



# Dietary Intake And Nutrient Inadequacies Among Women Of Reproductive Age In Rural Northern Tanzania: FRESH Baseline Survey

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# Background and objective

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Maintaining a healthy diet is essential for preventing chronic diseases and promoting long-term health (Herforth *et al.*, 2019).

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Understanding the dietary intake and the extent of nutrient inadequacies among women of reproductive age (WRA) is crucial for developing effective nutrition interventions and policies.

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We characterized dietary intake and assessed nutrient inadequacies among WRA in northern Tanzania by comparing their dietary intake with established harmonised average requirements (H-ARs)



# Methods



# Study design, population and data methods

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This study uses baseline data from the FRESH Tanzania end-to-end evaluation

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Data was collected from Arusha and Kilimanjaro regions between October 2023 and January 2024

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Study population included WRA (n=2600)

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SurveyCTO on android tablets was used for the data collection by trained interviewers

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# Dietary assessment

- ❖ Quantitative 24-hour dietary recall (24hR) which was repeated in a subset (N=524; ~ 20.2%)
  - ❖ Included in analysis: N= 2594
- ❖ Open DRS with survey CTO
  - ❖ Estimated intake of mixed/composite dishes and individual food items
  - ❖ Handy and household measures used to estimate intake
  - ❖ Obtained list of ingredients of mixed dishes but did not quantify ingredients
- ❖ Conversion factors formulated to convert intake from handy/household measures to g/day
- ❖ Formulated recipes by interviewing a random sample of women from the study (sub-study)





# Dietary assessment

- ❖ Recipe disaggregation was conducted using various sources:
  - ❖ Primary field data for the most common dishes: 54 recipes (40.0%)
  - ❖ Recipes formulated from primary data: 24 recipes (17.8%)
  - ❖ Recipe data from the Tanzania Food Composition Table: 40 recipes (29.6%)
  - ❖ Data from a previous study in Tanzania: 17 recipes (12.7%)



# Energy and nutrient intake estimation

- ❖ Tanzania Food Composition Table (FCT) used when available
  - ❖ Missing values were updated with Kenya, West Africa FCT and USDA (priority order)
  - ❖ USDA retention factors were applied for cooked foods (where necessary)
- ❖ Data processing and analysis done with SAS 9.4

# Usual intake estimation

❖ Usual intake was estimated with SAS SIMPLE and NCI macros

SIMPLE MACROS <sup>1</sup>	<sup>2</sup> NCI MACROS (2-part model for episodic foods)
Energy and all other nutrients	Vitamin B12 and most food groups except staples

❖ We adjusted for several covariates (weekend, age, region, district, physiologic status, household dependency ratio, household wealth index, food security, report of being sick, away from home, usually food intake day, and supplement intake)

❖ Only 1.6% reported supplement intake

❖ Estimates are reported as group mean ± S.E. for nutrients and mean (95% C.I.) for intake of food groups

1. Luo H, Dodd KW, Arnold CD, Engle-Stone R. Introduction to the SIMPLE Macro, a Tool to Increase the Accessibility of 24-Hour Dietary Recall Analysis and Modeling. Journal of Nutrition, 2021;151:1329–40.  
2. NCI. User’s Guide for Analysis of Usual Intakes v2.1. For use with versions 2.1 of the MIXTRAN, DISTRIB, and INDIVINT SAS macros [Internet]. Available from: [http://appliedresearch.cancer.gov/diet/usualintakes/macros\\_single.html](http://appliedresearch.cancer.gov/diet/usualintakes/macros_single.html).



# Results



# Baseline Characteristics



Characteristic	Overall (n=2594)
Age (Mean $\pm$ SD), years	38.3 $\pm$ 6.2
<b>Region</b>	
Arusha	37.0
Kilimanjaro	63.0
<b>Physiologic status</b>	
Non-pregnant/lactating	76.4
Pregnant	4.4
Lactating	19.2
BMI (Mean $\pm$ SD), kg/m <sup>2</sup>	26.5 $\pm$ 6.0
<b>Education status</b>	
None/incomplete primary	18.7
Primary (complete)	66.4
Secondary/higher	15.0
<b>Food security status</b>	
Food secure	36.7
Mild food insecurity	14.8
Moderate food insecurity	16.7
Severe food insecurity	31.9
Household dependency ratio (Mean $\pm$ SD)	1.2 $\pm$ 0.8

