The Year (or Two) in Review: Pediatric Renal Nutrition Literature
HELLO!

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At 2018 Annual Dialysis Conference...

Review of the Recent Research and Practical Applications for Nutrition Care

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Presentation reviewing last 5 years of significant pediatric renal nutrition research
Disclaimer…

This grouping of research is by no means comprehensive or meeting the scope of all influential research compiled in the last 2 years!!
From: CKiD

Prevalence and outcomes of fragility: a frailty-inflammation phenotype in children with chronic kidney disease

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**Abstract**

Fragility is a condition of decreased physiologic reserve and increased vulnerability to stressors. Frailty in combination with inflammation has been associated with increased mortality risk in adults with advanced chronic kidney disease (CKD). This study aimed to investigate prevalence and outcomes associated with a frailty-inflammation phenotype, or “fragility,” in children with CKD.

**Methods**

We analyzed 557 children (age 6–19 years, eGFR 30–90 ml/min/1.73 m²) from the Chronic Kidney Disease in Children (CKiD) study. Based on adult models, the CKiD fragility model included four indicators: (1) suboptimal growth/weight gain (BMI < 5th percentile-for-height-age, deceleration ≥ 10 BMI-for-height-age percentiles/1 year, height-for-age percentile < 3rd or deceleration ≥ 10 height percentiles/1 year); (2) low muscle mass (mid-upper-arm circumference < 5th percentile or deceleration ≥ 10 percentiles/1 year); (3) fatigue (parent/child report); (4) inflammation (CRP > 3 mg/l). Logistic regression was used to evaluate association of fragility indicators with three adverse outcomes: frequent infection (>1 per year/3 years), hospitalization (any), and rapid CKD progression (decline in eGFR > 30% or initiation of renal replacement therapy within 3 years).

**Results**

Prevalence of fragility indicators 1 year after study entry were 39% (suboptimal growth/weight gain), 62% (low muscle mass), 29% (fatigue), and 18% (inflammation). Prevalence of adverse outcomes during the subsequent 3 years were 13% (frequent infection), 22% (hospitalization), and 17% (rapid CKD progression). Children with ≥3 fragility indicators had 3.16-fold odds of frequent infection and 2.81-fold odds of hospitalization, but did not have rapid CKD progression.

**Conclusions**

A fragility phenotype, characterized by the presence of ≥3 indicators, is associated with adverse outcomes, including infection and hospitalization in children with CKD.
Key points
Measurement of frailty (fragility): poor growth, low muscle mass, fatigue, inflammation BMI stabilization in year 2
Fragility markers (≥3) associated with 3.16-fold increase of infection and 2.81-fold increase in hospitalization

Practical Applications
Motivation for families to promote physical activity; use of growth hormone; encouraging intake?
May be complementary to PEW evaluation
Question: How would this compare to the general pediatric population in terms of infection and hospitalization risk?
Key points
Anemia 1.9 times higher in children that were vitamin D insufficient or deficient (even after adjusting for other factors)

Practical Applications
Assessing and treating vitamin D early is important – protocols are key!
Correcting vitamin D deficiency may lower ESA needs
Possible first line defense/adjunctive therapy

**Abstract**

**Background:** Cardiovascular (CV) risk is high in children with chronic kidney disease (CKD), and further compounded in those who are overweight. Children with CKD have a unique body habitus not accurately assessed by body mass index (BMI). Waist-to-height ratio (WtHr), a better predictor of CV risk in populations with short stature, has not been investigated in children with CKD.

**Methods:** Analysis of 1723 visits of 593 participants enrolled in the Chronic Kidney Disease in Children (CKiD) study was conducted. CKiD participants had BMI and WtHr measured and classified as: 1) lean (WtHr<0.49, BMI <85th percentile), 2) WtHr-overweight (WtHr>0.49, BMI<85th percentile), 3) BMI-overweight (WtHr<0.49, BMI ≥85th percentile), or 4) overweight by both BMI and WtHr. Left ventricular mass index (LVM), fasting lipids, FGF23, blood pressure, and glucose were measured as markers of CV risk. Linear mixed-effects regression was used to evaluate differences in CV markers between overweight and lean groups.

