

Assessment and monitoring of CKD stages 1- 3

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Pearl Pugh
Paediatric Renal Dietitian
Nottingham Children's Hospital

Goals of Dietetic Management

- Optimal (and catch-up) growth and development
- Prevent and treat malnutrition
- Biochemistry profile
- Vitamins and minerals
- Nutritional prescription

Releasing growth potential

‘One third of the total growth occurs during the **first 2 years of life**, on a **primarily nutrition-dependent** basis...early growth is crucial for the realisation of the growth potential of children born with CKD.

‘Calorie and protein requirements are **proportionately greater at this age than at any other time** of life’



Nutrition & growth in relation to stage of CKD

Norman L & Coleman J et al 2000

Mean **weight, height** and **BMI SDS decreased** with increasing severity of CRF (similar to NAPRTCS 1996)

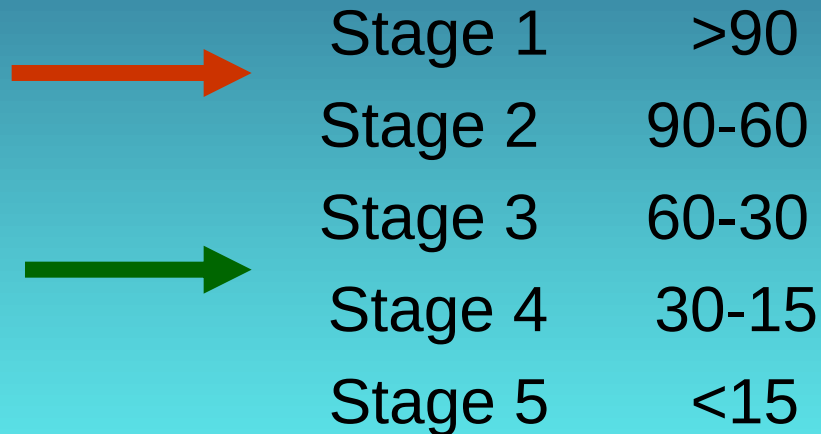
Loss of height being the most sensitive marker

Trends indicate that **change in growth** may begin in the mild **stages of the disease**



Severity of Chronic Kidney Disease

GFR (ml/min/1.73m²)



Stage 1	>90
Stage 2	90-60
Stage 3	60-30
Stage 4	30-15
Stage 5	<15

30-36 x height (cm)

Creatinine

(Schwartz et al 2009)

Clinical practice guidelines

- KDOQI Clinical Practice Guidelines for Nutrition in Children with Chronic Kidney Disease 2008 Update. Am J Kidney Dis 53:S11-104
- Dietary Reference Values for food energy and nutrients for the UK 1991
- SACNE 2011

Energy

Energy requirement kcal/kg/BW

Age	Normal requirement	Pre-dialysis	Peritoneal dialysis *	Haemodialysis
Preterm	110-150	120-180	120-180	120-180
0-2 yrs	81-120	95-150	95-150	95-150
2- adoles	Minimum of EAR for chronological age (use ht age if <2 nd centile for height)			

Dietary energy intake may need to be increased by up to 30% if vomiting, or reduced for children on PD to compensate for the energy derived from dialysate glucose, estimated at 8–12 kcal/kg/day if there is excessive weight gain.

Underweight: exclude kcal from PD

Overweight: include calories from PD

Protein

Protein requirements g/kg BW/day

Infants require extra protein for growth (KDOQI 2008)

Age	Normal Req- UK/USA	Pre- dialysis UK Guidelines	Pre- dialysis KDOQI (CKD) stage 4-5)	PD UK Guidelines	PD KDOQI (CKD) stage 4-5)	Haemo UK Guidelines	Haemo KDOQI (CKD) stage 4-5)
PRE- TERM	4	2.5-3.0	-	3-4	-	3	-
0-3 MONTHS	2.1/1.5	2.1	1.5-1.8	2.8-2.9	1.8	2.5	1.6
4-12 MONTHS	1.5-1.6/1.2-1.5	1.5-1.6	1.2-1.8	2.2-2.3	1.5-1.8	1.9	1.3-1.6
1-3 YEARS	1.1/1.05	1.1	1.05-1.25	1.8-1.9	1.3	1.5	1.15
4- PUBERTY	1.1/0.95	1.0-1.1		1.7-1.9		1.4-1.5	
4-13			0.95-1.15		1.1		1.05
14-18	0.8-0.9/0.85	0.8-0.9	0.85-1.05	1.6-1.8	1.0	1.3-1.4	0.95

DRI plus 0.15-0.3g/kg/day depending on patient age to compensate for peritoneal losses
PD patients can lose up to 10% daily protein intake, contributing to undernutrition

Nutritional Assessment

Fluid Overload affects - Overestimation of weight

- BMI
- Mid arm circumference
- Decreased serum albumin (dilutional)

Impact of Reference Values - Height against a reference range (SDS *just means how far from the normal*)

- Short stature and pubertal delay are common

Growth as a marker of Nutritional Status

Growth retardation

Serum Albumin

Hypoalbuminemia and risk of death in paediatric patients with end-stage renal disease

Wong CS et al. Kidney Int 2002

- Pts <18 years starting dialysis with hypoalbuminemia, greater risk of death
- In 1,723 children, each 1g/dl fall in albumin at start of dialysis was associated with 54% higher risk of death

Hypoalbuminemia cont...

