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Dietary Diversity as a Measure of the Micronutrient Adequacy of Women's Diets: Results from Metropolitan Cebu, Philippines Site

Melissa C. Daniels

December 2009

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Foreword

This report is one in a series of technical reports produced under the Women's Dietary Diversity Project (WDDP). The WDDP is a collaborative research initiative to assess the potential of simple indicators of dietary diversity to function as proxy indicators of the micronutrient adequacy of women's diets in resource-poor areas. Work carried out under the WDDP includes the development of a standard analysis protocol and application of that protocol to five existing data sets meeting the analytic criteria established by the project. The data sets analyzed as part of the WDDP are from sites in Bangladesh, Burkina Faso, Mali, Mozambique and the Philippines.

Comparative results across the five sites are presented in a summary report, which will be published in 2010:

Mary Arimond, Doris Wiesmann, Elodie Becquey, Alicia Carriquiry, Melissa C. Daniels, Megan Deitchler, Nadia Fanou, Elaine Ferguson, Maria Joseph, Gina Kennedy, Yves Martin-Prével and Liv Elin Torheim. *Dietary Diversity as a Measure of Women's Diet Quality in Resource-Poor Areas: Summary of Results from Five Sites*.

Detailed results for each data set are discussed in individual site reports:

- Bangladesh: Mary Arimond, Liv Elin Torheim, Doris Wiesmann, Maria Joseph and Alicia Carriquiry. *Dietary Diversity as a Measure of the Micronutrient Adequacy of Women's Diets: Results from Rural Bangladesh Site*.

- Burkina Faso: Elodie Becquey, Gilles Capon and Yves Martin-Prével. *Dietary Diversity as a Measure of the Micronutrient Adequacy of Women's Diets: Results from Ouagadougou, Burkina Faso Site*.

- Mali: Gina Kennedy, Nadia Fanou, Chiara Seghieri and Inge D. Brouwer. *Dietary Diversity as a Measure of the Micronutrient Adequacy of Women's Diets: Results from Bamako, Mali Site*.

- Mozambique: Doris Wiesmann, Mary Arimond and Cornelia Loechl. *Dietary Diversity as a Measure of the Micronutrient Adequacy of Women's Diets: Results from Rural Mozambique Site*.

- Philippines: Melissa C. Daniels. *Dietary Diversity as a Measure of the Micronutrient Adequacy of Women's Diets: Results from Metropolitan Cebu, Philippines Site*.

This report presents the results for the Philippines site.

The WDDP initiative began in 2006. Funding is provided by the United States Agency for International Development (USAID)'s Food and Nutrition Technical Assistance II Project (FANTA-2) and its predecessor project, FANTA, at FHI 360. The WDDP has been a collaboration among researchers from the International Food Policy Research Institute (IFPRI), FANTA, Akershus University College, Food and Agriculture Organization of the United Nations, Institute of Research for Development, Iowa State University, London School of Hygiene and Tropical Medicine, University of North Carolina at Chapel Hill and Wageningen University.

Acknowledgements

Funding for this report was provided by the United States Agency for International Development (USAID) through the Food and Nutrition Technical Assistance II Project (FANTA-2) and its predecessor project, FANTA, at FHI 360.

The 2005 Cebu Longitudinal Health and Nutrition Survey (CLHNS) was funded by a grant from the National Institutes of Health, Fogarty International Center (grant # RO1TW05596).

Many thanks to those who authored the protocol which guided this analysis: Mary Arimond and Doris Wiesmann at the International Food Policy Research Institute (IFPRI) who also provided excellent ongoing technical assistance and advice, Liv Elin Torheim at Asherkus University College, Maria Joseph and Alicia Carriquiry at Iowa State University, as well as the many others who have provided intellectual and technical support in this effort.

I also gratefully acknowledge colleagues at the University of North Carolina at Chapel Hill for their many years of dedication in organizing, developing, overseeing and maintaining the many rounds of the CLHNS, and for their generosity in publicly sharing these data. Special thanks to Linda Adair who currently oversees this effort and who provided insight into the survey design and methodology of the CLHNS.

