D4N 2025

**Delivering for Nutrition in South Asia**

Towards Impact at Scale

# Validation of an AI-assisted dietary assessment tool among adolescent girls in Sri Lanka: A step towards scalable nutrition monitoring

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CGIAR INITIATIVE ON Fruit and Vegetables for Sustainable Healthy Diets

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# Background



**Prevalence of malnutrition among children aged 10-17 years in Sri Lanka**
*(National Nutrition and Micronutrient Survey in Sri Lanka- 2022)*

Dietary assessment is vital for tracking adolescent health

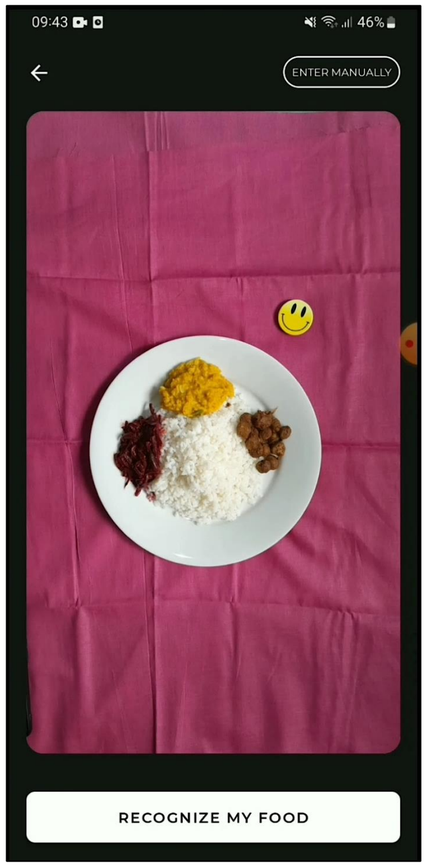
Traditional methods: Weighed Food Records (WFRs), 24-Hour Recalls (24HRs)

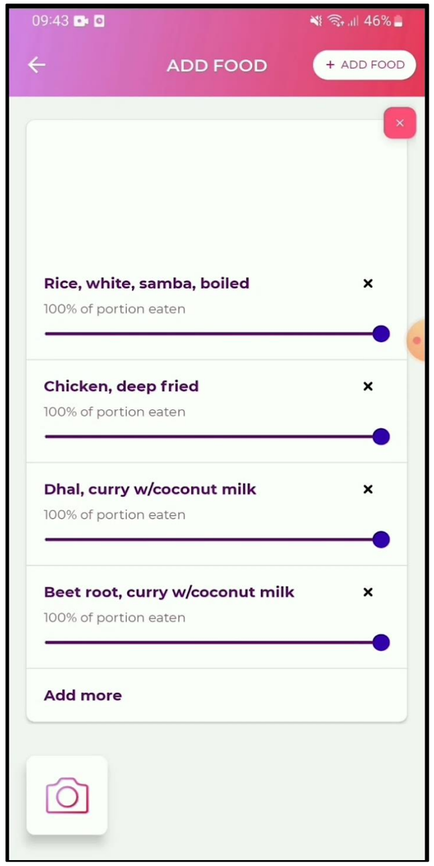
Time-consuming, costly and errors in portion size estimation

## AI-assisted mobile-based methods emerging as alternatives

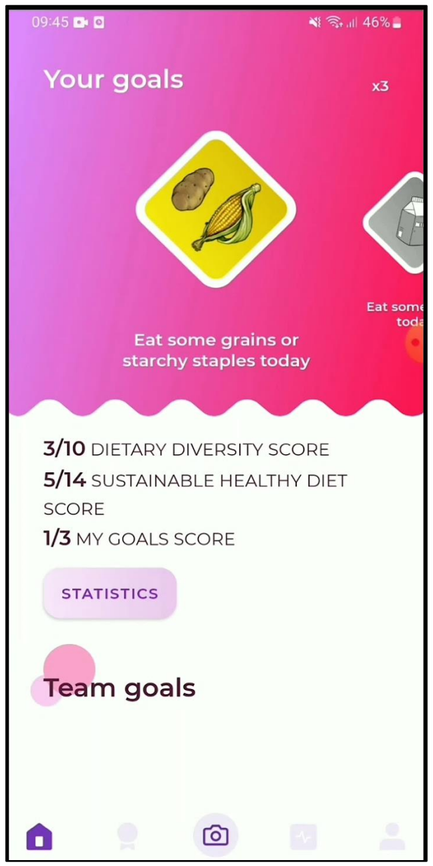
**F**ood **R**ecognition **A**ssistance and **N**udging **I**nsights

