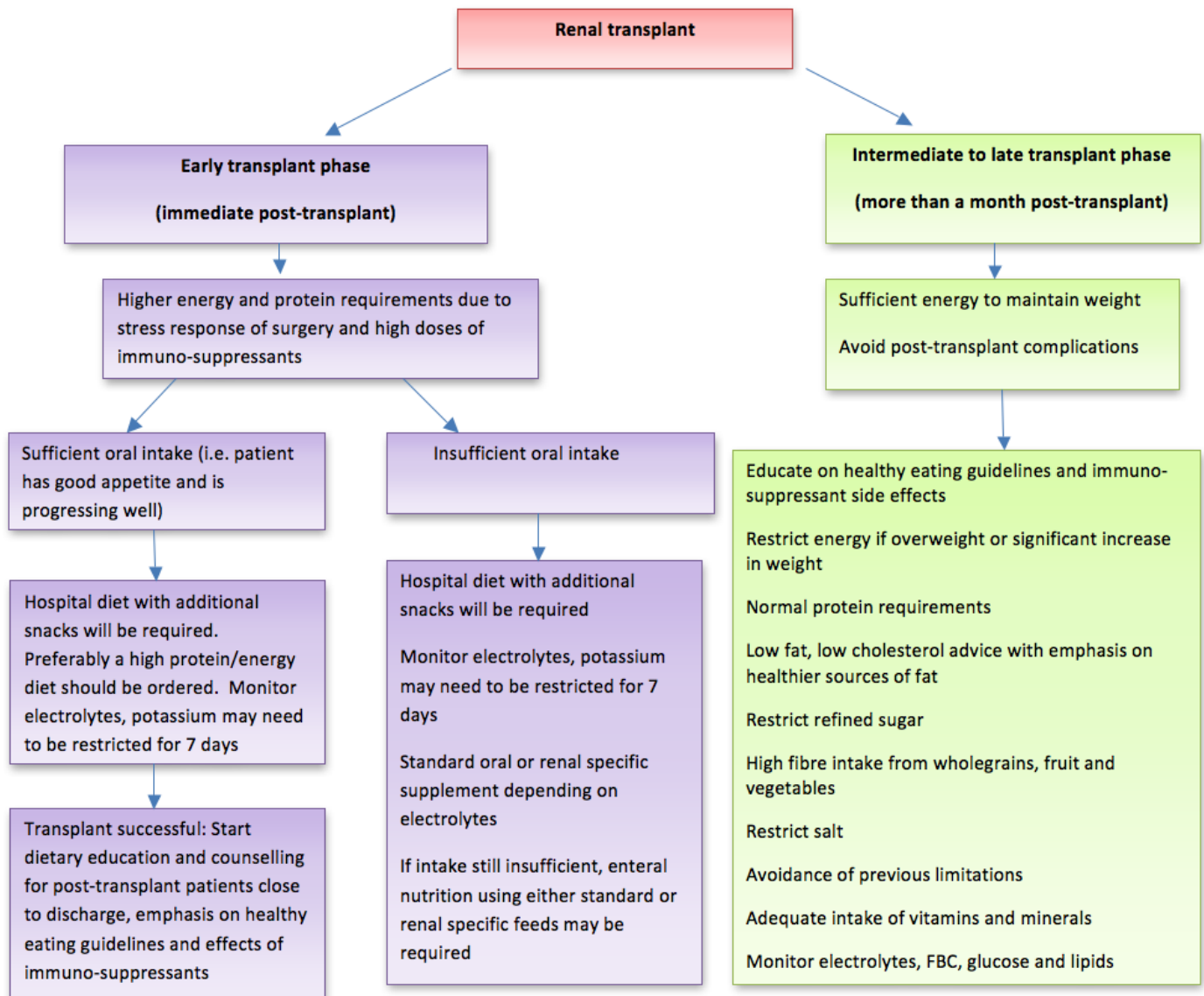


Table 16: Patient education (CKD) - general guide³¹

Treatment	Conservative		Dialysis (HD/PD)	
Factor	Initial intervention (within first month of referral)	Follow-up (3-4 weeks/ as needed) and quarterly intervention	Initial intervention (within first month of referral)	Follow-up (within 1 month) and six month intervention
<i>Self-management skills</i>	Discuss the role and effect of diet and medication on renal function.	Review and reinforce self-management skills, including a diet history and relevant feedback thereof.	Discuss the role and effect of diet and medication on renal function and dialysis treatment.	Review and reinforce self-management skills, including a diet history and relevant feedback thereof.
	The importance of blood pressure control and, if relevant, blood glucose control and slowing the progression of renal failure.	Provide feedback on changes in weight/nutritional status, blood pressure control.	The importance of blood pressure control and, if relevant, blood glucose control.	Provide feedback on changes in weight/nutritional status, blood pressure control.
	Discuss optimal caloric, protein and nutrient intake e.g. sodium, potassium, phosphorous.	Recommend changes in nutrient intake that may improve outcome.	Discuss optimal caloric, protein and nutrient intake e.g. sodium, potassium, phosphorous and vitamins according to type of dialysis (HD/PD).	Recommend changes in nutrient intake that may improve outcome.
	Basic dietary guidelines for renal failure, and for diabetes, include timing of meals and snacks if indicated.	Provide specific mineral restriction guidelines according to laboratory results.	Basic dietary guidelines for ESKD, and for diabetes, include timing of meals and snacks if indicated.	Provide specific mineral restriction guidelines according to laboratory results.
	Discuss fluid intake and restrictions, if indicated.	Review fluid status and recommendations.	Discuss dry weight and fluid restrictions, if indicated.	Review fluid status and recommendations.
	Discuss laboratory results and the significance thereof.		Discuss laboratory results and the significance thereof.	Review dialysis adequacy.
	Discuss the use and effect of phosphate binders.	Review the appropriate use of phosphate binders.	Discuss the use and effect of phosphate binders.	Review the appropriate use of phosphate binders.
	Discuss medicine-nutrient interactions as indicated.	Review medication prescribed, any changes and medicine-nutrient interactions.	Discuss medicine-nutrient interactions as indicated.	Review medication prescribed, any changes and medicine-nutrient interactions.
	Assess comprehension of education and projected compliance.	Assess comprehension of education and projected compliance.	Assess comprehension of education and projected compliance.	Assess comprehension of education and projected compliance.
	Provide relevant educational material, renal exchanges or diabetes exchanges (if appropriate).	Provide and review educational material.	Provide relevant educational material, renal exchanges or diabetes exchanges (if appropriate).	Provide and review educational material, especially with changes in dialysis modality.
<i>Behavioural</i>	Encourage exercise as part of a healthy lifestyle, if appropriate.	Assess activity and changes in recommendations.	Encourage exercise as part of a healthy lifestyle, if appropriate.	Assess activity and changes in recommendations.
	Identify short-term achievable goals.	Reset short-term goals and review long-term goals.	Identify short-term achievable goals.	Reset short-term goals and review long-term goals.
	Establish follow-up plan.	Establish follow-up plan.	Establish follow-up plan.	Establish follow-up plan.

Table 17: Patient education (transplant) - general guide³¹

Treatment	Acute phase		Chronic phase	
Factor	Initial intervention (within 72 hours of referral)	Follow-up (daily/as needed)	Initial intervention (1-2 months post transplant)	Follow-up (6 months/as needed)
<i>Self-management skills</i>	Discuss the role and effect of diet and medication in transplantation.	Review and reinforce self-management skills, including changes in medical status and therapies e.g. medication, dialysis.	Determine previous dietary instruction and practices.	Review and reinforce self-management skills, including daily intake and output and relevant feedback thereof.
	The importance of blood pressure control and, if relevant, blood glucose control.	Provide feedback on changes in weight/nutritional status, blood pressure and blood glucose control.	Review changes in nutritional status, blood pressure control and blood glucose control.	Provide feedback on changes nutritional status, blood pressure and glucose control.