# Zero intakes of nutrients

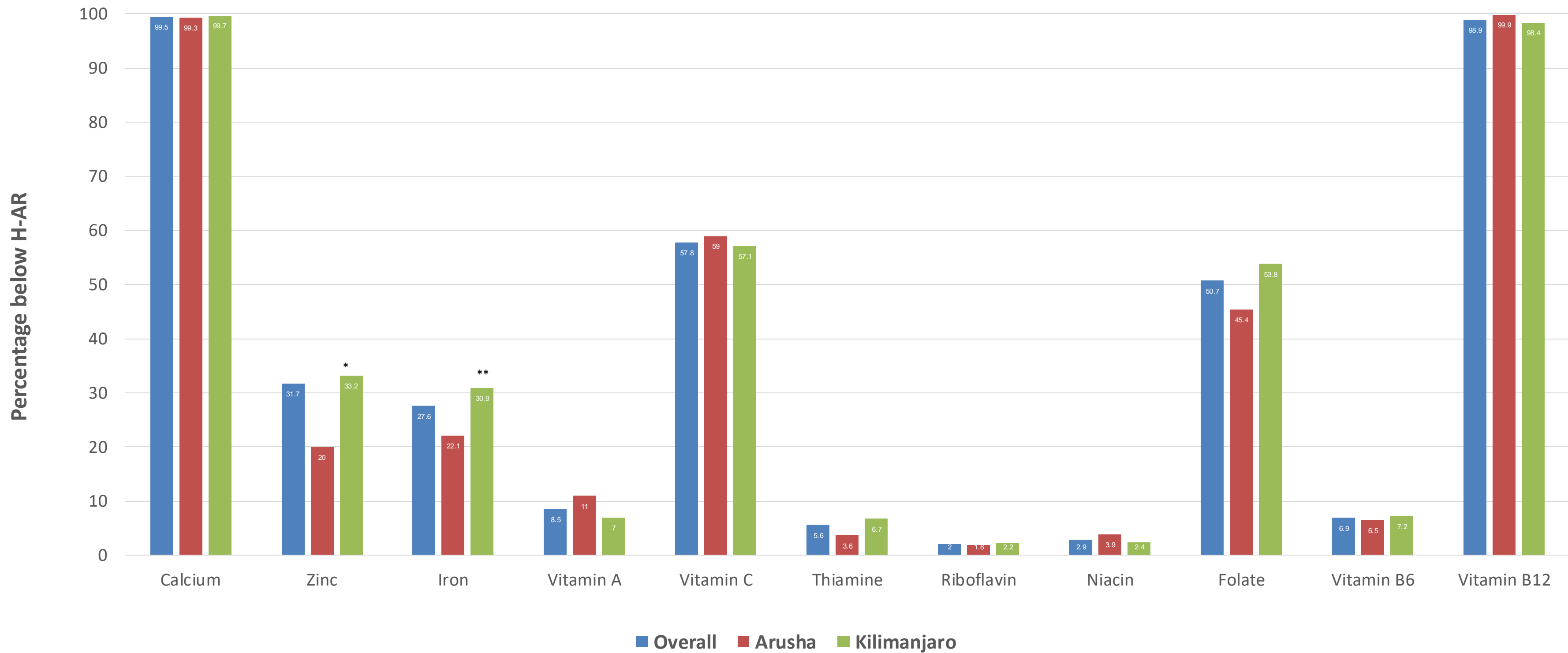
❖ All nutrients exhibited less than 3% zero intakes, except vitamin B12, which had a zero-intake rate of 23.3%.