I would also like to express appreciation to staff at the Office of Population Studies, University of San Carlos, Philippines for their continued efforts in carrying out successive rounds of the CLHNS. Particular thanks to Paulita Duazo who, through her expertise with CLHNS dietary data, provided important assistance in food identification, in expansion of the food composition table, and in collecting representative recipes. Thanks also to Connie Giultiano and Judith Borja for providing assistance with technical questions regarding survey procedures.

A special thanks also to Emelia Chabot who rendered much valuable assistance in expanding and updating the food composition table for this project, and assisted in preparing tables of results, to Megan Deitchler at FANTA who provided suggestions for the finalized manuscript, to Elaine Ferguson who rendered valuable counsel on estimations of nutrient intake, and to Yves Martin-Prével, Elodie Becquey, Gina Kennedy, and Nadia Fanou who analyzed data for other sites included in this multi-country project and whose insights and suggestions, both through email and at a 2008 meeting in Washington, DC, have improved the quality of this research and publication.

Acronyms and Abbreviations

AI	Adequate intake
AUC	Area(s) under the curve
BLUP	Best linear unbiased predictor
BMI	Body mass index
BMR	Basal metabolic rate
CLHNS	Cebu (Philippines) Longitudinal Health and Nutrition Survey
cm	Centimeter(s)
CV	Coefficient of variation
d	Day
DHS	Demographic and Health Surveys
DRI	Dietary reference intake
EAR	Estimated average requirement
FAO	Food and Agriculture Organization of the United Nations
FANTA	Food and Nutrition Technical Assistance Project
FANTA-2	Food and Nutrition Technical Assistance II Project
FCT	Food composition table
FGI	Food group diversity indicator
FGI-6	Food group diversity indicator summed from 6 groups, minimum intake 1 g per group
FGI-6R	Food group diversity indicator summed from 6 groups, minimum intake 15 g per group
FGI-9	Food group diversity indicator summed from 9 groups, minimum intake 1 g per group
FGI-9R	Food group diversity indicator summed from 9 groups, minimum intake 15 g per group
FGI-13	Food group diversity indicator summed from 13 groups, minimum intake 1 g per group
FGI-13R	Food group diversity indicator summed from 13 groups, minimum intake 15 g per group
FGI-21	Food group diversity indicator summed from 21 groups, minimum intake 1 g per group
FGI-21R	Food group diversity indicator summed from 21 groups, minimum intake 15 g per group
FNRI	Food and Nutrition Research Institute of the Philippines
g	Gram(s)
h	Hour
IFPRI	International Food Policy Research Institute
IOM	Institute of Medicine (United States National Academy of Sciences)
IRD	Institute of Research for Development
IZiNCG	International Zinc Nutrition Consultative Group
kcal	Kilocalorie(s)
kg	Kilogram(s)
µg	Microgram(s)
LSHTM	London School of Hygiene and Tropical Medicine
mg	Milligram(s)
MPA	Mean probability of adequacy
NPNL	Non-pregnant non-lactating
NRV	Nutrient reference values of the Codex Alimentarius
OPS	Office of Population Studies, University of San Carlos, Cebu, Philippines
ORC Macro	Opinion Research Corporation Macro International, Inc
PA	Probability of adequacy
R1	Round 1 of data collection

R2	Round 2 of data collection
RAE	Retinol activity equivalent
RE	Retinol equivalent
ROC	Receiver-operating characteristic
SD	Standard deviation
UK	United Kingdom
US	United States
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
USDA ARS	United States Department of Agriculture Agricultural Research Service
USDA Release	United States Department of Agriculture National Nutrient Database for Standard Reference Release
WDDP	Women's Dietary Diversity Project
WHO	World Health Organization
y	Year

Executive Summary

BACKGROUND

In resource-poor environments across the globe, low quality monotonous diets are the norm. When grain- or tuber-based staple foods dominate and diets lack vegetables, fruits and animal-source foods, risk for a range of micronutrient deficiencies is high. Women of reproductive age constitute one vulnerable group. While information on micronutrient deficiencies is scarce, it is clear that poor micronutrient status among women is a global problem and is most severe for poor women. Information about dietary patterns for women across countries is also scarce, but the Demographic and Health Surveys (DHS) have recently begun to fill this information void.