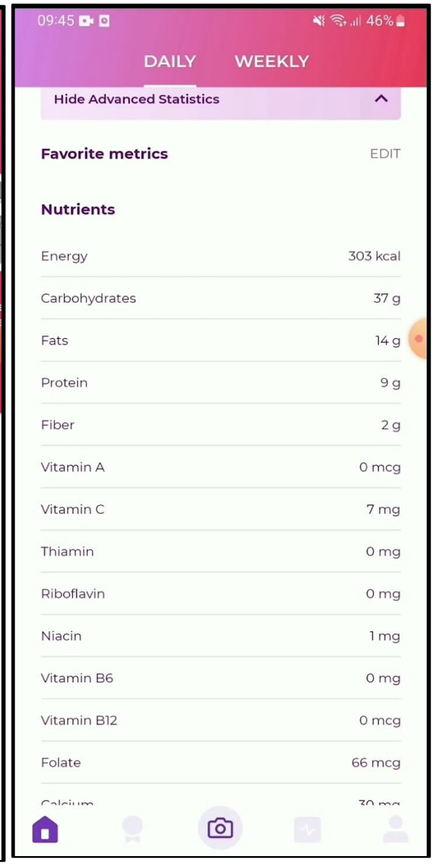
## FRANI: "A Smart Solution for Better Adolescent Nutrition"



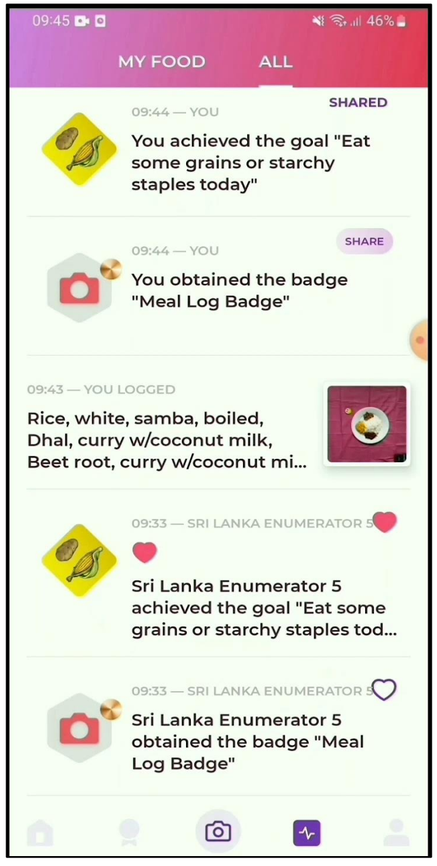




Recognize foods




Track food-group consumption and provide diet-related statistics




Provide gamified nudges to improve food consumption

# How FRANI was developed in Sri Lankan context

Preparing food database and image library

- A food inventory with most commonly consumed food
- A compilation of food composition data with recipes at ingredient level
- A collection of real life/ lab-based food photos

AI Model Training

- Food photo annotation
- Train segmentation model

Original image

Annotated image

Developing FRANI app

- Android-based mobile phone App integrating AI-model and user interaction


# Aims and Objectives

**Aim:** To validate the mobile AI application (FRANI) for dietary assessment in adolescent girls in Sri Lanka against:

- Observed weighed food records (WFR, Gold Standard for Dietary Assessment)
- Multi-pass 24h-recall (24HR, Standard Recall-based Method)

1

Estimate food and micronutrient intake using the three methods (FRANI, WFR, 24HR)

2

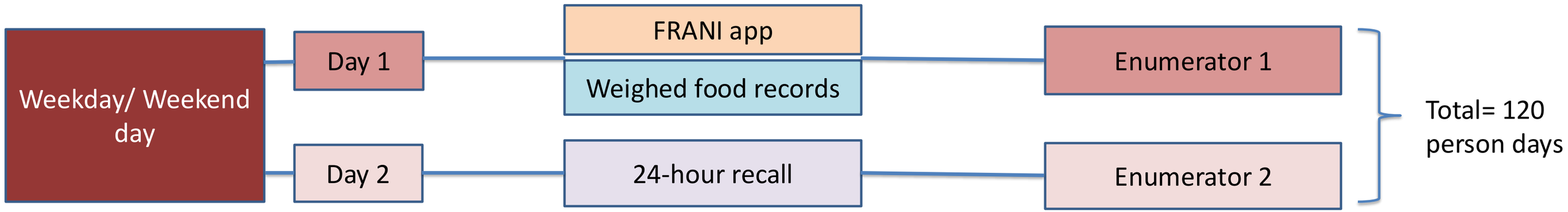
Assess extent of agreement with WFR of FRANI and 24HR

