

## **Topic: Development and validation of an electronic photographic food atlas for Ghanaian adolescents in Greater Accra**

### **ABSTRACT**

**Background:** Adolescence, defined by the World Health Organization as ages 10–19 years, is a critical period of rapid physical, cognitive, and social development with lasting implications for health. Adequate nutrition during this stage is essential for growth, development, and the prevention of later disease. However, accurate dietary assessment among adolescents remains difficult. Common methods such as 24-hour recalls (24HR), food frequency questionnaires, and weighed food records (WFR) are affected by recall bias, misreporting, and limited cultural suitability. Portion size estimation is especially challenging because adolescents are still developing cognitive skills while responding to social influences and changing food environments. This thesis addressed these challenges by developing and validating an Electronic Photographic Food Atlas (e-PFA) tailored for adolescents in Greater Accra, Ghana, to improve portion-size estimation in 24HR and strengthen dietary assessment.

**Aim:** To develop and validate an electronic photographic food atlas for Ghanaian adolescents in Greater Accra.

**Methods:** A cross-sectional survey was conducted among 413 adolescents from six districts in the Greater Accra Region, producing 3,958 food records and 364 individual food items. Foods were photographed under standardized conditions, with multiple portion sizes represented in each series, to create the e-PFA. A validation study was then conducted among a subsample of 111 adolescents. Participants' e-PFA-assisted portion-size estimates were compared with full-day observed weighed intake. Accuracy was assessed across foods and nutrients using Bland–Altman plots, concordance correlation coefficients, and omission and intrusion rates. Calibration models were applied to correct systematic overestimation of portions using weight correction factors based on coefficients of 0.65, and adjusted recalls were compared with weighed food records.

**Results:** Older adolescents were significantly more likely to make portion size estimation errors than younger adolescents [AOR = 2.44, 95% CI: 1.08–5.49], while adolescents living in rural areas were less likely to make such errors than those in urban settings. Equivalence testing between the e-PFA-assisted 24HR and WFR showed agreement within the 10% bound for energy, protein, and niacin; within the 15% bound for dietary fibre, calcium, folate, iron, thiamin, vitamin B6, vitamin C, and zinc; and within the 20% bound for carbohydrate and riboflavin. Concordance correlation coefficients for nutrient estimates ranged from 0.36 to 0.70, with a mean of 0.54. Comparison of food consumption episodes showed omission and intrusion errors of 16% and 18%, respectively.

**Conclusion:** A 24HR administered with the e-PFA provided reliable estimates of nutrient intake among adolescents, compared with weighed records, in both rural and urban communities. Calibration procedures further improved accuracy. Overall, the thesis demonstrates that a culturally tailored e-PFA, combined with calibration, is a robust and scalable tool for improving adolescent dietary assessment in Ghana.