



AI-assisted dietary assessment and personalised “nudges” in urban youth

Feasibility and effectiveness of a mobile phone-based intervention to improve diets in Ghana.

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Background

Diet-related risks cause 20% of global deaths (~11 million) per year (Afshin et al., 2019). Increased urbanization in low- and middle-income countries accompanied by a nutrition transition, involving increased consumption of unhealthy, processed foods and reductions in physical activity, has exacerbated diet-related risks, leading to increases in rates of overweight and obesity (Popkin et al., 2020). Diets in urban settings are also affected by the reduced time for food preparation, convenience and affordability of unhealthy foods.

We developed an artificial-intelligence-based phone application called PlantVillage Food Recognition Assistance and Nudging Insights (FRANI) to tackle these problems. PlantVillage FRANI was previously validated against observed weighed records, the gold standard for diet assessment, and shown to be as accurate as a trained dietician undertaking a standard, multi-pass 24-hr recall (Folson et al., 2023). PlantVillage FRANI was developed to also provide gamified nudges and personalized feedback designed to promote healthy food choices. The objectives of this study were to measure the acceptability, adherence, and likeability of the app, as well as its effects on the food choices of female youth in Accra, Ghana.



Methods

Sixty female participants aged 19-24y were recruited from the University of Ghana student population resident in the Legon campus and randomly allocated into two groups: The intervention group with the

full version of FRANI including the gamified nudges to encourage healthier food choices. The control group received a version of FRANI without the gamified nudges (FRANI Control). The intervention group was able to take pictures of their meals, set dietary goals, and receive personalized medals and badges according to the dietary quality of the foods they ate. Participants in the intervention group were also able to see the scores and statistics about the quality of their diet, and received a daily report summarizing everything they ate and notifications reminding them to take pictures. In contrast, the participants in the control group had access to a mobile phone with a limited version of FRANI, without possibility of setting dietary goals, nor a home screen, daily reports, scores and statistics. They also did not receive medals and badges. Both groups received the same notifications, except daily report reminders for the control group. Both groups had their food choices tracked for 8 weeks using the FRANI technology. The feasibility of the FRANI was assessed by measuring outcomes related to adherence (i.e. number of days with dietary records) measured through FRANI use directly, and acceptability (likeability, satisfaction, intent to use, intent to continue using the FRANI) measured through a structured questionnaire at the end of the experiment. Diet quality outcomes captured using FRANI in participants in both study groups included the daily diet diversity scores, and the EAT Lancet Diet Score. Treatment effects were estimated using multi-level regression models accounting for the repeated measures.

Results

The study period included a total of 14,579 individual food records and 2,614 person-day records out of a possible 3,360 person days, equivalent to adherence levels of 78%. Mean daily energy intake at baseline was 1794 kcals, with no significant decline during the study period. All participants found FRANI to be acceptable, likeable and usable. Treatment effect estimates suggest that FRANI improved dietary diversity, and EAT Lancet Diet Quality Scores (only when also modelling duration of exposure).

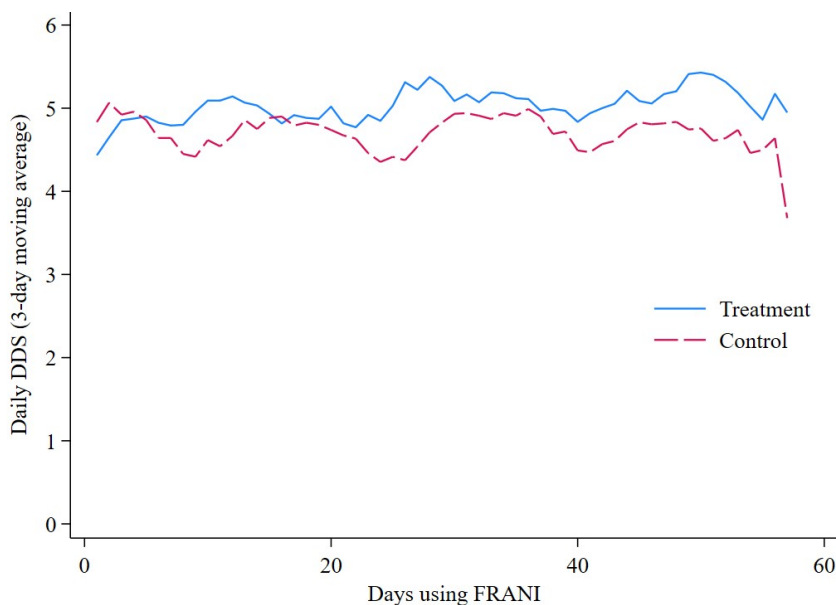


Figure 1: Diet diversity score, FRANI app (Treatment) and FRANI Control during the study period.

Source: Authors.

Conclusions

PlantVillage FRANI use was found to be feasible and may be effective to influence users toward healthy food choices in female youth living in urban Ghana, consistent with results in Vietnam (Braga et al., 2023). More research is needed to test the cost-effectiveness of PlantVillage FRANI in different contexts and at scale.

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