3

Examine sources of error for FRANI and 24HR

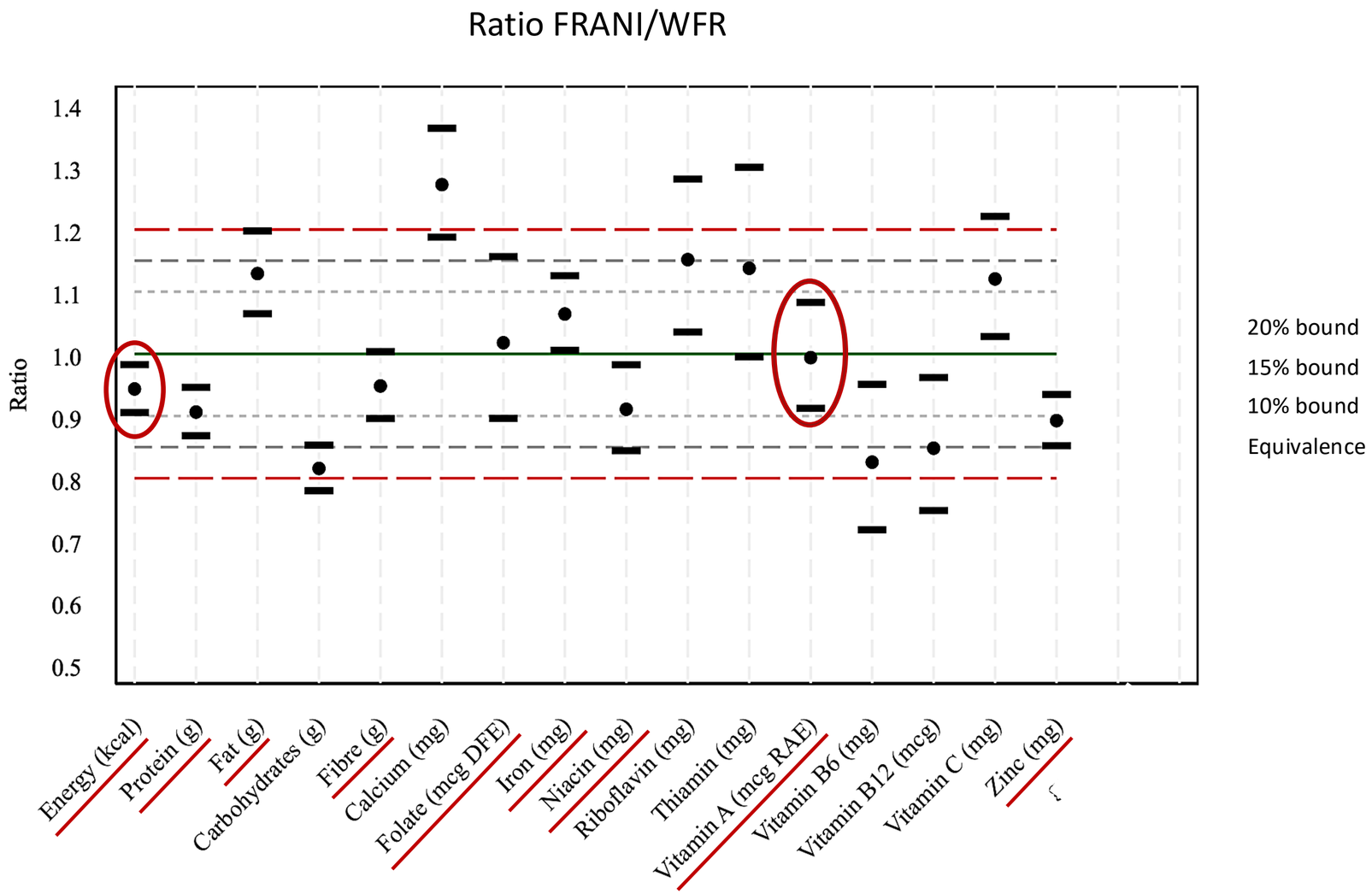
# Data Collection

| | |
|---|---|
| Study setting | Urban/semi-urban communities in North Western Province of Sri Lanka |
| Sample size | 60 adolescent girls aged between 14-18 years |
| Dietary intake assessments | 2 non-consecutive days including weekdays and weekends using 3 methods: FRANI, WFR and 24HR |