The broad objective of this study, carried out under FANTA's Women's Dietary Diversity Project (WDDP), is to use an existing data set with dietary intake data from 24-hour (24-h) recalls to analyze the relationship between simple indicators of dietary diversity – such as could be derived from the DHS – and diet quality for women. Adequate diet quality is defined here as a diet that delivers adequate amounts of selected micronutrients to meet the needs of women of reproductive age. We recognize that definitions of diet quality often include other dimensions, such as moderation and balance. However, because low intakes remain the dominant problem in many of the poorest regions, focus in this work is on micronutrient adequacy only.

Dietary diversity – i.e., the number of foods consumed across and within food groups over a reference period – is widely recognized as a key dimension of diet quality. There is ample evidence from developed countries showing that dietary diversity is indeed strongly associated with nutrient adequacy. There is less evidence from developing countries, but the few available studies of adult women have also supported the association between diversity and nutrient adequacy.

OBJECTIVES

To assess the potential of simple indicators of dietary diversity to function as proxy indicators of diet quality, the following main objectives were identified for the WDDP:

1. Develop a set of diversity indicators, varying in complexity, but all amenable to construction from simple survey data
2. Develop an indicator of diet quality, using current best practices to assess adequacy across a range of key micronutrients
3. Explore relationships among diversity indicators, energy intake and diet quality
4. Test and compare the performance of various indicators

As a secondary objective, the WDDP also aimed to characterize micronutrient adequacy for women of reproductive age in each study site.

Indicator performance in just one site is not sufficient to address the broader objective of developing indicators for global use. Therefore, results pertaining to objective four are not presented here but are discussed in the WDDP summary report.

DATA AND SAMPLING

The data analyzed for this study are from a sample of adult women (ages 20 to 49) from the 2005 round of the Cebu (Philippines) Longitudinal Health and Nutrition Survey (CLHNS). Between January and August 2005, two 24-h recalls of dietary intake were collected on all women. After exclusion of a small number of women for lack of anthropometric information, extreme energy intake and pregnant status, 1,798 non-pregnant and non-lactating (NPNL) women and 167 lactating women remained in the study sample.

METHODS

The analysis protocol developed for the WDDP directed the analysis for this study. Food composition data available through CLHNS, as well as other sources, were used to assess dietary intakes of energy, protein, carbohydrate, fat and 11 micronutrients (calcium, iron, zinc, thiamin, riboflavin, niacin, folate and vitamins B6, B12, A and C). Estimates of usual micronutrient intake, calculated from both days of dietary recall data, were compared with nutrient requirement distributions to calculate the probability of adequacy (PA) for each nutrient. The probabilities of adequacy were averaged across the 11 micronutrients to form a summary indicator of diet quality: —mean probability of adequacy" (MPA).

Eight dietary diversity indicators (FGIs) were created, each summing food groups consumed to generate a dietary diversity score. The indicators vary in the extent to which major food groups are disaggregated. The indicators also vary in regard to the amount of food (either 1 gram [g] or 15 g) that must be consumed in order for the food group to count. The most aggregated indicator has 6 major food groups (FGI-6). The more disaggregated indicators have 9, 13 and 21 food groups (FGI-9, FGI-13, FGI-21), with nutrient-dense food groups (animal-source foods, fruits and vegetables) more disaggregated than staple food groups. The indicators with a 15 g minimum consumption requirement use the same food groups as FGI-6, FGI-9, FGI-13 and FGI-21. Throughout the report, these indicators are referred to as FGI-6R, FGI-9R, FGI-13R and FGI-21R, respectively.

Correlations and simple linear regressions were used to describe relationships between the diversity indicators, energy intake and MPA.