	Discuss optimal caloric, protein and nutrient intake and vitamin/mineral supplementation as indicated.	Recommend changes in nutrient intake that may improve outcome, depending on tolerance of oral intake or changes in appetite.	Ensure optimal caloric, protein and nutrient intake and the use of vitamin/mineral supplementation, depending on tolerance of oral intake or changes in appetite.	Recommend changes in nutrient intake that may improve outcome, depending on tolerance of oral intake or changes in appetite or chronic rejection.
	Basic dietary guidelines as indicated and reinforce temporary nature of recommendations based on medical condition and laboratory results.	Basic dietary guidelines as indicated to improve outcome.	Specific dietary guidelines as indicated to improve outcome.	Provide specific dietary guidelines according to laboratory results, presence of diabetes, medicine-nutrient interactions, episodes of rejection and reinforce temporary nature of recommendations where applicable.
	Discuss fluid intake and restrictions, if indicated.	Review fluid status and recommendations.	Discuss fluid intake and fluid restrictions, if indicated.	Review fluid status and recommendations.
	Discuss laboratory results e.g. sodium, potassium, phosphate, calcium, magnesium and the significance thereof.	Review laboratory results and relevant changes.	Discuss laboratory results e.g. sodium, potassium, phosphate, calcium, magnesium, lipid profile and the significance thereof.	
	Discuss medicine-nutrient interactions as indicated, especially immuno-suppressant medication.	Review medication prescribed, any changes and medicine-nutrient interactions.	Discuss medicine-nutrient interactions as indicated.	Review medication, especially any changes in immuno-suppressant medication prescribed, and medicine-nutrient interactions.
	Implement nutritional plan as per individual requirements.	Re-assess nutritional plan for adequacy and appropriateness.	Implement nutritional plan as per individual requirements.	Re-assess nutritional plan for adequacy and appropriateness.
	Assess comprehension of education and projected compliance.	Assess comprehension of education and projected compliance.	Assess comprehension of education and projected compliance.	Assess comprehension of education and projected compliance.
			Provide relevant educational material.	Provide and review educational material, especially if presenting with chronic rejection.
<i>Behavioural</i>	Identify short-term achievable goals.	Reset short-term achievable goals.	Identify short-term achievable goals.	Reset short-term achievable goals and review long-term goals.
			Encourage exercise as part of a healthy lifestyle.	Assess activity and changes in recommendations.
	Establish follow-up plan.	Establish follow-up plan.	Establish follow-up plan.	Establish follow-up plan.

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7. ANNEXURES

ANNEXURE 1: Enteral product formulation

Enteral product formulations	Definition
Renal-specific formulas *Low/high protein low electrolytes *According to treatment Energy dense formula	These formulas include those with adapted macro- and micronutrient compositions to the needs of a specific disease (including digestive and metabolic disorders)
Low sodium feed	2kcal/ml; 3g/100ml Protein; 78mg/100ml Sodium, 112mg/100ml Potassium

ANNEXURE 2: Subjective global assessment (SGA)

- 1) Weight change over past two weeks and last six months
 - weight gain, no change, mild weight loss (>0.5kgs but <1kg)
 - moderate weight loss (>1 kg but <5%)
 - severe weight loss (>5%)
- 2) Change in dietary intake
 - no change or slight change for a short duration
 - intake borderline and increasing
 - intake borderline or poor and decreasing
- 3) Presence of GI symptoms
 - few intermittent or no symptoms
 - some symptoms for >2 weeks or severe symptoms that is improving
 - symptoms daily or frequently >2 weeks
- 4) Functioning state
 - no impairment in strength/stamina or mild to moderate loss and now improving
 - mild to moderate loss of strength/stamina in daily activity or severe loss but now improving
 - severe loss of strength/stamina or bed ridden
- 5) Subcutaneous loss of fat
 - little or no loss
 - mild-moderate in all areas
 - severe loss in some or most areas
- 6) Muscle wasting
 - little or no loss
 - mild-moderate in all areas
 - severe loss in some or most areas
- 7) Oedema
 - little or no oedema
 - mild-moderate oedema
 - severe oedema

Minimum score = 7

Maximum score = 49

1-14 - Well nourished

15-35- Mild to moderate malnourishment

36-49- Severe Malnourishment

Adapted from: Tapiawala, S, Vora, H, Patel, Z, Badve, S, Shah B. 2006. Subjective global assessment of nutritional status of patients with chronic renal insufficiency and end stage renal disease on dialysis. JAPI.(54):923-926.

ANNEXURE 3: South African renal exchange lists (updated 2012)
Meat and Meat Substitute Exchanges – High Phosphate (> 100 mg)
350 kJ, 7 g Prot, 5 g Fat, 0 g CHO, 120 mg PO₄, 55 - 430 mg Na, 90 mg K

Food Item	Code	Portion	Measure	Low in Sodium (55 mg)									
				Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	PO ₄ (mg)	Na (mg)	K (mg)			
Canned fish, pilchards in brine	3055	30g	1 heaped DSP	162	6	1.6	0	115	156	126			
Canned fish, pilchards in tomato sauce	3102	30g	size of small matchbox	159	5.6	1.6	0.2	105	111	126			
Canned fish, sardines in oil	3104	30g	1 large / 2 small	253	7.4	3.5	0	147	152	119			
Canned fish, sardines in tomato sauce	3087	30g	1 large / 2 small	220	4.9	3.6	0.2	110	124	102			
Cheese, Cheddar	2722	30g	size of small matchbox	494	7.4	9.7	0.5	160	146	25			
Cheese, Gouda / Edam / Swiss	2723	30g	size of small matchbox	473	7.2	9.5	0.1	170	153	21			
Cheese, Mozzarella, grated	2790	30g	2 heaped TBS	350	5.8	6.5	0.7	111	112	20			
Cheese, Ricotta	2793	70g		507	7.9	9.1	2.1	111	59	74			
Egg, boiled or poached	2867	55g	1 extra-large	339	6.9	5.7	0.7	106	69	54			
Liver, chicken, simmered	2970	30g	1 liver	190	7.3	1.7	0.3	94	15	42			
Liver – sheep / lamb, fried	2955	30g	size of small matchbox	290	7.7	3.8	1.1	128	37	106			
Liver, beef, fried	2920	30g	size of small matchbox	265	8	2.4	2.4	138	32	109			
Macaroni and cheese, white sauce(WM, HM)	3301	90g	1 heaped LS	642	6	8.4	12.9	112	151	78			
Oysters, canned	3068	80g	12 oysters	224	5.7	2	3.1	111	90	183			
High in Sodium (430 mg)													
Bacon, cured, fried / grilled	2906	30g	3 rashers	702	9.2	14.8	0	101	479	146			
Cheese, Blaauwkrantz / Roquefort	2726	30g	size of small matchbox	460	6.5	9.2	0.6	118	543	27			
Cheese, Camembert	2758	30g	size of small matchbox	373	5.9	7.3	0.2	104	253	56			
Cheese, Parmesan, grated	2762	20g	2 heaped DSP?	376	8.3	6	0.7	161	372	21			
Pizza with cheese, tomato & olives,	3353	80g	2 wedges	834	7.2	9.4	19.8	128	456	120			

TO BE RESTRICTED

- Brains (High phosphate)
- Cheese spread/wedges (High phosphate, sodium)
- Feta (High phosphate, sodium)
- Marmite, Bovril (High phosphate, sodium, potassium)
- Nuts, all types (High phosphate, potassium)
- Dried fish (Bokkems) (Extremely high in sodium; phosphate not known)
- Fish paste (Extremely high in sodium; phosphate not known)

**Meat and Meat Substitute Exchanges – Low Phosphate (< 100 mg)
350 kJ, 7 g Prot, 5 g Fat, 0 g CHO, 65 mg PO₄, 55 - 430 mg Na, 90 mg K**