# Usual intake of energy and macronutrient contribution

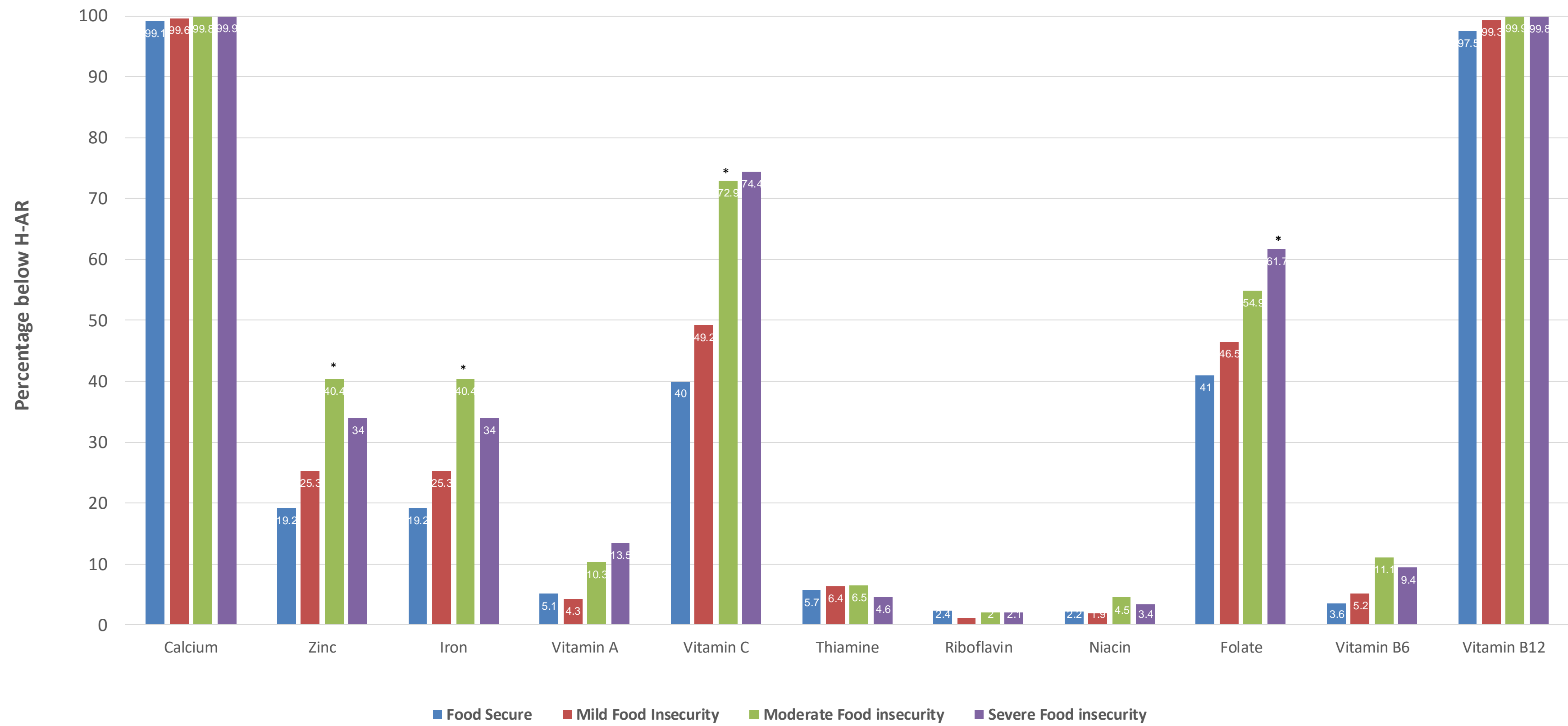
Nutrient	Overall (n=2594) ( $\mu \pm \text{S.E}$ )	Arusha (n=959) ( $\mu \pm \text{S.E}$ )	Kilimanjaro (n=1635) ( $\mu \pm \text{S.E}$ )	P-value
Energy (kcal/day)	2415 $\pm$ 29	2437 $\pm$ 43	2402 $\pm$ 31	0.50
Percentage contribution of macronutrients & dietary fibre to energy intake				
Carbohydrates	62.2 $\pm$ 12.3	64.6 $\pm$ 10.8 	60.9 $\pm$ 12.9	< 0.001
Protein	9.9 $\pm$ 2.4	9.9 $\pm$ 2.1	9.8 $\pm$ 2.6	0.37
Fat	24.6 $\pm$ 12.1	22.0 $\pm$ 10.6	26.1 $\pm$ 12.6 	< 0.001
Dietary fibre	3.3 $\pm$ 1.0	3.5 $\pm$ 1.0	3.2 $\pm$ 1.0	< 0.001