Brem 2002

- more common in children on PD
- 39 children on PD over 2 years 35.9% had low levels cf to none in 32 on HD (protein intake equal)
- Children maintained on PD are at greater risk of protein malnutrition
- Protein losses → 2-fold greater in infants

Quam & Baum 1996

- **Protein losses in infants** impair growth and may contribute to **permanent loss of growth potential**

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Nutritional Products

Per 100ml	Protein	Na (mg)	K (mg)	P (mg)
Breast milk	1.3	16	59	14
Renastart	1.5	48	23	18
Whey based Infant Formula	1.3	18	68	28
Infatrini	2.6	37	95	50
Soya formula	1.8	19	72	50
Renilon 7.5	7.5	59	22	3
Suplena	3.0	78	112	74
Cow' milk	3.2	50.4	156	93
Nutrini	2.8	60	110	50

Expected weight gain

- Initial weight loss 5-10 day as full feeds are established
- 200g week for 1st 3 months (28g/day)
- 150g per week for 2nd 3 months (20g/day)
- 100g per week for 3rd 3 months (14g/day)
- 50-75g per week for 4th 3 months (7-10g/day)



Maintain normal electrolyte blood levels

PHOSPHATE

Phosphate restriction- may to be beneficial when $GFR < 75 \text{ ml/min/1.73m}^2$ (Stage 2-5)



- Guidelines for intake
 - <400mg/day in infants
 - <600mg/d <20kg
 - <800mg/d >20kg
 - <1000mg/d >40kg

Table 23. Recommended Maximum Oral and/or Enteral Phosphorus Intake for Children With CKD

Age	DRI (mg/d)	Recommended Phosphorus Intake (mg/d)	
		High PTH and Normal Phosphorus*	High PTH and High Phosphorus†
0-6 mo	100	≤100	≤80
7-12 mo	275	≤275	≤220
1-3 y	460	≤460	≤370
4-8 y	500	≤500	≤400
9-18 y	1,250	≤1,250	≤1,000

Phosphate restriction

Infants - Whey based for up to 2 yrs

Delay introduction of cows milk



Children & adolescents – Limit dairy products, cola drinks & chocolate, low PO₄ snacks and drinks

Phosphate binders - timing with food, formula & tube feeds

- ↓ intestinal phosphate absorption
- Taken with meals/snacks/tube feeds
- Adjust dose and timing to phosphate content of meals/snacks/tube feed

Bone health

Calcium

Assess Calcium: intake from diet and PO4 binders

Aim to meet UK RNI:

- 0-1 Year: 525mg
- 1-3 years: 350mg
- 4-6 years: 450mg
- 7-10 years: 550mg
- Males: 11-18 years: 1000mg
- Females: 11-18 years: 800mg

KDOQI

- Intake 100% OF DRI
- Safe upper limit for older than 1 year: is 2,500mg

Potassium restriction

Infants

- Low potassium formula
- K content of baby foods & fruit juices

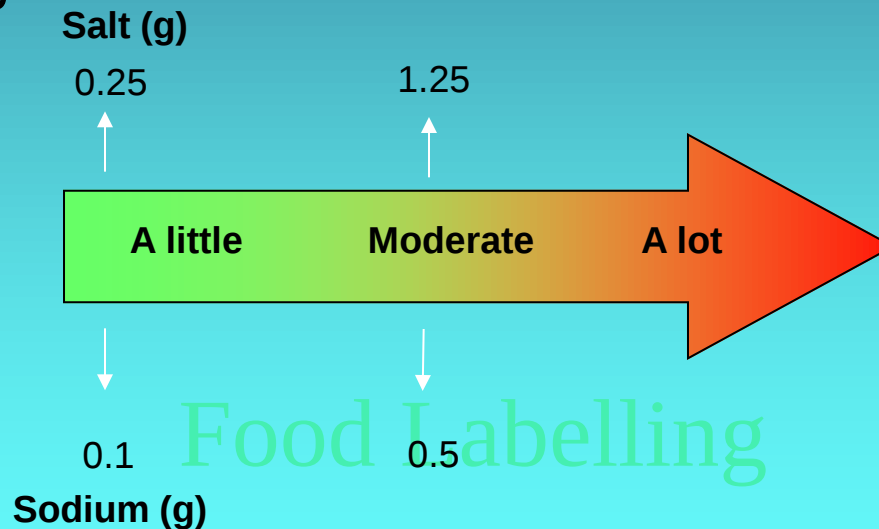
Children & Adolescents

- Foods to avoid, limit and choose alternatives
- Use of fruit drinks instead fresh fruit juices
- Ideas for low K snacks
- Peeling, pre-soaking and boiling K-rich vegetables
- Avoid certain cooking methods e.g. steaming, roasting
- K content of salt substitutes
- Avoid potato crisps and jacket potatoes
- Some dry spices are rich in potassium

Sodium restriction

- By reading food labels you can make better choices and choose foods lower in salt.

- As a general rule:**
Per 100g



To convert '**sodium**' to '**salt**', multiply the sodium value by 2.5: e.g. 1g of Sodium = 2.5g of Salt

Vitamin Supplements

- Vitamins & iron are supplemented <80% RNI
- Avoid preparations with Vitamin A and D
- Dialysis – loss of water-sol vitamins in dialysate fluid
- Acceptable taste to children
- Dialyvit Paediatric ½-1 caplet/d
(vit C, B-complex, E, K, folic acid, zinc & copper)
- Include nutritional supplements/infant feeds when assessing vitamin & mineral intake