Food Item	Code	Portion Grams/ml	Measure	Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	PO ₄ (mg)	Na (mg)	K (mg)
Low in Sodium (55 mg)										
Beef stew, with vegetables	3020	60g	~¼ cup	323	6.9	3.7	3.3	53	24	117
Bobotie, regular mince	3023	40g	1 heaped TBS	332	5.8	3.1	6.5	57	161	153
Calamari, fried	3099	30g	8 med rings	214	5.4	2.3	2.3	75	92	84
Canned fish, mackerel, canned	3113	30g	size of small matchbox	227	6	3.4	0	81	57	58
Canned fish, tuna in brine, drained	3054	30g	1/4 cup	139	7.7	0.2	0	49	101	71
Canned fish, tuna in oil, drained	3093	30g	1/4 cup	239	8.7	2.5	0	93	106	62
Chicken, cooked without bones	2963	30g	1 small drumstick	200	8.8	1.4	0	59	18	76
Cheese, Brie	4312	30g		416	6.2	8.3	0.1	56	189	46
Chicken, giblets, cooked, simmered	2998	30g	size of small matchbox	185	7.8	1.4	0	69	17	47
Chicken stew no skin, with vegetables	4378	60g	~¼ cup	266	6.9	2.1	3.3	60	20	114
Cottage cheese, low fat	2729	60g	2 heaped TBS	221	6.3	2.4	1.5	68	97	111
Cottage pie, lean mince, WM, HM	3009	50g	2 heaped DSP	296	7.3	3.1	3	58	26	137
Crab, fresh, cooked	3065	30g	2 TBS	123	6.1	0.5	0	62	84	97
Lobster (crayfish), cooked	3069	30g		172	7.9	0.6	0.9	69	68	94
Duck roasted meat and skin	2995	45g	1 drumstick / 1TBS	618	8.6	12.8	0	70	27	92
Fish, fatty (butterfish, herring), grilled	3082	30g	size of small matchbox	246	6.9	3.5	0	91	35	126
Fish, medium fat (snook), grilled / steamed	3089	30g	size of small matchbox	194	8.5	1.4	0	95	32	148
Fish, medium fat, battered/crumbed, fried in oil	3084	30g	size of small matchbox	285	7.6	4.2	0	85	28	133
Fish, white, battered fried in oil	3094	30g	size of small matchbox	302	6.7	4.2	1.8	76	26	115
Fish, low fat, fried in oil	3060	30g	size of small matchbox	231	6.3	3.4	0	57	28	92
Goat, roasted	4281	30g	size of small matchbox	172	8.1	0.9	0	60	26	122
Hare, stewed	4328	30g	1 heaped DSP	241	9	2.4	0	75	12	63
Kidneys, beef simmered	2923	30g	3 heaped TBS	168	7.7	1	0	92	40	54
Kidneys, sheep / lamb, braised	2956	30g	1 kidney	161	7.1	1.1	0	87	45	53
Lasagne, lean mince, cheese source (LFM, HM)	3440	75g	1 heaped LS	505	7.9	4.5	11.6	82.5	67.5	91.5
Meatball, lean mince, without egg	2966	30g	1 small meatball	265	8.3	2.9	0.9	56	29	87
Meat, cooked without bones, beef	4370	30g	size of small matchbox	357	8.2	5.9	0	50	28	83
Minced meat, mutton, cooked	3041	30g	3 level DSP	345	7.4	5.9	0	60	24	102
Mopanie worms, canned	4284	60g		257	8.5	2.2	0.4	74	140	139
Mopanie worms, dried	4250	15g		259	8.5	2.2	0.4	75	142	141
Mussels, black / blue, boiled	3085	30g	10 mussels	209	7.1	1.4	2.2	86	111	80
Mutton, leg roasted, meat and fat	2947	30g	1 thin slice	314	7.7	5	0	57	20	94
Mutton, leg and shoulder braised, lean	3036	30g	1 heaped DSP	270	10.1	2.6	0	62	21	78

Food Item	Code	Portion Grams/ml	Measure	Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	PO ₄ (mg)	Na (mg)	K (mg)	
											Code
Mutton stew, with vegetables	2916	60g	~ ¼ cup	416	7.4	6	3.3	56	22	111	
Ostrich, cooked	4283	30g	1 heaped DSP	168	7.6	1.1	0	77	16	97	
Patty, beef, grilled	2984	40g	1 small	458	9.8	7.9	0	63	31	118	
Perlemoen / Abalone, fried	3078	30g	1 slice	232	5.9	2	3.3	NA	177	26	
Pork leg, roasted	2958	30g	1 thin slice	332	8	5.3	0	79	18	106	
Pork loin, braised	3044	30g	size of small matchbox	244	8.9	2.5	0	54	19	110	
Shrimps / prawns, cooked	3070	30g	1 heaped TBS	119	6.3	0.3	0	41	67	55	
Spaghetti bolognese, lean mince	3388	75g	1 heaped LS	425	7.7	2.3	11.3	64.5	16.5	120	
Spleen, sheep / lamb braised	4340	30g	size of small matchbox	188	8.9	1.4	0	72.3	17.4	74.4	
Turkey, roasted, meat only	2981	30g	size of small matchbox	205	8.8	1.5	0	64	21	89	
Veal, chuck, cooked	4331	30g	size of small matchbox	247	8.8	2.6	0	66	30	99	
Veal, breast, cooked	4356	30g	size of small matchbox	290	7	4.6	0	58	35	91	
Venison, roasted, fine	2913	30g	1 heaped DSP	190	9.1	1	0	68	16	101	
High in Sodium (430 mg)											
Ants, flying dried	4333	15g		373	5.7	7	0.9	91	295	71	
Bitlong / dried sausage, beef	3021	20g	6 slices	340	6.6	5.1	1.8	81	443	119	
Chicken pie	2954	70g	1 small square	1119	4.8	17.4	22.5	50	270	71.4	
Chicken liver pate	2922	50g		413	6.8	6.6	3.3	87.5	193	47.5	
Comed meat, beef, canned	2940	30g	2 thin slices	290	5.9	4.5	1.5	33	302	41	
Frankfurters	2937	60g	1 Frankfurter	790	6.8	17.5	1.6	52	672	100	
Ham, cooked, 15cm X 9cm	2967	30g	1 thin slice	223	5.2	3.2	0.9	74	395	99.6	
Meat pie, steak 'n kidney	2957	90g	1 wedge	1350	8.3	20.6	25.7	76.5	356	88	
Offal – beef	3003	50g		337	7.9	5.5	0	51	271	79	
Pastrami, turkey	4343	40g	4 thin slices	228	7.4	2.5	0.7	80	418	104	
Polony/cold meat, beef and pork, 10 cm diam	2919	60g	4 thin slices	776	7	17	1.7	55	611	108	
Pork sausages, thin, grilled	2932	30g	10 cm piece	452	5.9	9.4	0.3	55	388	108	
Salami / Russians, 5cm diam	2948	30g	5 thin slices	512	6.9	10.3	0.8	43	558	113	
Sausage, beef and pork / Boerewors, thick, grilled	2931	60g	10 cm piece	974	8.3	21.8	1.6	64	483	113	
Smoked fish – Haddock	3061	30g	size of small matchbox	140	7.6	0.3	0	75	229	125	
Vienna sausage, beef and pork, canned	2936	70g	2 large	799	7.2	17.6	1.4	34	667	71	

**Meat and Meat Substitute Exchanges – Legumes –
350 kJ, 7 g Prot, 5 g Fat, 15 g CHO, 120 mg PO₄, 55 - 430 mg Na, 245 mg K**

Food Item	Code	Portion Grams/ml	Measure	Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	PO ₄ (mg)	Na (mg)	K (mg)
Low in Sodium (55 mg)										
Biryani, with lentils, ghee, no meat/ potato	3194	150g	2 heaped LS	980	6.6	6.9	33	125	5	224
Biryani, with lentils, oil, no meat/potato	3193	150g	2 heaped LS	980	6.6	6.9	33	125	3	224
Dried beans, cooked, kidney / white	3183	90g	3/4 cup	453	7	0.4	12.3	100	2	457
Dried beans, cooked, sugar	3205	90g	3/4 cup	553	6.4	0.5	17.6	110	12.6	331
Dried peas, cooked	3177	90g	3/4 cup	464	7.5	0.4	13.7	89	2	326
Lentils, cooked	3203	90g	2/3 cup	455	7.7	0.2	12.3	116	5	243
Lentils split, cooked	3179	90g	2/3 cup	459	8.1	0.4	13.1	162	2	332
Peanut butter, smooth style	3485	30g	2 level DSP	786	7.4	15	4.4	97	143	216
Peanuts, roasted, unsalted	3452	30g	1 med handful	778	7.9	14.8	3	155	2	205
Soup mix, dried, 4-in-1, raw	3175	50g		766	7.5	1.1	29.3	128	12	NA
Soya beans, cooked	3188	50g	4 level TBS	392	8.3	4.5	2.4	123	1	268
Tofu, fried	3209	50g		609	8.6	10.1	4.7	144	8	73
Tofu, raw, (soybean curd)	3202	100g		348	8.1	4.8	0.7	97	7	121
High in Sodium (430 mg)										
Baked beans, canned in tomato sauce	3176	90g	2 heaped TBS	482	4.3	0.5	16.1	94	357	266
Toppers, cooked	3196	140g	3/4 cup	584	8.1	2.4	17.9	141	552	346

