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Prevalence and Risk Factors of Multiple Micronutrient Deficiencies Pre- and Post-ART

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Background

- HIV-infected adults, including those on ART, have higher prevalence of several individual micronutrient deficiencies that are associated with disease progression.
- Prevalence and risk factors of concurrent and multiple micronutrient deficiencies have not been described
- Objective of this study was to determine the prevalence and risk factors of multiple micronutrient deficiencies among ART-naïve HIV-infected adults and assess change in micronutrient status 48 weeks post-ART initiation

Methods

Population

- Sampled from Prospective Evaluation of Antiretrovirals in Resource-Limited Settings (PEARLS) trial (ACTG A5175)
  - 1571 HIV-infected, ART-naïve adults from 9 countries
  - Baseline CD4 T-cell count <300 cells/mm^3
  - No acute medical illness or severe laboratory derangement (Hgb <7.5 g/dL, AST/ALT >5x upper limit of normal, CrCl <60 mL/min, ANC <750/µL)
  - Randomized to 1 of 3 ART regimens and followed regularly for 96 weeks post-ART initiation

Figure 1. Study Sites



Study Design

- Nested Cohort Study
  - A random sub-cohort (n=270) was selected from the PEARLS trial
  - The sub-cohort was stratified by country (30 individuals from each of the 9 countries)
- Micronutrients Measured:
  - Vitamins A, B_6, B_{12}, D, E
  - Total Carotenoids (α-carotene, β-carotene, β-cryptoxanthin, lutein, lycopene & zeaxanthin
  - Iron: Serum Ferritin and soluble transferrin receptor
  - Selenium

Methods

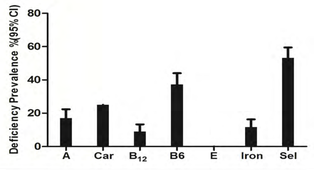
Analysis

- Prevalence and risk factors of single and multiple micronutrient deficiencies were determined
  - Defined serum concentration cutoffs were used for deficiencies
  - Logistic regression was used to determine risk factors
- Mean changes in micronutrient concentrations from pre-ART to week 48 post-ART was assessed using multivariable random effects models.

Results

- 13.9% had no micronutrient deficiency
- Prevalence of 1, 2, 3, 4 or above 4 micronutrient deficiencies was 29.2%, 24.5%, 17.6%, 10.2% and 4.6%, respectively

Figure 2. Pre-ART micronutrient concentrations and prevalence of individual deficiencies



n	251	251	244	225	251	249	252
Median (IQR)	1.5 (1.2-2.0)	1.1 (0.8-1.5)	249.4 (186.7-342.3)	23.3 (15.3-37)	22.4 (18.8-27.4)		83.0 (57.3-99.9)

Table 1. Prevalence of 2 concurrent micronutrient deficiencies at pre-ART initiation

	Carotenoids	Vitamin B_{12}	Vitamin B_6	Vitamin D	Iron	Selenium
Vitamin A	5.6	1.2	9.3	8.4	4.0	14.3
Carotenoids		4.1	12.5	11.7	1.2	14.8
Vitamin B_{12}			5.5	4.1	0.4	4.9
Vitamin B_6				17.4	5.8	25.3
Vitamin D					6.5	21.2
Iron						6.8

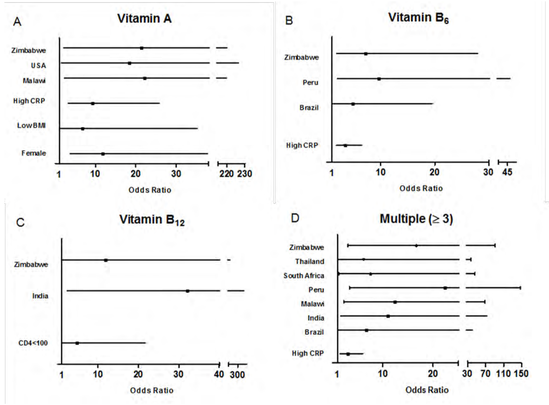
Table 1 Legend: Cutoff values for deficiency include: <1.05 µmol/L for retinol (vitamin A), <19 nmol/L for vitamin B_6, <148 pmol/L for vitamin B_{12}, <9.3 µmol/L for α-tocopherol (vitamin E) and <85 µg/L for selenium. Iron deficiency (ID) was defined by either transferrin receptor concentration (> 8.3 mg/L) or ferritin concentration (ferritin < 12 µg/L if CRP ≤5 mg/L or ferritin < 30 µg/L if CRP >5 mg/L).

Results

Table 2. Prevalence of conditional deficiencies pre-ART initiation.

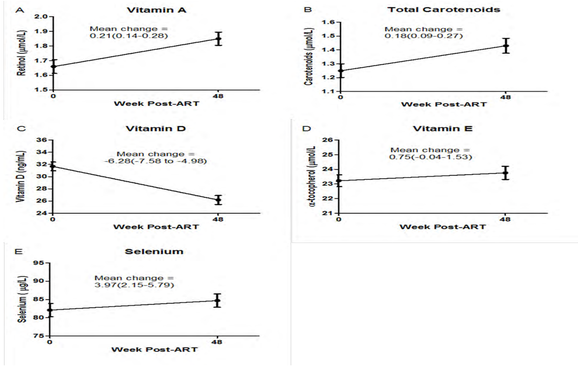
	Vitamin A	Carotenoids	Vitamin B_{12}	Vitamin B_6	Vitamin D	Iron	Selenium
Vitamin A	-	32.6	7.1	53.9	50.0	23.8	83.7
Carotenoids	22.2	-	16.7	56.0	46.0	4.8	58.7
Vitamin B_{12}	13.6	45.5	-	57.1	45.5	4.6	54.6
Vitamin B_6	25.0	33.3	14.6	-	46.4	15.7	67.9
Vitamin D	20.0	27.9	10.0	40.2	-	15.1	50.0
Iron	34.5	10.3	3.7	46.4	55.2	-	58.6
Selenium	27.1	28.0	9.3	46.3	40.1	13.0	-

Figure 3. Risk factors for individual and multiple micronutrient deficiencies pre-ART



Results

Figure 4. Micronutrient status at 48 weeks post-ART initiation.



Conclusions

- Single and Multiple micronutrient deficiencies are common among HIV-infected adults pre-ART initiation.
- High individual and concurrent deficiencies were observed for selenium, vitamin D and vitamin B_6 with 12.1% have concurrent deficiencies of all three micronutrients.
- Risk factors for multiple micronutrient deficiencies are country and inflammation (as assessed by elevated CRP).
- Despite increases in mean concentrations of micronutrients, prevalence of individual deficiencies remained largely unchanged after 48 weeks on ART.
- These results suggest that ART alone is not sufficient to improve micronutrient deficiencies.

Acknowledgements

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