RESULTS

Diets in this metropolitan Cebu sample were rice-based, with consumption of other grains and starchy staples also common. Meats were consumed daily in small quantities by nearly all women: most frequently women consumed large fish/shellfish. About half of the women reported eating meats in the beef/pork food group, with somewhat less consumption by lactating women. Large fish/shellfish were also commonly consumed by all. Dark green leafy vegetables high in vitamins A and C were the most common vegetables consumed. Fruit (other than bananas), dairy products, nuts, small fish with bones and organ meat were consumed rarely.

Energy intakes were low in this sample (~1,350 kilocalories [kcal]), also resulting in lower-than-recommended intakes of protein, carbohydrates and fat. However, the proportion of energy from macronutrients was in line with WHO recommendations. Micronutrient intakes were similar for lactating and NPNL women, except for niacin, which was somewhat lower, and folate, which was somewhat higher, among lactating women. Median micronutrient intake was in most cases lower than the estimated average requirement (EAR), with the exception of niacin for NPNL women and vitamin B12 for both groups of women. Intakes of vitamin B6, folate, vitamin A and zinc were slightly below the corresponding EARs for NPNL women and were well below the corresponding EARs for lactating women. All other nutrient intakes were well below the EARs for both groups of women.

Grains and grain products and animal flesh foods (primarily the large fish and beef/pork food groups) contributed the majority of nutrients to the diet. Large fish/shellfish were the principal source of vitamin B12 and niacin intakes. Correlations of MPA with energy were explored for each food group. After adjustment for energy intake, partial correlations were reflective of nutrient density for the individual food groups. Correlations with grains and starchy staples and beef/pork, etc. were fully attenuated by adjusting for energy, reflecting low nutrient density (for the beef/pork category this was due to very high fat contents of the cuts consumed). Food groups with the most promise for increasing the nutrient density of the diet were (in descending order) large fish/shellfish, milk/yogurt, organ meat, all other vegetables, vitamin C-rich fruits and eggs.

Compared with the dietary diversity indicators with a 1 g minimum consumption requirement, the indicators with a 15 g consumption requirement were correlated more strongly with energy intakes and also more robustly with nutrient intakes. In energy-adjusted correlations with MPA, the 15 g indicators also performed better than the 1 g indicators, indicating a stronger relationship with dietary nutrient density. Among lactating women, the 15 g consumption requirement was critical to indicator performance: Except for FGI-9, only indicators with the 15 g requirement remained significantly correlated with MPA after adjusting for energy intake.

FGI-21R was most strongly related to individual nutrient intakes. Correlations between the eight diversity indicators and nutrient intakes were in most cases positive and significant but low. Controlling for energy intake reduced many correlations greatly. Among NPNL women, FGI-21R remained significantly correlated with intakes for all nutrients; among lactating women, FGI-21R remained significantly correlated with the intakes for most nutrients.

Among NPNL women, MPA increased fairly consistently with increasing dietary diversity scores for each diversity indicator. Among lactating women, this was true only for FGI-21R. For both groups of women, all diversity indicators were positively and significantly correlated with MPA. All correlations remained positive after controlling for energy intake; among NPNL women all correlations were significant; among lactating women correlations for scores with a 15 g requirement remained significant. Correlations were again highest for FGI-21R; FGI-21R also exhibited the greatest explanatory power in linear regressions of MPA on each dietary diversity indicator.

DISCUSSION

The superior performance of FGI-21R compared with other indicators was due to the disaggregation of meats into several more food groups in the FGI-21R than in the other indicators. The meat group included in FGI-6 and FGI-6R was comprehensive in scope (all animal flesh foods) and was eaten ubiquitously by the sample. This translated into a lack of meaningful variability in diversity scores from these indicators, since the foods from the meat group provided a large percentage of most nutrients for this sample and nearly all of niacin and vitamin B12 intakes. Correlations improved slightly as animal flesh foods were slightly more disaggregated in the 9 and 13 food group indicators and were stronger yet in the 21 food group indicators, where poultry, large fish and beef/pork were separate food groups, each of which was consumed frequently and with variability among women in the sample.