# Probability of inadequate micronutrient intake by Region



\*P < 0.05; \*\* P ≤ 0.001

# Probability of inadequate micronutrient intake by household food insecurity status



\*P <0.05

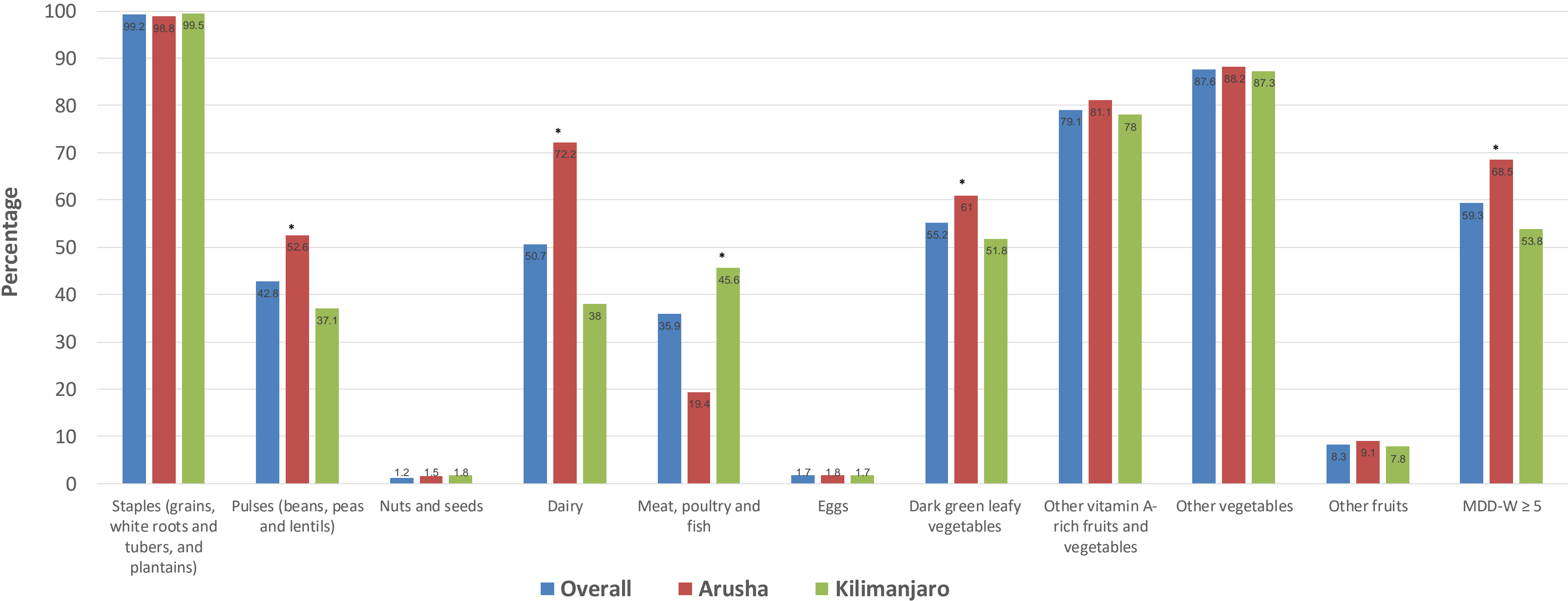


# Mean Probability of Adequacy (MPA)

Variable	Sample size	Mean probability of adequacy (MPA)	S. E	P-value
Overall sample	2594	64.3	2.3	
<b>Region</b>				
Arusha	959	66.1	2.3	0.48
Kilimanjaro	1635	63.8	2.6	Ref.
<b>Physiologic state</b>				
Non-pregnant, non-lactating	1982	68.1	2.4	Ref.
Pregnant	115	53.2	6.6	<b>0.03</b>
Lactating	497	53.6	3.1	<b>0.0001</b>
<b>Age group</b>				
20-29 yrs.	198	61.2	3.0	Ref.
30-39 yrs.	1247	63.0	2.4	0.64
≥ 40 yrs.	1149	67.1	2.6	0.13
<b>Educational Status</b>				
None/Incomplete primary	484	61.4	2.8	Ref.
Complete Primary	1722	65.4	2.5	0.27
Secondary/Higher	388	65.4	3.3	0.34
<b>Household Food Security</b>				
Food secure	951	68.9	2.5	Ref.
Mild food insecurity	384	66.6	3.2	0.57
Moderate food insecurity	432	60.7	3.3	<b>0.04</b>
Severe Food insecurity	827	61.0	2.8	<b>0.03</b>
<b>Household Wealth Index</b>				
Quintile 1	516	59.1	3.1	Ref.
Quintile 2	516	65.1	2.9	0.15
Quintile 3	528	66.6	2.8	0.07
Quintile 4	518	65.7	3.0	0.12
Quintile 5	516	66.7	2.9	0.06

MPA= Mean probability of adequacy for 11 micronutrients (Ca, Zn, Fe, Vitamins A, C, and B-vitamins (thiamine, riboflavin, niacin, folate, B6 and B12)

