Hypervitaminosis A is Prevalent in Children with Chronic Kidney Disease and Contributes to Hypercalcaemia

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INTRODUCTION

Vitamin A accumulates in renal failure, but the prevalence of hypervitaminosis A in children with chronic kidney disease (CKD) is only documented in dialysis (1). Due to the composition of current infant formulae and enteral feeds, vitamin A intake up to twice the Reference Nutrient Intake (RNI) is inevitable. There are no evidence based guidelines for vitamin A intake and current intake may drive serum retinol levels.

Hypervitaminosis A has also been linked with hypercalcaemia (2). We studied the relationship between dietary vitamin A intake, serum retinol and associated retinoids against serum calcium levels.

METHODS

• Serum retinol, its carrier proteins (retinol binding protein [RBP] and transthyretin [TTR]), and its metabolite retinoic acid (all trans [ATRA] and 13-cis) were measured in 106 children with CKD stage 2-5, dialysis and post-transplant.

• Dietary vitamin A intake was assessed through an estimated 3 day food diary and included any intake from feed.

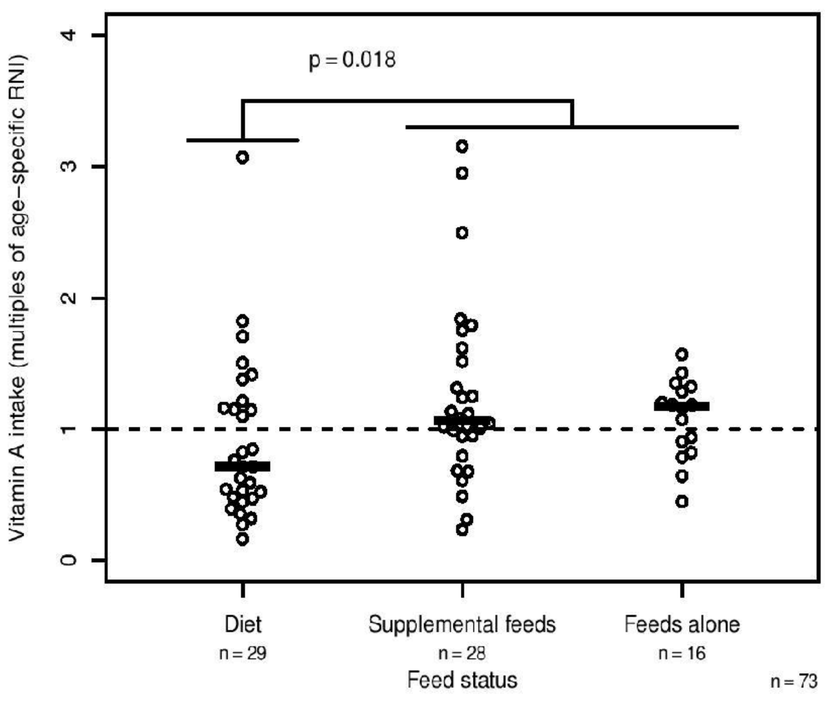

Figure 1A Dietary vitamin A intake (expressed as multiples of the age-specific RNI) is higher in children on supplemental feeds / feeds alone compared with diet.

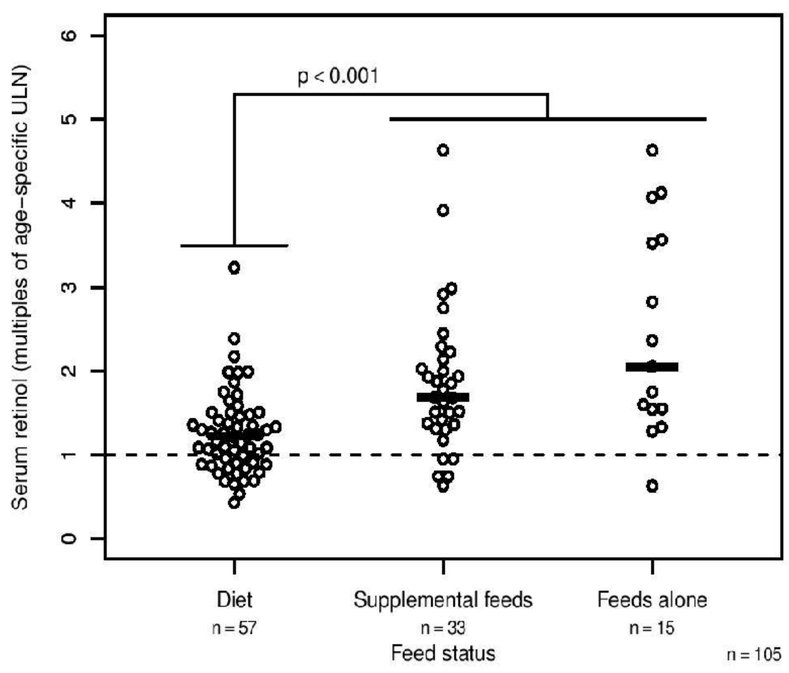

Figure 1B Serum retinol levels (expressed as multiples of age-specific upper limit of normal (ULN)) are highest in children on supplemental feeds / feeds alone compared with diet.