# Key Results

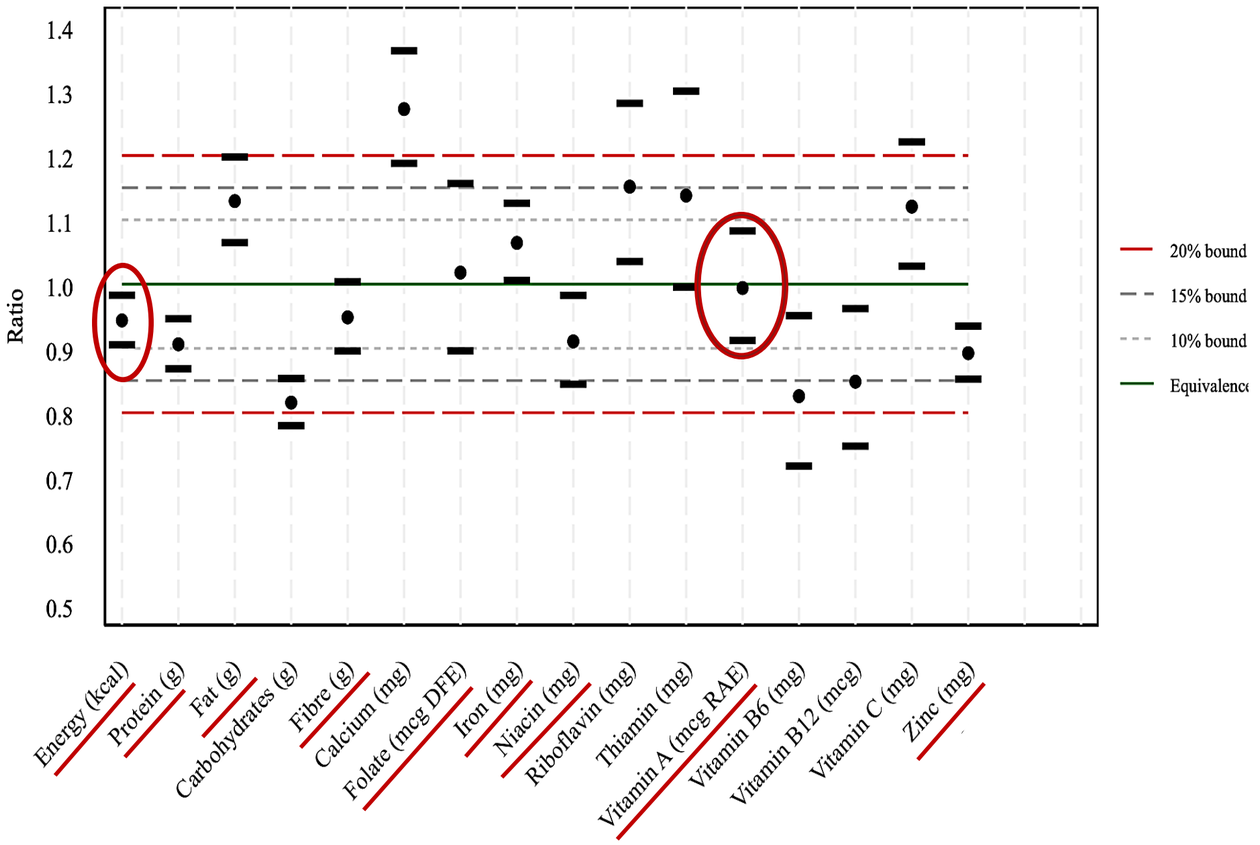
## Equivalence tests: Ratios of daily nutrient intake for WFR, FRANI and 24HR