# Percentage intake of food groups and the percentage who achieved the minimum dietary diversity



\* P < 0.0001

Mean minimum dietary diversity score (MDD-W) , Mean ± SD			
Overall	Arusha	Kilimanjaro	P-value
4.6 ± 1.4	4.9 ± 1.4	4.5 ± 1.3	<0.0001

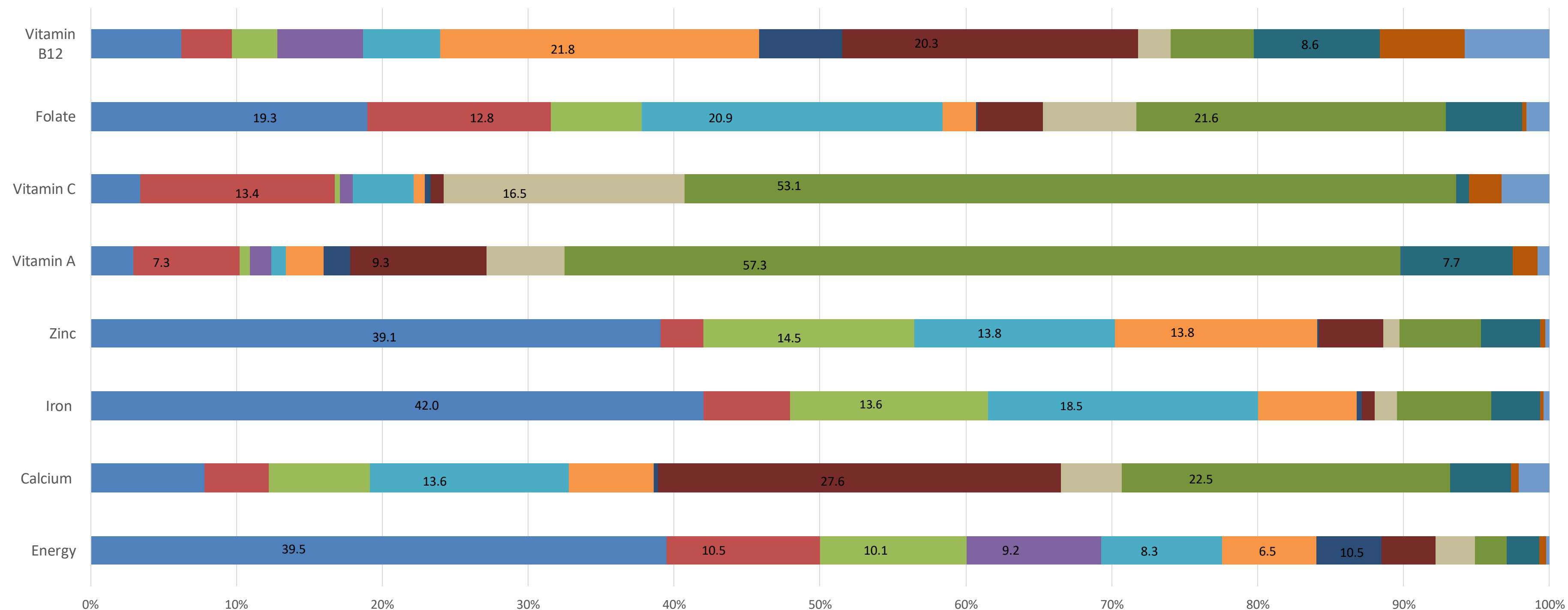
# Estimated usual intakes of food groups

Outcome	Mean (95% C.I) g/day
	<b>Overall (n=2594)</b>
Fruits & vegetables (F&V)	279.0 (200.5, 364.9)
Percentage intake of F&V < 400g/day	98.8
Fruits	35.1 (2.2, 117.6)
Vegetables	245.0 (168.3, 328.4)
Staples (grains, white roots and tubers, and plantains)	449.4 (362.8, 536.1)
Pulses (beans, peas and lentils)	58.9 (25.4, 104.1)
Nuts and seeds	***
Dairy	89.2 (6.28, 220.6)
Meat, poultry and fish	35.2 (4.1, 89.0)
Eggs	***
Dark green leafy vegetables	93.5 (31.0, 156.4)
Other vitamin A-rich fruits and vegetables	59.0 (39.5, 80.8)
Other vegetables	109.5 (64.4, 164.3)
Other fruits	17.6 (0.6, 67.7)

\*\*\*Estimates are close to zero (0)



# Percentage contribution of food groups to energy and micronutrient intake



# Conclusions and discussions



# Conclusions

- ❖ Estimated usual mean energy intake ~ 2400Kcal/day, consistent with other studies from Sub-Saharan Africa
- ❖ The macronutrient contribution to total energy intake aligns with recommended guidelines.
- ❖ Nearly all participants exhibited insufficient intakes of calcium and vitamin B12, a pattern that persisted across all subgroups.
- ❖ At least half of the respondents had inadequate intake of vitamin C and folate.
- ❖ Approximately one-quarter of the population demonstrated inadequate intake of iron and zinc
- ❖ Overall, intakes of thiamine, riboflavin, niacin, and vitamin B6 appeared sufficient.