**Results:** Participants were 12.2 years old, 60% male, 17% African-American. Approximately 15% were overweight by WtHr but not by BMI. Overweight status by WtHr-only or both WtHr and BMI was associated with lower HDL and higher LVMI, triglycerides, and non-HDL cholesterol.
Key points
Children classified by: 1) lean (WHr≤0.49, BMI ≤0.49, BMI <85%ile) 2) WHr-overweight (WHr>0.49, BMI <85%ile), 3) BMI-overweight (WHr≤0.49, BMI ≥85th percentile) 4) overweight by both BMI and WHr

WHr overweight or WHr and BMI >85%ile linked to cardiovascular risk factors, BMI >85%ile only similar to lean patients

15% elevated WHr and not >85%ile BMI (often shorter)

Practical Applications
More clinical data is needed for WHr – consider collecting and sharing!
Develop protocols for measuring waist circumference

**Abstract**

**Background** The relationship between muscle strength and chronic kidney disease (CKD) in children is unknown. This study aims to quantify the association between grip strength (GS) and kidney function and to explore factors associated with grip strength in children and adolescents with CKD.

**Methods** We included 411 children (699 GS assessments) of the Chronic Kidney Disease in Children (CKiD) study. They were matched by age, sex, and height to a healthy control from the National Health and Nutrition Examination Survey to quantify the relationship between GS and CKD. Linear mixed models were used to identify factors associated with GS among CKD patients.

**Results** Median GS z-score was −0.72 (IQR −1.39, 0.11) among CKD patients with CKD stages 2 through 5 having significantly lower GS than CKD stage 1. Compared with healthy controls, CKiD participants had a decreased GS z-score (−0.53 SD lower, 95% CI −0.67 to −0.39) independent of race/ethnicity and body mass index. Factors associated with reduced GS included longer duration of CKD, pre-pubertal status, delayed puberty, neuropsychiatric comorbidities, need of feeding support, need for alkali therapy, and hemoglobin level. Decreased GS was also associated with both a lower frequency and intensity of physical activity.

**Conclusions** CKD is associated with impaired muscle strength in children independent of growth retardation and BMI. Exposure to CKD for a prolonged time is associated with impaired muscle strength. Potential mediators of the impact of CKD on muscle strength include growth retardation, acidosis, poor nutritional status, and low physical activity. Additional studies are needed to assess the efficacy of interventions targeted at these risk factors.

**Keywords** Children · Chronic kidney disease · Muscle strength · Outcomes · Quality of life
Key points

Compared to controls, children with CKD had lower hand-grip z-scores

Longevity of CKD decreases hand-grip strength

Increased hours of physical activity improved hand-grip strength

Delayed puberty, feeding support, need for alkali therapy and low Hgb associated with poorer hand-grip

Poor QOL associated with poor hand-grip strength

Practical Applications

Consider assessment of hand-grip strength and possibly interventions if poor

Physical activity is important in CKD!
From:

*Pediatric Nephrology*
Marlais M, Stojanovic J, Jones H, Cleghorn S, Rees L.

Key points
Children with CKD stage 2-5 started on enteral feeds after the age of 2 still had improved height and weight SDS
Younger children and those not on dialysis had the most improvement
BMI stabilization in year 2
Height SDS continued to improve into second year

Practical Applications
Start enteral feeds early in age and stage of CKD if need suspected; however...
Don’t hesitate to initiate enteral feeds in older children
Careful dietetic management can prevent overweight with enteral feeds and improve linear growth
Take home message...

Key points
Underweight and overweight children at greater risk for arterial stiffness
BMI with height age highly correlated with fat mass
Inflammation likely culprit

Practical Applications
Mediterranean diet and exercise recommended for this population
BMI with height age still a fairly accurate anthropometric marker
Lean to fat mass important!
Take home message...

Key points
Protein provision important for survival with CRRT use
Patients only met protein goals ~38% of the time
Weaning from PN to EN = inadequate protein intake

Practical Applications
Need to increase protein in enteral feeds – possibly through modular
Be mindful in transitions from PN to EN
Renal RD’s communicate with critical care RD’s!
Esmaeili M, Rakhshanizadeh F.
Take home message...

Key points
Copper levels similar in PD, HD, pre-dialysis and control groups
Zinc, selenium, and lead similar in controls and pre-dialysis patients vs HD and PD
Zinc and selenium lower in dialysis groups
Lead higher in dialysis groups

Practical Applications
Start supplementation of Zn and Se upon initiation of dialysis – don’t wait
Consider annual Pb evaluation
What about transport status, other dialysis variables?
What is the role of the diet?
Other....
Key points

World-wide, both obesity and underweight are a problem in pediatric dialysis patients – more than would be comparable to healthy children.