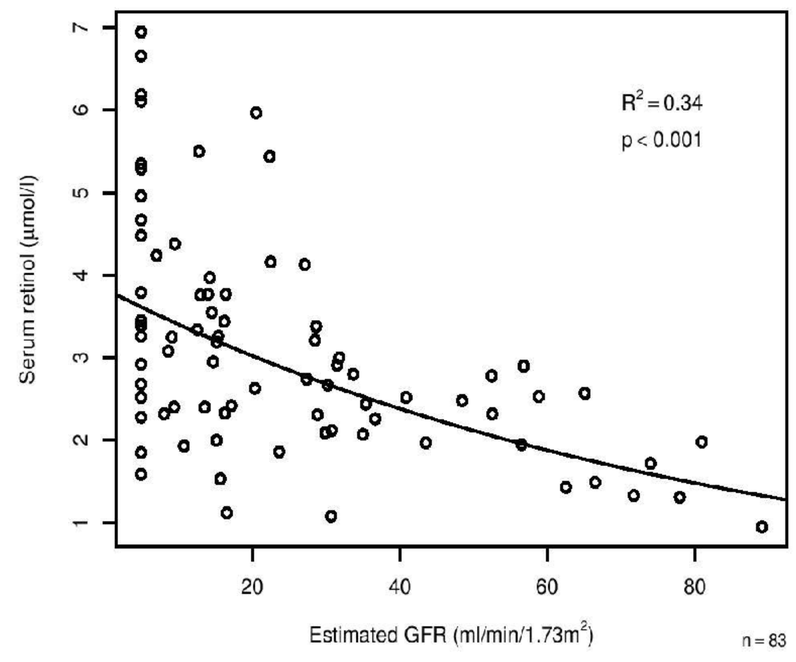

Figure 2 Serum retinol levels show a significant negative association with eGFR in CKD.

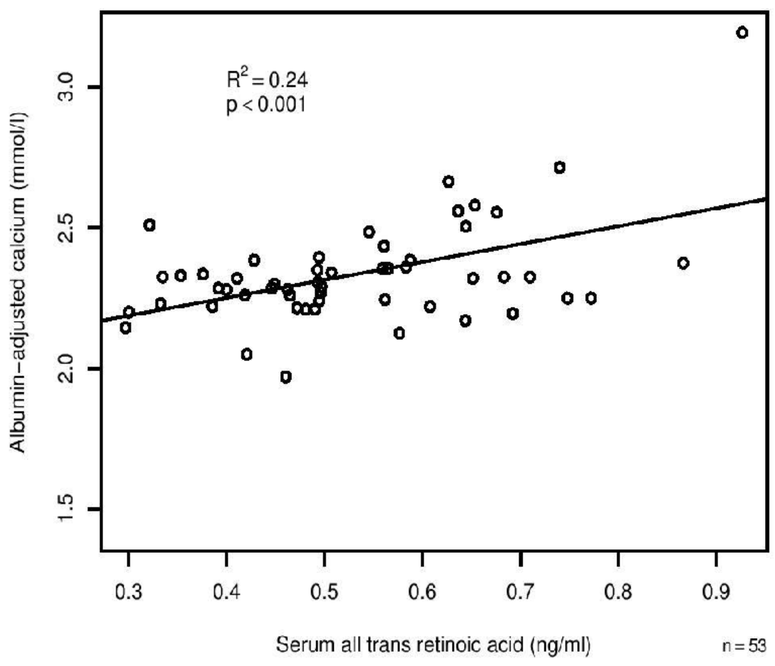

Figure 3 Increased ATRA is associated with increased albumin-adjusted calcium levels, n = 53 randomly selected CKD 2-5, dialysis and transplant patients.

RESULTS

• Serum retinol levels were elevated in 86% of children in CKD 2-5 and dialysis, with levels returning to the normal range post transplant (p<0.001).

• Children receiving supplemental or exclusive feeding compared to diet alone had higher median intake (relative to RNI) and higher serum retinol concentration relative to upper limit of normal (p=0.018 and p<0.001 respectively; Figure 1A, 1B).

• For every 10ml/min/1.73 m² fall in eGFR there was a 13% increase in serum retinol (p<0.001; Figure 2).

• ATRA showed an inverse association with eGFR (p=0.001). In a multivariate linear regression model, only serum ATRA and vitamin A intake by weight were significant predictors of serum calcium (adjusted R^2 0.58; p<0.001).

CONCLUSIONS

Hypervitaminosis A is seen in early CKD and increases significantly with eGFR decline. Higher serum calcium levels are associated with increased serum ATRA and vitamin A intake.

A lower vitamin A concentration in infant formulae and paediatric enteral feeds for CKD patients may be indicated in order to reduce the risk of hypervitaminosis A and associated hypercalcaemia.

REFERENCES

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Poster presented at: ERA-EDTA 50th Congress Istanbul, Turkey May 15-21, 2013
PosterSessionOnline.com