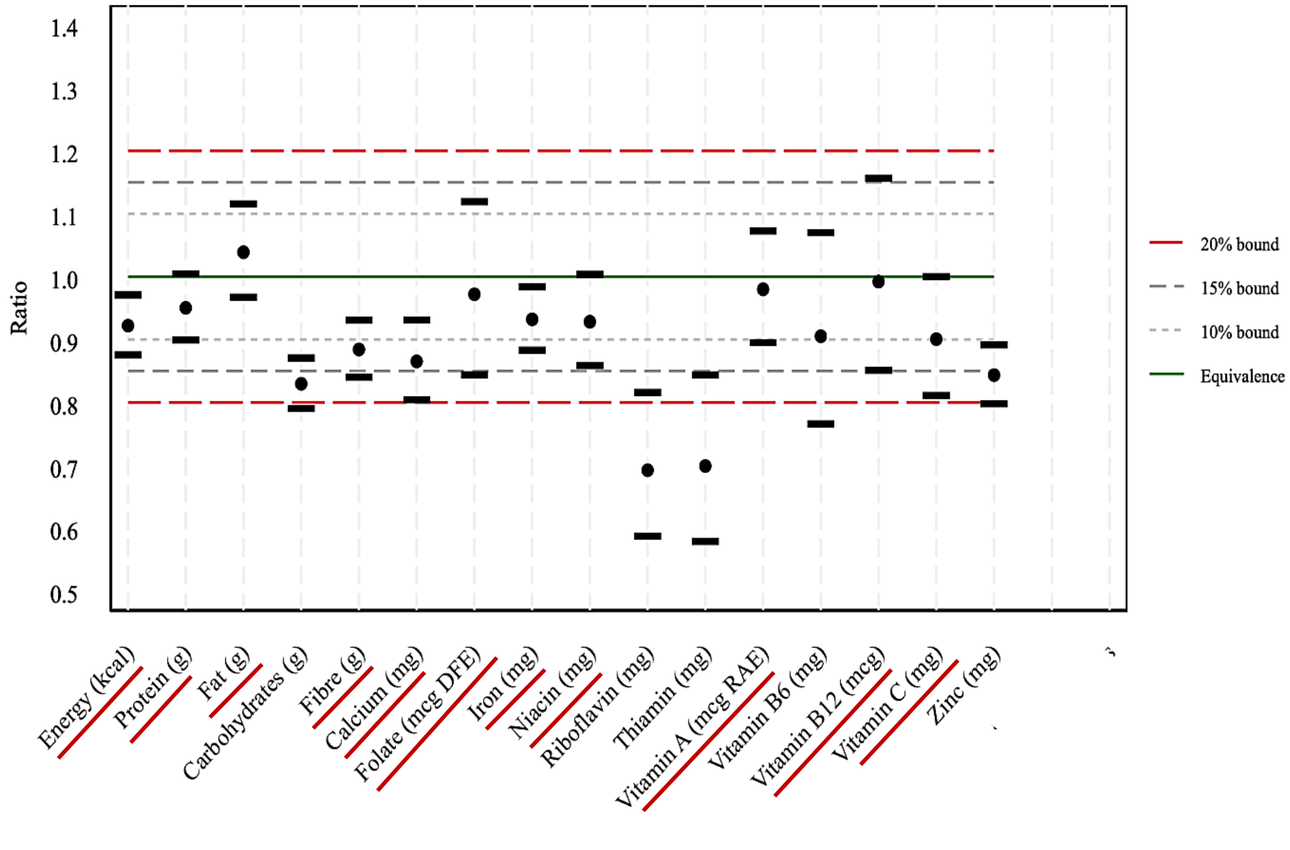
# Key Results

## Equivalence tests: Ratios of daily nutrient intake for WFR, FRANI and 24HR

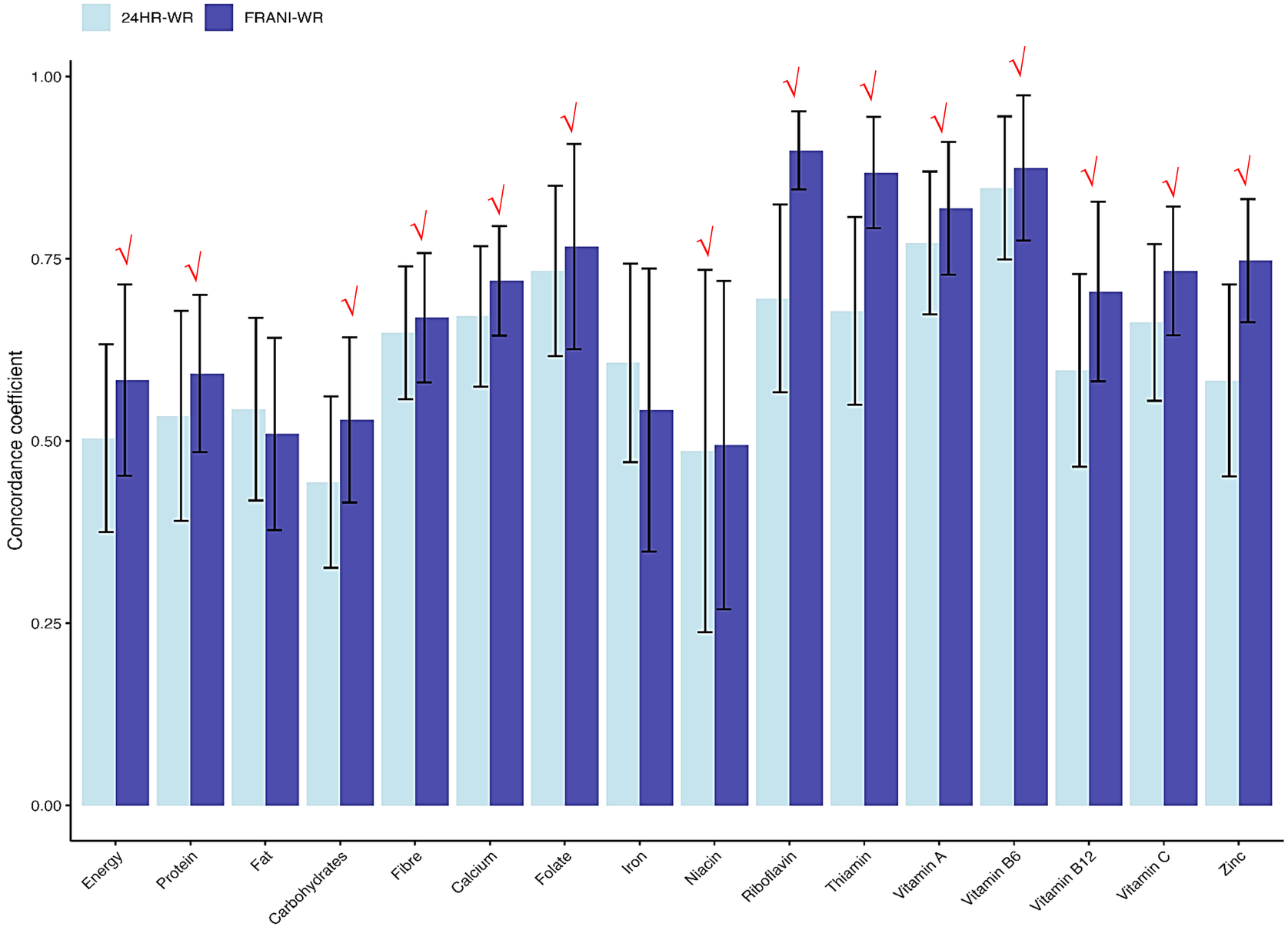
Ratio FRANI/WFR




Ratio 24HR/WFR

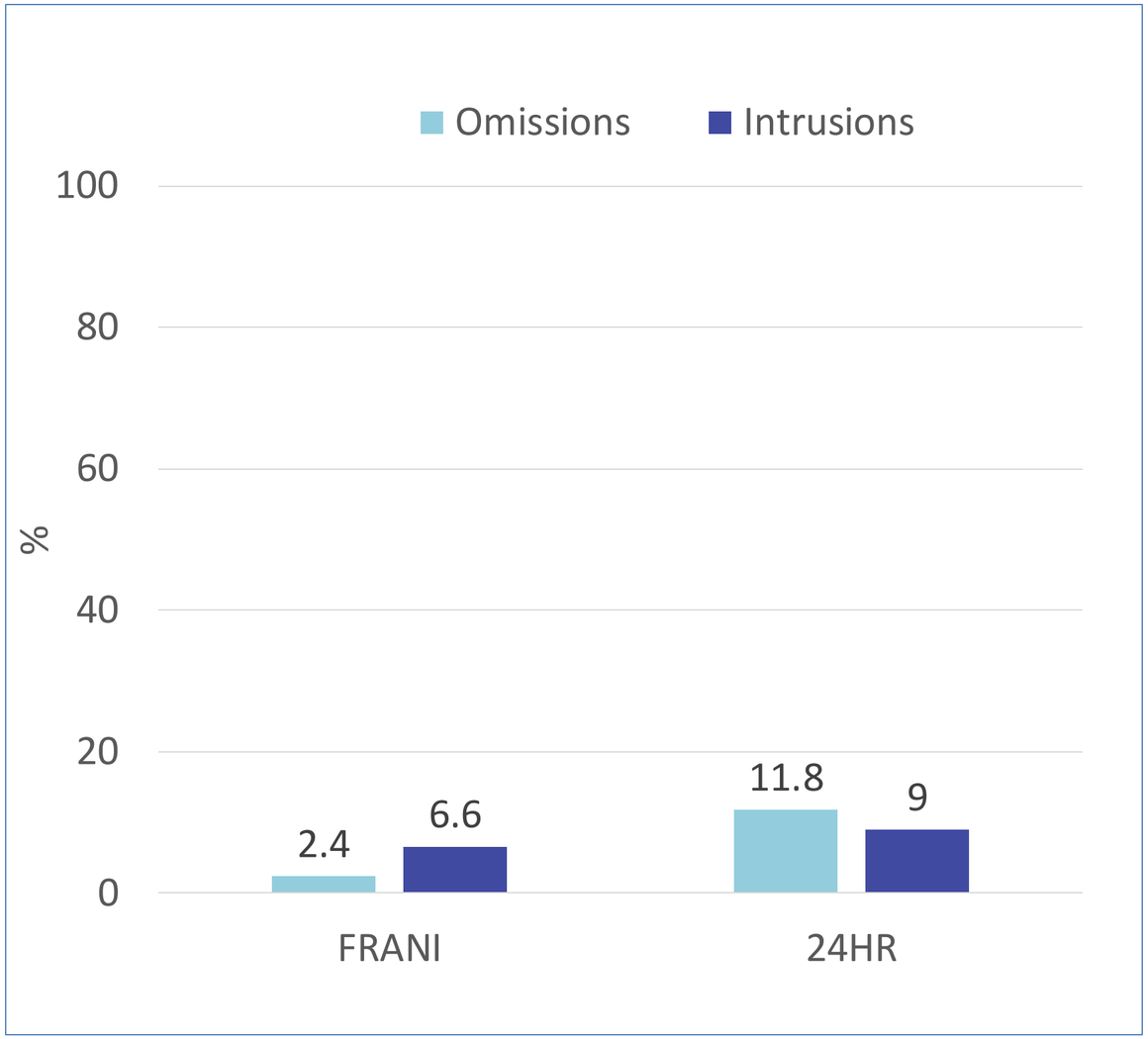


# FRANI and 24HR concordance correlation coefficients (CCC) of nutrient intakes with WFR




- The CCCs between FRANI and WFR ranged between 0.49 to 0.89 which were slightly higher CCCs between 24HR and WFR (0.44 to 0.85)