# Conclusions

- ❖ The MPA was approximately 64% and was similar for both regions.
  - ❖ MPA decreased significantly with increasing severity of household food insecurity
- ❖ The MDD-W was 4.6 out of 10.
  - ❖ The MDD-W was higher in Arusha compared to Kilimanjaro, and more women achieved the MDD-W in Arusha than in Kilimanjaro
- ❖ Fruit and vegetable (F&V) consumption averaged around 279g/day, with almost all participants consuming less than the recommended 400 g/day.
  - ❖ Fruit intake is very low (35 g/day)
  - ❖ Vegetable intake averaged 245 g/day
- ❖ Diet diversification and food fortification programmes may be necessary to meet requirements to improve nutrient adequacy
  - ❖ May include food security programmes and intervention to increase intake of F&V





# Thank You



Email

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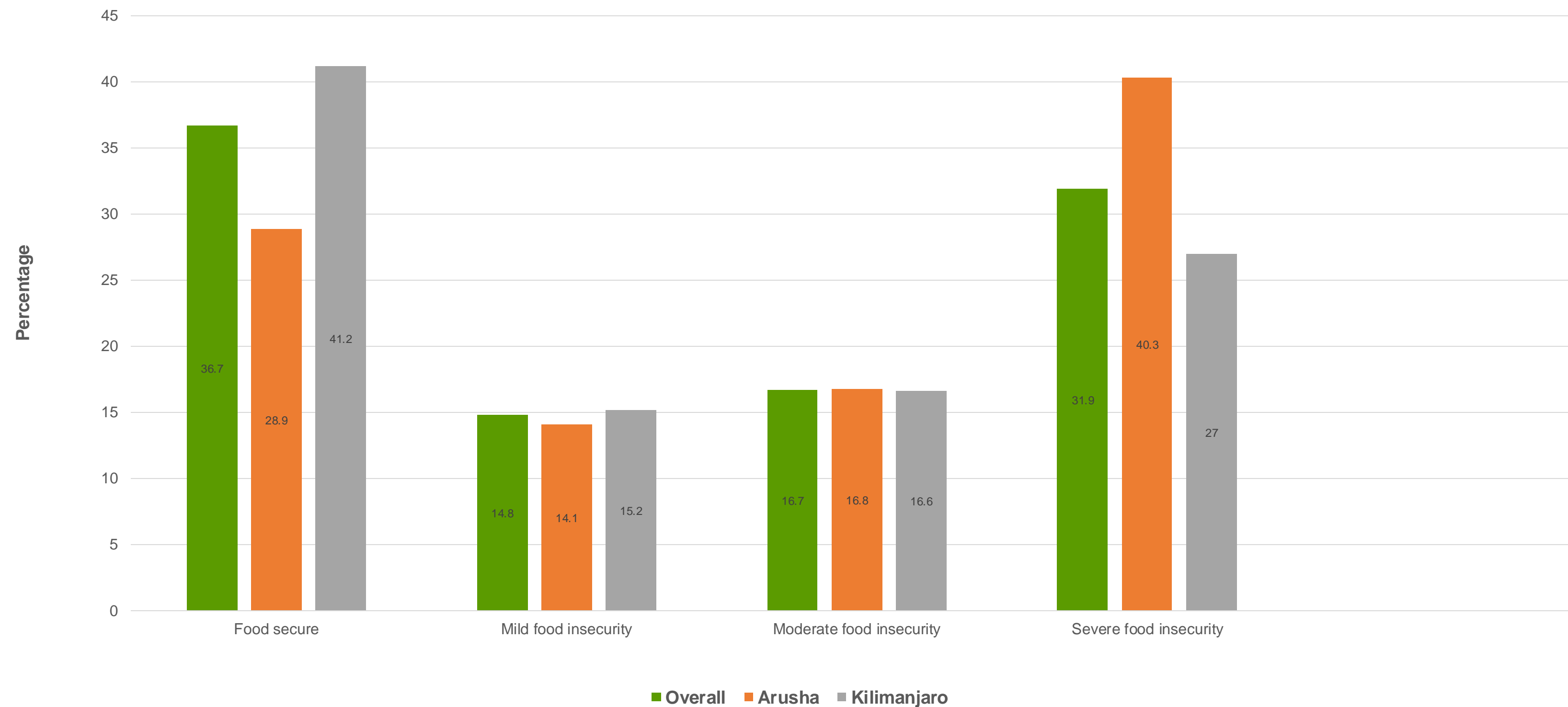
# Additional Slides