Enteral feeds can be a risk for young children for obesity.

Mortality increases in underweight teens and obese young children.

Practical Applications

Don’t over-feed infants and young children on tube feeding.

Careful monitoring of growth very important!


**Children Tolerate Intradialytic Oral Nutrition**

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**Abstract**

**Background**—Haemodialysis (HD) patients have poor nutrition, which contributes to worse outcomes. Inadequate nutrition has a particularly deleterious effect on growth and neurocognitive development, as well as mortality, in children and adolescents. Nutritional supplementation can improve outcomes but can be difficult to administer.

**Objective**—Determine the tolerability of intradialytic oral nutrition in paediatric patients.

**Design**—Cross-sectional quality improvement study in an outpatient paediatric HD unit. Intervention was intradialytic oral nutritional supplementation provided as protein bars and/or meals.

**Subjects**—Children and adolescents on outpatient HD who were able to participate in surveys and eat by mouth.

**Measurements**—Adverse effects and symptoms on nurse- and patient-reported surveys, respectively. Relationships between the predictor variables and the outcomes were assessed using generalized estimating equations.

**Results**—The majority of children felt better after eating on dialysis (72%) with no adverse effects (80%). On unadjusted analyses and confirmed with generalized estimating equation...
Key points
Majority of patients felt better when eating on dialysis; most had no adverse effects
Inadequate nutrition a problem for many pediatric dialysis patients

Practical Applications
Meal trays, sack lunches, snacks...feed your patients on dialysis!
Monitor patients individually for tolerance
Management of side effects does not necessarily exclude eating on dialysis
Key points
Sodium Polystyrene Sulfonate (SPS) formula treatment effective at lowering serum potassium, but...
Half of lab values reflected serious biochemical derangements
Hypokalemia
Hypernatremia
Hypocalcemia

Practical Applications
May consider other means for lowering serum potassium
If SPS is used, monitor labs very closely

Applications for Practice
Key points
Quality of life scores low in CKD and dialysis patients
Related to nutritional issues such as short stature and poor appetite

Practical Applications
Nutritional intervention addresses mental health as well
Height and appetite important to children and teens
**Take home message...**

**Key points**
- 9 times the risk of developing DM (greatest risk in first year)
- Risk continues even after 10 years
- 3 times greater risk of death if DM developed
- Good news – kidney recipients lower risk than other organs

**Practical Applications**
- Dietetic involvement important to prepare for transplant (and educate on long-term risks) and long-term
Nutrition and Growth in Children with Chronic Kidney Disease

Submission closed.

Notable mentions

Research Topic

Nutrition and Growth in Children with Chronic Kidney Disease

Overview  Articles  Authors  Impact  Comments

6  27

About this Research Topic

Providing optimal nutrition is a challenge in children with chronic kidney disease (CKD). Nutritional management in the patient is necessary to maintain adequate dietary intake for optimal growth, while avoiding complications.

Abstract

Introduction: Nutrition is an important part of treatment in critically ill children. Clinical guidelines for nutrition adaptations during continuous renal replacement therapy (CRRT) are lacking. We collected and evaluated current knowledge on this topic and provide recommendations. Methods: Questions were produced to guide the literature search in the PubMed database. Results: Evidence is scarce and extrapolation from adult data was often required. CRRT has a direct and substantial impact on metabolism. Indirect calorimetry is the preferred method to assess energy expenditure (REE). Moderate underestimation of REE is common but not clinically relevant. Formula-based calculation of REE is inaccurate and not validated in critically ill children on CRRT. The nutrient impact of nonnutritional solutions delivered as citrate, lactate, and plasma during CRRT must be considered. Quantifying energy balance is not feasible during CRRT. Protein delivery should be increased by 25% to compensate for losses in the effluent. Fats are not removed by CRRT and should not be adapted during CRRT. Electrolyte disturbances are frequently present and should be treated accordingly. Vitamins B2, B6, B12, and C are lost in the effluent and should be added to the effluent flow. Trace elements, with the exception of selenium, are not cleared in relevant quantities. Manganese accumulation is of concern because of potential neurotoxicity. Conclusions: Current recommendations regarding nutrition support in pediatric CRRT must be extrapolated from adult studies. Recommendations are provided, based on the weak level of evidence. Additional research on this topic is warranted. (Nutr Clin Pract. 2018;01: 31)
THANKS!

Any questions?

What favorite articles have you found in the last couple of years?