# Sources of memory errors for FRANI and 24HR

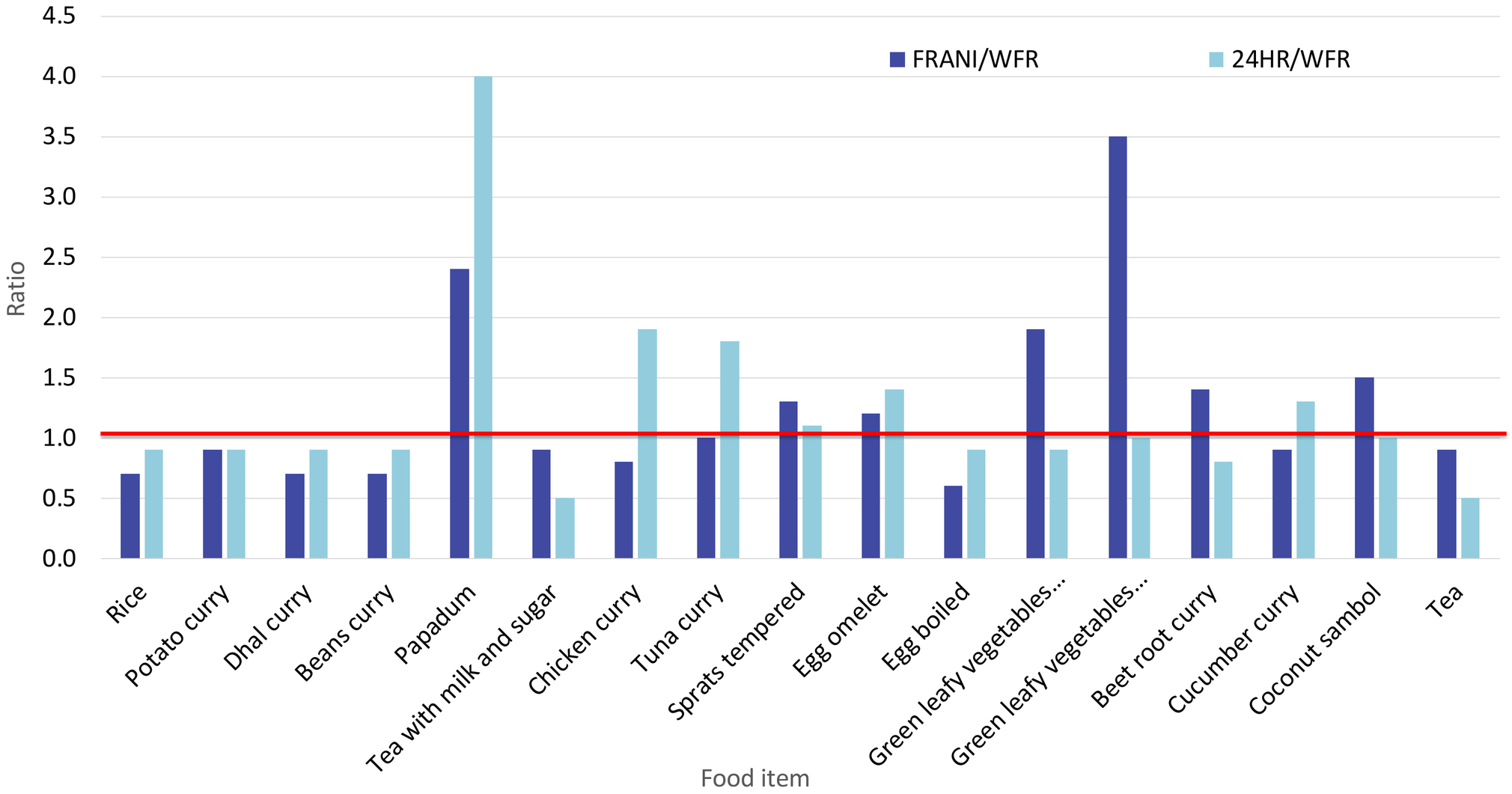



- Omissions (foods consumed but not reported)
  ~2% for FRANI vs. ~12% for 24HR
- Intrusions (foods reported that were not consumed)
  ~7% for FRANI and 9% for 24HR

# Sources of portion estimation errors for FRANI app and 24HR

| Food | Food group | Consumption episodes (n) | | | Quantity consumed (g) | | | Ratio of quantities consumed | |
|---|---|---|---|---|---|---|---|---|---|
| | | WFR | FRANI | 24HR | WFR | FRANI | 24HR | FRANI/WFR | 24HR/WFR |
| Rice | Grains, white roots and tubers, plantains | 343 | 344 | 338 | 206.1 | 139.6 | 175.4 | 0.7 | 0.9 |
| Potato curry | | 39 | 43 | 32 | 49.2 | 46.3 | 44.4 | 0.9 | 0.9 |
| Dhal curry | Pulses (beans, peas, lentils) | 153 | 161 | 157 | 55.0 | 37.4 | 47.8 | 0.7 | 0.9 |
| Beans curry | | 23 | 27 | 29 | 37.5 | 24.7 | 34.0 | 0.7 | 0.9 |
| Papadum | | 33 | 32 | 31 | 6.1 | 14.4 | 24.4 | 2.4 | 4.0 |
| Tea with milk and sugar | Dairy | 22 | 22 | 20 | 177.8 | 164.6 | 83.6 | 0.9 | 0.5 |
| Chicken curry | Meat, poultry and fish | 27 | 26 | 26 | 46 | 38.5 | 88.2 | 0.8 | 1.9 |
| Tuna curry | | 45 | 43 | 46 | 35.8 | 34.2 | 65.6 | 1.0 | 1.8 |
| Sprats tempered | | 47 | 45 | 39 | 23.2 | 29.6 | 24.7 | 1.3 | 1.1 |
| Egg omelet | Eggs | 28 | 25 | 22 | 40.8 | 48.2 | 58.2 | 1.2 | 1.4 |