# Food insecurity status by region



Fruit and Vegetables  
for Sustainable  
Healthy Diets



# Micronutrient intake by region



Fruit and Vegetables  
for Sustainable  
Healthy Diets

Nutrient	Overall (n=2594) ( $\mu \pm \text{S.E}$ )	Arusha (n=959) ( $\mu \pm \text{S.E}$ )	Kilimanjaro (n=1635) ( $\mu \pm \text{S.E}$ )	P-value
Calcium (mg/day)	370.8 $\pm$ 7.8	430.4 $\pm$ 12.2	335.8 $\pm$ 8.1	< 0.001
Iron (mg/day)	18.5 $\pm$ 0.3	19.8 $\pm$ 0.4	17.8 $\pm$ 0.3	< 0.001
Zinc (mg/day)	10.4 $\pm$ 0.1	10.9 $\pm$ 0.2	10.1 $\pm$ 0.2	0.003
Vitamin A ( $\mu\text{g}$ RAE/day)	1003.5 $\pm$ 29.6	1030.1 $\pm$ 39.0	987.9 $\pm$ 32.0	0.40
Vitamin C (mg/day)	83.2 $\pm$ 2.0	82.5 $\pm$ 2.7	83.6 $\pm$ 2.4	0.77
Thiamine (mg/day)	1.5 $\pm$ 0.02	1.6 $\pm$ 0.03	1.4 $\pm$ 0.02	< 0.001
Riboflavin (mg/day)	4.4 $\pm$ 0.1	4.9 $\pm$ 0.2	4.1 $\pm$ 0.2	0.001
Niacin (mg/day)	16.7 $\pm$ 0.2	16.7 $\pm$ 0.3	16.7 $\pm$ 0.3	0.84
Folate ( $\mu\text{g}$ /day)	280.7 $\pm$ 5.0	294.2 $\pm$ 7.2	272.8 $\pm$ 5.6	0.02
Vitamin B6 (mg/day)	1.8 $\pm$ 0.02	1.80 $\pm$ 0.04	1.8 $\pm$ 0.03	0.27
Vitamin B12 ( $\mu\text{g}$ /day)	0.9 $\pm$ 0.1	0.7 $\pm$ 0.1	0.9 $\pm$ 0.1	< 0.001