TO BE RESTRICTED
Salted peanuts (High in sodium)

Milk Exchanges
325 - 835 kJ, 4 g Protein, 5 - 10 g Fat, 10 - 20 g CHO, 110 mg PO₄, 65 mg Na, 185 mg K

Food Item	Code	Portion	Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	PO ₄ (mg)	Na (mg)	K (mg)
Low to Moderate in Energy (325 kJ), Fat (5 g) and Carbohydrate (10 g)									
Buttermilk (cultured)	2713	125g/125 ml	280	4.1	3.5	4.8	110	126	200
Custard, wm (with custard powder)	2716	125g/125 ml	475	4.0	4	15.1	108	55	185
Custard, low fat (with custard powder)	2779	125g/125 ml	411	4.1	2.4	14.8	106	53	180
Custard, skim (with custard powder)	2717	125g/125 ml	330	4.3	0.3	14.5	121	60	198
Maas / Amasi / Sour milk	2787	125g/125ml	338	4.1	4.6	5.6	116	89	238
Melkkos / - snyssels wm (no sugar)	2733	135g	458	5.3	4.9	10.9	128	68	204
Milk, evaporated, full fat, unsweetened	2715	60g/60ml	320	4	4.1	5.8	140	64	152
Milk, low fat / 2% fat, fresh	2772	125g/125ml	266	4.1	2.5	6.1	111	58	190
Milk, low fat powder (vit A, B, D, E, folate added)	2825	10g	163	3.4	0.6	5	97	54	179
Milk powder, blend, medium fat, (Numel)	2794	15g	254	4.2	1.7	7	126	76	234
Milk, skim, fresh	2775	125g/125ml	186	4.3	0.3	6.1	126	65	208
Milk, full fat / whole, fresh	2718	125g/125ml	328	4.0	4.3	6	113	60	196
Nesquik, powder (+ 100ml wm)	2830	10g powder	437	3.3	3.6	14.6	96	49	172
Ovaltine powder, no sugar (+ 100ml wm)	2754	10g powder	299	3.6	3.7	6.0	102	54	177
Soya milk, plain	2737	125g/125ml	186	3.5	2.4	0.6	61	15	176
Soya milk, fortified	4351	125g/125ml	260	3.3	3.3	5	44	49	113
Yoghurt, low fat, flavoured, drinking, sweetened	2756	125g/125ml	396	3.9	1.6	15.9	101	59	163
Yoghurt, low fat, plain	2734	125g/125ml	318	5.4	2.4	8.1	138	83	243
High in Energy (835 kJ), Fat (10 g) and Carbohydrate (20 g)									
Baked custard, wm (egg), plain	2724	125g/125ml	605	5.8	5.4	18.3	124	71	161
Baked custard, low fat(egg), plain	2785	125g/125ml	563	5.8	4.1	18.4	123	69	158
Baked custard, skim (egg), plain	2745	125g/125ml	505	5.9	2.5	18.4	133	75	170
Ice cream, kulfi	4323	100g	1764	5.4	39.9	11.5	150	76	240
Ice cream sorbet (8% fat)	3491	80g/125ml	598	2.6	7	17.4	80	61	136
Ice cream (regular 10 % fat)	3483	80g/125ml	694	2.8	8.8	18.9	84	64	159
Ice cream (rich 16 % fat)	3519	80g/125ml	832	2.8	13	17.9	76	45	127
Ice cream, soft serve (13 % fat)	3518	135g	1253	5.5	17.6	30	157	82	239
Milk, condensed, full fat, sweetened	2714	50g	691	4.0	4.4	27.2	127	64	186
Milk ice (frozen on stick)	3530	100g	601	3.9	4.3	22.1	99	80	202
Milk shake, vanilla, purchased	2788	125g/125ml	600	4.9	3.8	22.1	144	119	229
Pancake / Crumpet, plain, wm, sun oil	3238	70g	808	4.4	11	19	78	34	102

Food Item	Code	Portion	Measure	Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	PO ₄ (mg)	Na (mg)	K (mg)
Sweets, chocolate coated bar	3997	55g	1 lunch bar	1089	2.8	12.4	34.3	80	91	157
Sweets, chocolate, Kit kat	4024	50g	1 medium	1076	4.0	13.3	30.3	95	54	165
Sweets, chocolate, milk	3987	50g	1/2 X 100g slab	1151	4.3	15.3	30.1	120	60	210
Sweets, chocolate, white	4023	50g	1/2 X 100g slab	1160	4.7	16.1	28.7	115	55	175
Yoghurt, frozen	4324	75g	1/2 cup	515	3.0	4.2	18.2	97	65	158
Yoghurt, wm, curry spice (khuri)	2786	125g/125ml	1/2 cup	520	5.3	7.3	8.8	131	73	265

TO BE RESTRICTED

Chocolates with coated nuts, raisins

Dark chocolates - Albany

High protein milk drinks e.g. drinking chocolate powder

Puddings, instant

(high in potassium, sodium and phosphate)

(high in potassium and phosphate)

(high in phosphate)

(very high in phosphate)

*Creamer, non-dairy powder (cremora, coffee-mate) - only 10 g/d (kJ, Prot, 4 G Fat, 6 g CHO, 42 mg PO₄, 18 mg Na, 81 mg K)

Starch Exchanges – Low Potassium (< 100 mg)

350 - 835 kJ, 2 g Protein, 0 - 10 g Fat, 20 g CHO, 40 mg PO₄, 70 mg Na, 50 mg K

Food Item	Code	Portion Grams/ml	Measure	Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	PO ₄ (mg)	Na (mg)	K (mg)
Low to Moderate in Energy (350 kJ), and / or Fat (0 g)										
Barley, pearl cooked	3368	75g	3 heaped TBS	397	2	0.4	17.9	41	7	70
Brown bread / rolls (fortified)	3211	30g	1 slice / 1 roll	309	2.7	0.4	13	28	194	68
Crumpets (wm, sunflower oil)	3238	25g	1 crumpet	289	1.6	3.9	6.7	28	12	37
Jelly	3983	120g	~ 1/2 cup	320	1.4	0	17.4	1	6	6
Maize meal cooked, crumbly porridge	3401	50g	1 heaped TBS	410	2.4	1.0	21	50	3.5	64
Maize meal cooked, soft porridge	3399	200g	2 heaped LS	400	2.4	1	21	80	8	44
Maize meal cooked, stiff porridge	3400	100g	1 heaped LS	520	2.8	1.1	27	80	7	71
Maize, rice cooked (white)	3250	100g	2 heaped LS	424	2.2	0.2	21.5	15	1	28
Maize, samp cooked (white)	3280	100g	1 heaped LS	424	2.2	0.2	21.5	15	1	28
Maltabella, cooked	3241	200g	5 heaped TBS	356	2.2	0.6	17	52	NA	86
Oats, cooked	3239	110g	1 heaped LS	307	1.9	1.8	10.6	85	2	63
Pasta, cooked	3262	40g	1 heaped TBS	236	1.9	0.3	10.7	22	0.4	12
Pearl wheat, cooked	3249	60g	2 heaped TBS	229	1.9	0.3	9.4	24	2	41
Provita biscuits	3235	20g	3 biscuits	354	2.3	1.7	14.4	35	142	41
Puffed rice - sweetened (cocopops)	3372	30g	1 cup	486	1.6	0.1	26.5	42	227	26
Puffed wheat, plain	3325	15g	1 cup	247	2.2	0.2	11.4	53	1	52
Pumpernickel bread	3283	25g	1 slice	282	2.1	0.4	11.5	40	145	48
Rice, brown, cooked	3315	90g	3 heaped TBS	422	2.3	0.8	19.2	75	5	39
Rice, white, cooked	3247	75g	3 heaped TBS	398	2	0.2	20.6	35	2	29
Scone, plain	3237	25g	1 small scone	401	2	4	12.5	27	77	32
Scone, whole-wheat (hm / wm)	3320	25g	small	383	2.7	3.9	9.4	64	73	75
Tasty wheat, cooked	3240	100g	1 heaped LS	220	1.5	0.2	11	17	1	17
White bread / rolls* (fortified)	3210	30g	1 slice / 1 med roll	311	2.6	0.4	13.8	29	196	64
Whole-wheat bread/rolls	3212	30g	1 slice / 1/2 roll	325	2.5	0.6	13.3	53	114	64
High in Energy (835 kJ) and / or Fat (10 g)										
Apple tart, short crust	3224	75g	1 large wedge	700	2	5.9	25.4	23	115	84
Baked cheese cake, egg and cream	3293	50g	1 small wedge	867	2.7	16.2	12.7	48	155	55
Banana loaf (wm, hm)	3333	40g	1 cm slice	562	1.9	4.4	21	26	84	84
Beskuit, whole-wheat, buttermilk (hm)	3255	30g	1 rusk	597	2.7	6.2	16.8	65	130	77
Boerbeskuit	3364	30g	2 small pieces	530	2.7	2.3	22.6	50	34	62
Butter cake, plain (wm, hm)	3288	50g	1 small piece	754	2.6	6.2	27.9	37	119	41
Buttermilk rusk, white, commercial	3329	30g	1 rusk	569	2.4	4.5	20.6	50	164	61