| Egg boiled | | 37 | 39 | 39 | 47.7 | 29.0 | 45.2 | 0.6 | 0.9 |
| Green leafy vegetables salad | Dark green leafy vegetables | 43 | 39 | 33 | 23.1 | 44.8 | 20.5 | 1.9 | 0.9 |
| Green leafy vegetables mallum | | 81 | 72 | 83 | 21.2 | 73.5 | 20.5 | 3.5 | 1.0 |
| Beet root curry | Other vegetables | 48 | 49 | 54 | 44.4 | 61.3 | 35.6 | 1.4 | 0.8 |
| Cucumber curry | | 20 | 20 | 20 | 50.1 | 43.5 | 65.7 | 0.9 | 1.3 |
| Coconut sambol | | 63 | 65 | 63 | 23.1 | 33.9 | 22.7 | 1.5 | 1.0 |
| Tea | | 34 | 35 | 37 | 154.5 | 145.5 | 75.6 | 0.9 | 0.5 |

# Ratio of quantities consumed



## Conclusion

- FRANI is a valid tool for assessing nutrient intake in adolescent girls, with accuracy comparable to 24HRs.
- Improvements in recipe coverage and portion estimation could enhance its performance.

## Implications

- AI-assisted tools like the FRANI app can be integrated into adolescent nutrition programs as a scalable and cost-effective solution for improving dietary monitoring.
- They help overcome limitations of traditional dietary assessment, offering faster, more reliable data collection for program use.

My participation was made possible through the generous support of the

**Delivering for Nutrition 2025 Conference funders**

This work was funded by IFPRI