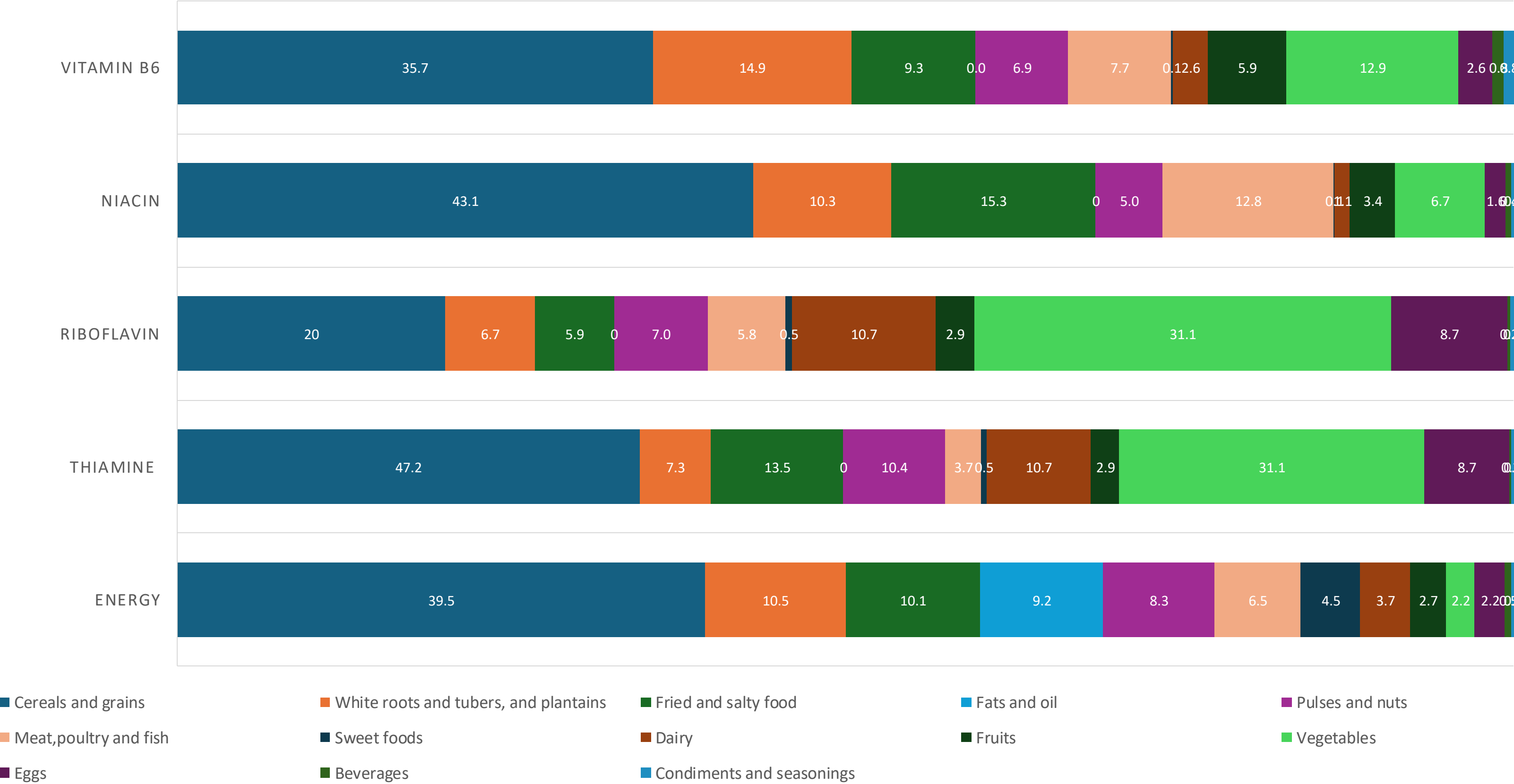
# Estimated usual intakes of food groups by region



Fruit and Vegetables  
for Sustainable  
Healthy Diets

Outcome	Mean (95% C.I) g/day			
	Overall (n=2594)	Arusha (n=935)	Kilimanjaro (n=1635)	P-value
Fruits & vegetables (F&V)	279.0 (200.5, 364.9)	286.7 (205.6, 377.0)	274.5 (198.1, 356.1)	0.95
Percentage intake of F&V < 400g/day	98.8	97.9	99.3	0.91
Fruits	35.1 (2.2, 117.6)	37.8 (2.6, 125.9)	33.5 (2.1, 112.6) ↓	<.0001
Vegetables	245.0 (168.3, 328.4)	258.2 (180.1, 341.0)	237.2 (163.8, 317.2) ↓	0.06
Staples (grains, white roots and tubers, and plantains)	449.4 (362.8, 536.1)	473.5 (384.7, 555.6)	435.3 (354.5, 514.2) ↓	<.0001
Pulses (beans, peas and lentils)	58.9 (25.4, 104.1)	71.1 (32.7, 115.3)	51.8 (23.8, 89.7) ↓	<.0001
Dairy	89.2 (6.28, 220.6)	109.6 (7.5, 251.4)	77.2 (5.8, 190.2) ↓	<.0001
Meat, poultry and fish	35.2 (4.1, 89.0)	29.9 (3.3, 75.3) ↓	38.3 (4.7, 95.5)	<.0001
Dark green leafy vegetables	93.5 (31.0, 156.4)	88.0 (29.3, 146.8) ↓	96.7 (32.2, 160.8)	<.0001
Other vitamin A-rich fruits and vegetables	59.0 (39.5, 80.8)	58.2 (38.8, 80.8)	59.5 (39.9, 80.8)	0.41
Other vegetables	109.5 (64.4, 164.3)	109.4 (64.9, 163.8)	109.5 (64.1, 164.7)	0.46
Other fruits	17.6 (0.6, 67.7)	25.1 (0.9, 94.8)	13.2 (0.5, 50.0) ↓	0.04

# Percentage contribution of food groups to energy and micronutrient intake



# Percentage contribution of food groups to energy and nutrient intake by region