Food Item	Code	Portion		Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	PO ₄ (mg)	Na (mg)	K (mg)
		Grams/ml	Measure							
Carrot cake, plain (egg, sun oil)	3392	50g	1 med wedge	791	2.1	9.9	22.3	82	157	48
Chocolate éclair with cream filling	3268	50g	1 med	802	2.1	11.9	19	37	75	44
Commercial cookies with filling	3217	30g	2 cookies	611	1.5	5.6	21.9	25	67	36
Commercial cookies, plain	3216	30g	3 biscuits	579	2.2	4	22.7	25	123	42
Corn flakes, plain	3243	40g	1 cup	642	3.10	0.1	33.2	20	484	42
Cream crackers	3230	25g	3 crackers	507	2.4	4.1	17.1	28	152	30
Doughnut, plain	3232	45g	1 small	793	2.7	9.8	21.2	36	104	39
Ginger bread (hm)	3253	40g	1 cm slice	662	2.1	5	25.4	29	127	54
Koeksister	3231	60g	1 large	869	1.6	5.6	37.2	25	NA	NA
Madeira cake, commercial	3291	50g	2 thin slices	866	2.7	8.5	29.2	60	190	60
Mosbolletjies	3426	40g	1/2 big	554	2.3	2.6	23.8	26	25	34
Noodle salad	3336	95g	1/2 cup	817	3.1	12.3	17.6	39	79	56
Popcorn, sugar coated / candied	3359	100g	2 cups	2165	2.1	20	77.6	58	56	75
Rice crispies	3252	40g	1 cup	642	2.6	0.1	34.7	56	529	40
Roti with butter	3356	50g	15 cm diam small	1096	2.4	18.7	20.8	29	186	35
Roti with oil	3358	50g	15 cm diam small	1245	2.3	22.8	20.7	23	1	29
Samosa, mutton filling	3355	40g	1 small	1000	2.0	22.4	7.2	25	13.2	48
Shortbread (butter)	3296	25g	2 pieces	550	1.6	6.8	15.4	20	60	25
Sweetcorn fritter	3254	50g	2 small	876	2.8	15	15.4	58	124	100
Tipsy tart	3323	60g	1 med wedge	729	1.8	2.6	34.3	25	25	83
Velkoek	3257	60g	1 small	914	4.3	10.6	25.4	52	16	47

**Vegetable Exchanges – Low Potassium (< 120 mg)
90 kJ, 1 g Prot, 0 g Fat, 2 g CHO, 20 mg PO₄, 20 mg Na, 75 mg K**

Food Item	Code	Portion	Measure	Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	PO ₄ (mg)	Na (mg)	K (mg)
Artichoke, globe / French, cooked	3944	30 g		62	1.1	0.1	1.7	26	29	106
Broccoli, cooked	3701	75g	1/2 cup	89	1.7	0.2	1.1	37	3	91
Cabbage Chinese, boiled (pre-tsoi)	4109	65g	1/2 cup	46	0.5	0.1	1.2	14	7	90
Cabbage, cooked	3756	70 g	1/2 cup	73	0.7	0	2.2	17	14	81
Cabbage, raw	3704	40 g	1/2 cup	54	0.6	0	1.7	13	12	69
Celery, cooked	3774	20 g	1 heaped DSP	14	0.1	0	0.3	5	6	55
Celery, raw	3829	10 g	1 stick	8	0.1	0	0.2	2	4	38
Chicory (witloof), raw	3947	50g	2 heaped TBS	44	0.5	0.1	0.5	13	1	106
Coleslaw, commercial	3707	50g	1/2 cup	328	0.8	5.6	3.9	18	135	90
Coleslaw, mayonnaise, raisins	3705	50g	1/2 cup	302	0.8	5.5	4.3	17	87	86
Cucumber, raw, English	4119	50 g	5 med slices	31	0.4	0.1	1	14	6	84
Leek, cooked	3833	100 g	1/2 cup	150	0.8	0.2	6.6	17	10	87
Lettuce, shredded	3723	40 g	1/2 cup	27	0.4	0	0.7	11	3	68
Mixed vegetables (carrot, corn, peas, beans)	3727	75 g	1/2 cup	201	1.7	0.4	6.2	38	26	109
Mixed vegetables(carrot, cauliflower, beans)	4265	75 g	1/2 cup	98	1.1	0.2	2.2	29	25	101
Onion, cooked, whole	3773	50 g	2 small or 1 med	96	0.5	0.1	4.4	15	7	81
Onion, raw	3755	30g	2 slices	58	0.3	0	2.6	10	5	54
Peas, fresh, cooked	3719	50g	2 heaped TBS	182	2.7	0.4	4	31	7	104
Peas, frozen, cooked	4146	50g	2 heaped TBS	176	2.6	0.4	2.7	46	4	54
Peas, mangetout, cooked	3717	25g	10 small pods	46	0.5	0	1.6	13	0	36
Pepper, chili	3977	5g	1 heaped TSP	12	0.1	0	0.2	3	0	17
Pepper, sweet, green, raw	3733	25 g	4 med slices	26	0.2	0	0.8	6	2	44
Pepper, sweet, red, raw	3734	25g	4 med slices	33	0.2	0.1	1.1	5	1	44
Pepper, sweet, yellow, raw	4153	25g	4 med slices	33	0.3	0.1	1.4	6	1	53
Pumpkin, summer, marrow	4179	110g	1/2 cup	64	0.1	0	1.9	2	2	47
Radish, raw	3745	50 g	2 large radishes	45	0.3	0.3	1	9	12	116
Sambal, tomato, onion	4272	50g		82	0.4	0.1	3.7	13	4	99
Sou sou (Chayote), cooked	4166	50g		49	0.4	0.1	1.3	11	0	68
Sweetcorn, cream style, canned	3726	65 g	1/4 cup	212	1	0.2	10.1	31	172	81
Sweetcorn, whole kernel, canned	3942	50 g	~1/4 cup	156	1	0.2	7.3	26	107	82
Tomato ketchup / sauce	3139	25g	1 level TBS	120	0.3	0.1	6.2	10	146	116

Vegetable Exchanges – Moderate Potassium (120 – 200 mg)

90 kJ, 1 g Prot, 0 g Fat, 2 g CHO, 20 mg PO₄, 20 mg Na, 150 mg K

Food Item	Code	Portion	Measure	Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	PO ₄ (mg)	Na (mg)	K (mg)
Asparagus, cooked (green)	3695	90g	1/2 cup	100	2.1	0.3	1	49	0	191
Amaranth leaves, boiled	3980	50g		56	1	0.1	0.6	19	2	123
Beetroot, cooked with skin (flesh only)	3698	50 g	1/2 med	108	1	0	4	18	30	145
Beetroot leaves, cooked	3914	20g	1 large DSP	30	0.5	0	0.5	8	48	182
Brinjal, cooked (including skin)	3700	90 g	1/2 cup	94	0.6	0	2.9	21	4	160
Brussels sprouts, cooked	3703	80 g	1/2 cup	120	2.2	0.1	1.8	46	7	187
Calabash / Gourd (white), boiled	4212	100g		120	0.6	0	3.7	13	2	170
Carrot salad, pineapple, orange juice	3710	65g	1/2 cup	124	0.5	0	5.1	12	11	142
Carrots, cooked, rings	3757	80 g	1/2 cup	130	0.7	0.1	4.2	23	23	125
Carrots, raw, grated	3709	50g	1/2 cup	85	0.5	0	3.2	12	12	121
Cauliflower, cooked	3716	80 g	1/2 cup	75	1.1	0.1	1.7	23	5	134
French salad (lett, tom, cuc), no dressing	3921	70g	1/2 cup	55	0.6	0.1	1.7	19	5	130
Green beans, cooked, long pieces	3696	65 g	1/2 cup	89	1.2	0.1	1.7	24	3	168
Kalahari truffle, raw	4195	50g		191	2.1	1.8	0.4	71	2	145
Mushroom, raw, sliced	3842	45g	1/2 cup	60	1	0.1	1.2	36	5	132
Pumpkin, summer, patty pan, sliced	4181	100g	3 heaped TBS	81	1	0.2	1.4	28	1	140
Pumpkin, winter, white, cooked	4164	105g	1/2 cup	97	0.7	0.1	3	18	2	165
Pumpkin, winter, hubbard, cooked	4177	105g	1/2 cup	142	0.7	0.1	5.9	20	2	165
Spinach, cooked (Swiss chard)	3913	90 g	1/2 cup	121	2.4	0.3	1.8	32	129	159
Sweetcorn, cooked	3725	65 g	1/4 cup	345	2.1	0.8	14.5	67	11	162
Tomato, raw	3750	80g	1 small	73	0.7	0.2	2.3	20	4	185
Turnip, cooked	3911	90 g	1/2 cup	89	0.6	0.1	2.6	17	45	122
Waterblommetjies, fresh (boiled)	4194	100g		95	0.7	0	2.1	25	20	131
Watercress, raw	3954	50g		41	1.2	0.1	0.4	30	21	165

**Vegetable Exchanges – High Potassium (> 200 mg)
90 kJ, 1 g Prot, 0 g Fat, 2 g CHO, 20 mg PO₄, 20 mg Na, 270 mg K**

Food Item	Code	Portion	Measure	Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	PO ₄ (mg)	Na (mg)	K (mg)
Amadumbe, tuber, boiled, flesh only	4087	50g		300	0.3	0.1	15	38	8	242
Amadumbe / taro, leaves, steamed	4089	50g		65	1.4	0.2	1	14	1	230
Bamboo shoots, raw	4095	50g		55	1.3	0.2	0.6	27	3	234
Marog, cooked	8302	50g		100	2	0	3.8	18	8	310
Mixed vegetables, canned	4264	140g	1/2 cup	277	2.9	0.1	9.7	46	532	294
Mushroom, cooked, whole	3729	90 g	1/2 cup	120	2.1	0.2	2.4	66	9	239
Okra, boiled	3939	100g	1/2 cup	162	1.9	0.2	4.7	56	5	322
Pumpkin leaves, boiled	4205	50g		56	1.4	0.1	0.4	40	4	219
Pumpkin, summer, gem, cooked	3760	90g	1/2 large	87	0.5	0.1	3.2	19	1	232
Pumpkin, winter, butternut, cooked	3759	105g	1/2 cup	247	1.6	0.1	11	45	2	288
Spinach, small leaf, boiled	3761	90g	1/2 cup	114	2.7	0.3	1.3	50	63	419
Spinach, small leaf, raw	4167	50g		62	1.5	0.2	0.4	25	40	279
Tomato and onion stew, with sugar	3910	75g	1 heaped LS	129	0.8	0.2	5.3	24	7	203

TO BE RESTRICTED

- Gherkins/pickled cucumber (High sodium and potassium)
- Pickled onion (High sodium)
- Waterblommeijes canned (High sodium)

Fruit Exchanges – Low Potassium (< 120 mg)
250 kJ, 0.5 g Protein, 0 g Fat, 10 g CHO, 15 mg PO₄, 5 mg Na, 95 mg K

Food Item	Code	Portion Grams/ml	Measure	Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	PO ₄ (mg)	Na (mg)	K (mg)
Fresh Fruit (Raw)										
Apple, skin	3532	100g	1 small	267	0.2	0.1	13	7	4	99
Cherry	3542	50g	2 heaped DSP	137	0.6	0.1	6.7	10	3	118
Granadilla (without peel)	3545	20g	1 med	90	0.4	0.1	2.6	7	0	62
Kumquat	3630	50g	6 med	149	0.5	0.1	4.9	10	3	98
Lemon, with peel	3577	70g	1/2 med	149	0.8	0.2	4.2	11	2	102
Litchi	3632	50g	6 litchis	164	0.4	0.1	8.6	10	2	112
Melon, wild	3678	60g		64	0.8	0.1	2.4	14	21	14
Mulberries	3634	50g		103	0.7	0.2	4.1	19	5	97
Pear	3582	100g	1 small	305	0.3	0.2	14.4	9	4	85
Pineapple	3581	40g	2 med slices	99	0.2	0	4.8	2	0	64
Plum	3570	50g	1 med	116	0.4	0.1	5.5	9	2	86
Prickly pear	3571	50g	1 small	139	0.5	0.2	5.3	10	1	72
Strawberry	3573	50g	4 med	79	0.4	0.2	3	14	2	85
Youngberry	4236	50g		122	0.4	0.2	3.8	10.5	0	98
Dried Fruit										
Apple, dried, raw	3600	25g	5 rings	287	0.2	0.1	14.3	9.5	22	113
Dates, dried, raw	3543	10g	2 dates	130	0.2	0.1	6.6	4	0.3	65
Pear, dried, raw	3585	12g	1 half	148.5	0.3	0.1	7.5	7	0.5	64
Fruit Juice										
Apple juice, Ceres / Liquifruit	3606	125 ml	1/2 cup	288	0.1	0	16.6	9	3	113
Apricot juice, Liquifruit	3610	125 ml	1/2 cup	279	0.4	0	15.3	14	3	85
Grape juice, Ceres / Liquifruit	3690	125ml	1/2 cup	304	0.1	0.1	17.4	14	5	53
Guava juice, Ceres / Liquifruit	3629	125 ml	1/2 cup	260	0.3	0.1	14.4	11	8	81
Litchi juice, Ceres	3684	125 ml	1/2 cup	274	0.1	0	15.9	14	5	59
Mango juice, Ceres	3683	125 ml	1/2 cup	268	0.1	0	15.5	11	3	39
Mango and orange juice, Liquifruit	3681	125 ml	1/2 cup	291	0.4	0.1	16.4	15	3	94
Orange juice, Ceres, Liquifruit	3638	125ml	1/2 cup	273	0.4	0.1	15.1	16	5	119
Peach juice, Ceres	3687	125 ml	1/2 cup	273	0.5	0.1	15.1	11	4	110
Strawberry juice, Liquifruit	3654	125 ml	1/2 cup	261	0.4	0.1	14.6	15	4	66
Canned or Cooked Fruit										
Apple, fresh, stewed with sugar	3603	120g	1/2 cup	509	0.4	0.5	25.7	10	1	106
Fruit salad, canned in syrup	3580	140g	1/2 cup	491	0.4	0.1	26.2	13	8	112

Food Item	Code	Portion	Measure	Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	PO ₄ (mg)	Na (mg)	K (mg)
Litchi, canned in syrup	3631	125g	1/2 cup	395	0.5	0	22.1	15	3	94
Peach salad, curried/atchar/pickles	3693	45g	1 heaped TBS	153	0.3	0	8	9	2	61
Peach, canned in syrup	3567	125g	1/2 cup	394	0.6	0.1	21	13	6	104
Pear, canned in syrup	3583	130g	1/2 cup	410	0.3	0.1	21.8	13	7	107
Pineapple, canned in fruit juice	3647	90g	1/2 cup	249	0.4	0.1	13.4	5	1	110
Pineapple, canned in syrup, pieces	3648	90g	1/2 cup	332	0.2	0.1	19	6	1	94

Fruit Exchanges – Moderate Potassium (120 – 200 mg)

250 kJ, 0.5 g Protein, 0 g Fat, 10 g CHO, 15 mg PO₄, 5 mg Na, 170 mg K

Food Item	Code	Portion	Measure	Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	PO ₄ (mg)	Na (mg)	K (mg)
Fresh Fruit (Raw)										
Apricot	3534	50g	2 small	79	0.4	0.1	3.3	13	2	160
Gooseberry	3622	50g	10 berries	125	1	0.4	3	20	0.5	137
Grapefruit	3546	100g	half	165	0.7	0.1	6.9	16	3	134
Guava	3551	50g	1 small	145	0.4	0.2	3.9	12	0.5	132
Mango	3556	100g	quarter	303	0.6	0.2	15.3	11	1	164
Melon, green	3575	60g	3 cm wedge	115	0.4	0.1	5.4	13	7	162
Minneola, peeled	4227	100g		201	0.7	0.2	9.3	19	2	177
Naarfjie / Tangerine	3558	100g	1 med to large	230	0.9	0.2	10	15	5	139
Pawpaw, cubes	3563	100g	4 heaped TBS	186	0.4	0.1	8.6	7	7	192
Canned or Cooked Fruit										
Fruit cocktail, canned in fruit juice	3664	140g	1/2 cup	337	0.6	0	17.1	25	7	168
Fruit cocktail, canned in syrup	3665	140g	1/2 cup	451	0.6	0.1	24.1	15	8	123
Gooseberry, canned in syrup	3621	130g	1/2 cup	666	0.7	0.3	36	30	4	157
Grapefruit, canned in fruit juice	4215	125g	1/2 cup	109	0.5	0.1	4.8	10	6	121
Grapefruit, canned in syrup	3547	125g	1/2 cup	345	0.8	0.1	18.8	13	3	161
Guava, canned in syrup	3553	105g	1/2 cup	385	0.4	0	17.1	12	7	126
Mango, canned in syrup	3633	125g	1/2 cup	449	0.4	0	25.1	13	4	125
Peach, canned in fruit juice	3640	125g	1/2 cup	288	0.5	0	14.9	26	6	194
Pear, canned in fruit juice	3643	130g	1/2 cup	256	0.4	0	12.4	16	5	125

Fruit Exchanges – High Potassium (> 200 mg)

250 kJ, 0.5 g Protein, 0 g Fat, 10 g CHO, 15 mg PO₄, 5 mg Na, 240 mg K

Food Item	Code	Portion	Measure	Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	PO ₄ (mg)	Na (mg)	K (mg)
Fresh Fruit (Raw)										
Avocado	3656	40g	quarter	408	0.7	9.4	0.8	13	1	233
Banana, peeled	3540	100g	1 large	382	1.4	0.4	18.8	20	1	241
Fig	3544	100g	2 large figs	353	1.2	1	13.5	20	4	237
Grapes	3550	100g	1 small bunch	300	0.7	0.1	14.7	19	2	215
Kiwi fruit	3660	100g	1 fruit	294	1	0.5	13	26	2	253
Marula, peeled	4241	100g		248	0.5	0.4	12.1	12	2	317
Melon, tsama	4246	100g		80	0.4	0	2.7	5	2	267
Melon, orange flesh	3541	60g	3 cm wedge	104	0.5	0.1	4.9	8	10	226
Num num	3679	100g		325	0.7	1.2	6.5	26	10	261
Orange	3560	120g	1 small	274	1	0.1	11	23	1	211
Peach	3565	100g	1 small	196	0.7	0.1	8.6	17	4	201
Watermelon	3576	200g	1 med wedge	276	1.8	0.2	11.8	10	8	274
Dried Fruit										
Apricot, dried, raw	3536	20 g	~ 6 halves	227	0.7	0.1	11	23	2	276
Currants, dried	3662	30g	3 heaped DSP	388	0.9	0.2	20	30	5	270
Dried fruit sweets	3995	40g	3 large sweets	553	0.6	0.1	29.6	21	5	214
Fig, dried, raw	3557	40g	2 figs	484	1.2	0.5	22	27	4	285
Peach, dried, raw	3568	25g	2 halves	283	0.9	0.2	13.1	30	2	249
Prune, dried, raw	3596	30g	3 prunes	339	0.8	0.2	17	24	1	224
Raisins, seedless	3552	30g	2 heaped DSP	411	1	0.2	22	29	5	242
Fruit Juice										
Orange juice, fresh	3561	125ml	1/2 cup	245	0.9	0.3	12.8	21	1	250
Tomato juice, Ceres	3976	125ml	1/2 cup	166	1.0	0.1	7.1	1.3	32.5	294
Canned or Cooked Fruit										
Apricot, canned in syrup	3535	135g	1/2 cup	402	0.5	0.3	21.5	15	12	201
Apricot, canned in fruit juice	3607	135g	1/2 cup	273	0.8	0	13.6	30	5	243

TO BE RESTRICTED

Guava roll, dried (high potassium)

Sugar Exchanges

155 kJ, 0 g Prot, 0 g Fat, 10 g CHO, 0 mg PO₄, 0 mg Na, 10 mg K

Food Item	Code	Portion Grams/ml	Measure	Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	PO ₄ (mg)	Na (mg)	K (mg)
Chewing gum	3993	10g	2-5 sweets	162	0	0	9.5	0	0	0
Coconut ice	4011	20g	1 med piece	381	0.3	2.6	15.9	8	5	22
Fruit gums	4000	10g	2 sweets	152	0.1	0.2	8.6	0	6	36
Golden syrup	3988	10g	thinly spread	135	0	0	7.9	2	27	24
Honey	3984	10g	thinly spread	140	0	0	8.2	1	1	5
Jam / Marmalade	3985	10g	thinly spread	120	0	0	6.9	2	2	9
Marshmallow	4001	10g	1 sweet	140	0.2	0	8	1	4	1
Peppermints	4004	10g	3 sweets	177	0.1	0.1	10.2	0	1	0
Sugar, brown	4005	10g	~ 2 TSP	164	0	0	9.6	2	3	34
Sugar, white	3989	10g	~ 2 TSP	170	0	0	10	0	0	0
Super C sweets (129 mg vit C / 10g)	4022	10g	2 sweets	177	0.1	0.1	10.2	0	1	0
Sweets, hard boiled or soft jelly type	3986	10g	2 small sweets	160	0	0.1	9.3	1	2	0

TO BE RESTRICTED

Assorted chocolates
 Chocolate coated bars/nuts/raisins
 Dark/bittersweet chocolate
 Fudge/toffee

(high in protein, potassium, sodium and phosphate)
 (high in protein, potassium, phosphate and sodium)
 (high in protein, potassium and phosphate)
 (high in protein, potassium, sodium and phosphate)

Fat Exchanges

160 kJ, 0 g Prot, 5 g Fat, 0 mg CHO, 0 mg PO₄, 45 mg Na, 0 mg K

Food Item	Code	Portion		Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	PO ₄ (mg)	Na (mg)	K (mg)
		Grams/ml	Measure							
Butiro	3523	5g	1 level TSP	152	0	4.1	0	1	41	1
Butter, salt added	3479	5g	1 level TSP	152	0	4.1	0	1	41	1
Butter, salt free	3529	5g	1 level TSP	152	0	4.1	0	1	1	1
Cream, fresh, 20% fat	3481	15g	1 level TBS	154	0.4	3.8	0.5	11	6	17
Ghee	3525	5g	1 level TSP	185	0	5	0	0	0	0
Holsum	3516	5g	1 level TSP	185	0	5	0	NA	NA	NA
Lard	3495	5g	1 level TSP	185	0	5	0	0	0	0
Margarine, light (soft)	3521	10g	2 level TSP	302	0	8	0.1	0	153	1
Margarine, med fat (PUFA)	3496	10g	2 level TSP	306	0	8.3	0	0	40	1.0
Margarine, plain, brick	3484	5g	1 level TSP	149	0	4	0	0	40	0
Mayonnaise	3488	10g	1 heaped TSP	217	0.1	5.4	0.9	3	76	1
Mutton tallow	3497	5g	1 level TSP	185	0	5	0	NA	NA	NA
Oil, sunflower, olive oil	3507	5g	1 TSP	185	0	5	0	0	0	0
Olives, ripe / canned / pitted	3658	25g	5 Olives	130	0.2	2.7	0.8	1	218	2
Orley whip	3492	15g	1 level DSP	148	0	3.9	0	2	6	2
Salad cream	3489	10g	1 heaped TSP	148	0.1	3.3	1.5	4	96	4
Salad dressing, French	3487	5g	1 level TSP	121	0	3.2	0.3	1	0	1
Salad dressing, low fat	3505	30g	2 DSP	175	0.3	3.9	1.6	0	142	1
Sandwich spread	3552	10g	2 level TSP	165	0.1	3.4	2.2	NA	NA	NA

TO BE RESTRICTED

Nuts, salted (High in phosphate, sodium and potassium)

Nuts, unsalted (High in phosphate and potassium)

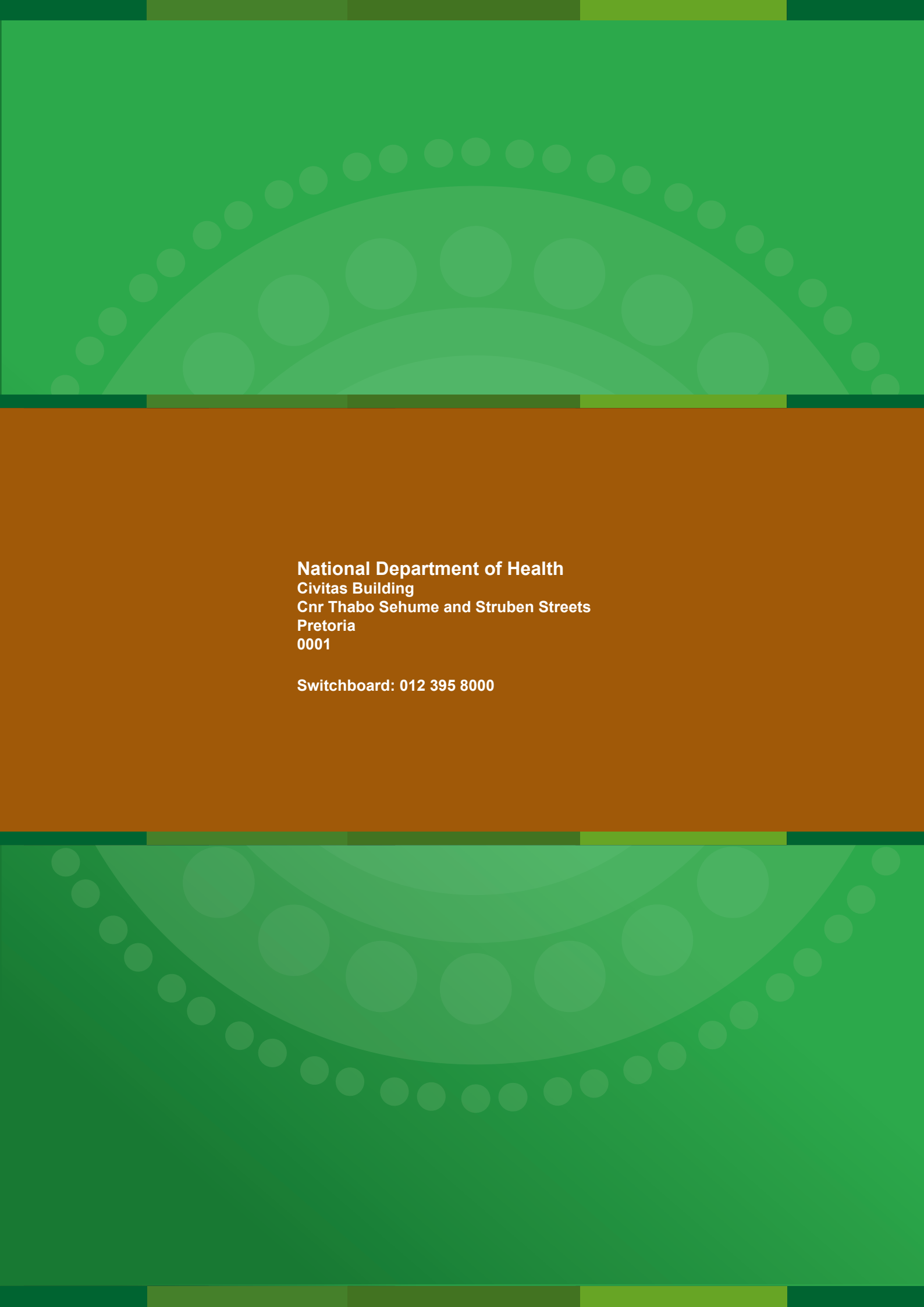
Drink Exchanges

10 - 300 kJ, 0 g Protein, 0 g Fat, 5 g CHO, 5 mg PO₄, 10 mg Na, 20 mg K

Food Item	Code	Portion Grams/ml	Measure (300 kJ)	Energy (kJ)	Protein (g)	Fat (g)	CHO (g)	PO ₄ (mg)	Na (mg)	K (mg)
Energy Drinks (300 kJ)										
Cold drink, carbonated	3981	250ml	1 med glass	438	0	0	25.8	8	17.5	2.5
Cold drink, squash, diluted	3982	250ml	1 med glass	298	0	0	17.5	2.5	12.5	10
Liqueur	4040	25ml	1 liqueur glass	360	0	0.1	11.6	1.5	2	7.5
Liqueur, with cream	4055	25ml	1 liqueur glass	346	0.7	3.9	5.2	13	23	8
Lucozade	4007	125ml	1/2 med glass	383	0	0	22.5	5	35	2.5
Mahewa / Magou	4056	125ml	1/2 cup	199	1.0	0.4	9.8	48	0	23
Sherry, dry / med, Vermouth	4043	50ml	1 sherry glass	225	0.1	0	2.1	4.5	4.5	46
Sherry, sweet / port, Muscadel	4032	50ml	1 glass	291	0.1	0	5.9	4.5	4.5	46
Spirit/Brandy/Gin/Whiskey/Cane/Vodka/Rum	4035	50g	1 tot	522	0	0	0	2	0.5	1
Energade	NA	125ml	1/2 cup	150	0	0	9	NA	46	6
Powerade	NA	125ml	1/2 cup	156	0	0	9.4	0	28	21
Game	NA	125ml	1/2 cup	153	0	0	9.5	19	31	6
Non-Energy Drinks (10 kJ)										
Coffee, brewed, instant	4037	180 ml	1 tea cup	16	0.2	0	0.7	2	3.6	97
Cold drink, artificially sweetened / diet squash	3999	250ml	1 med glass	7.5	0.3	0.0	0.3	25	27.5	2.5
Tea, Ceylon, brewed	4038	180ml	1 tea cup	9	0	0	0.5	1.8	5.4	67
Tea, herbal	4053	180ml	1 tea cup	5	0	0	0.4	0	2	16
Tea, rooibos	4054	180ml	1 tea cup	5	0	0	0.4	NA	5.4	7.2

TO BE RESTRICTED

All types of beer
 Ciders, sweet
 Cola drinks e.g. Coke, Pepsi
 Wine
 (high in phosphate, potassium)
 (high in potassium)
 (high in phosphate)
 (high in potassium)



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