All dietary diversity indicators were correlated with intakes of several individual micronutrients and significantly correlated with MPA, which suggests the diversity indicators might have potential for distinguishing groups of women consuming diets of different levels of micronutrient adequacy.

This analysis supported some alterations to the typical diversity indicator format that might improve their validity. Indicators employing the 15 g cutoff showed important improvements in their ability to represent the micronutrient adequacy of the diet. Also, indicator relationships to adequacy can be improved by tailoring food groups in indicators to reflect nutrient-rich food groups consumed with variability. This might not be practical for widely administered surveys such as the DHS, which must maintain comparability across regions. However, it might be useful in smaller studies for regional and longitudinal comparisons. Also, indicators focused on a few micronutrients of concern in an area could be similarly tailored to become more informative for potential interventions.

The dietary diversity indicators showed less promise among lactating women than NPNL women; this was partially due to the smaller number of lactating women in the study sample and the corresponding lower power. Also, nutrient intakes of lactating women were similar to NPNL women but nutrient requirements are much higher. This resulted in somewhat narrower ranges of adequacy (NPNL MPA median 0.32, range [0 to 0.94]; lactating MPA median 0.20, range [0 to 0.80]) which might have attenuated correlations slightly. Given the likelihood of narrower adequacy ranges for these women, indicators must be increasingly sensitive. Separate indicators developed with greater focus on key nutrients in pregnancy and lactation might be more helpful for assessing the micronutrient adequacy of the diet among these populations.

CONCLUSIONS

This analysis supports the use of simple dietary diversity indicators as promising tools for assessing the micronutrient adequacy of the diet among women of reproductive age in developing countries. Positive relationships with MPA were the result of clear and significant individual relationships between the dietary diversity indicators and intakes of several micronutrients. In most cases, these correlations were robust to energy adjustment, supporting a relationship between the diversity indicators and nutrient density of the diet. When nutrient intakes were not related to dietary diversity indicators, clear reasons were apparent. The findings of this study also support the potential for improving the relationship of dietary diversity indicators to MPA through careful selection of the food groups comprising the indicator and using a minimum consumption requirement for a food group to count in the dietary diversity score.

1. Background

In resource-poor environments across the globe, low quality monotonous diets are the norm. When grain- or tuber-based staple foods dominate and diets lack vegetables, fruits and animal-source foods, risk for a variety of micronutrient deficiencies is high. Those most likely to suffer from deficiencies include infants and young children, and adolescent girls and women of reproductive age. Unfortunately, outside of developed countries, very little information is available on women's micronutrient status, but even with limited data, it is clear that poor micronutrient status among women is a global problem, and is most severe for poor women.[1]

Similarly, comparable information about dietary patterns for women across countries is also scarce. The Demographic and Health Surveys (DHS) have recently added questions on mothers' diets in order to begin to fill this information void. The current survey questionnaire includes a set of questions about food groups eaten in the last 24 hours by mothers of young children under three years of age (see **Appendix 5**).[2]

The broad objective of this study, carried out under FANTA's Women's Dietary Diversity Project (WDDP), is to use an existing data set with dietary intake data from 24-hour (24-h) recall to analyze the relationship between simple indicators of dietary diversity – such as could be derived from the DHS and other surveys – and diet quality for women.

Simple indicators are urgently needed in developing countries to characterize diet quality, to assess key diet problems, such as lack of animal source foods, fruits and vegetables, and to identify sub-groups particularly at risk of nutrient inadequacy. Simple indicators are also needed to monitor and evaluate intervention programs. The present study contributes to development of such simple indicators. At the same time, the study also provides descriptive information on dietary patterns and levels of micronutrient adequacy for women in one resource-poor setting.

For the purposes of this study, adequate diet quality is defined as a diet that has a high probability of delivering adequate amounts of selected micronutrients, to meet the needs of women of reproductive age. We recognize that definitions of diet quality often include other dimensions, such as moderation (e.g., in intakes of energy, saturated/trans fat, cholesterol, sodium, refined sugars) and balance. But because low intakes remain the dominant problem in many of the poorest regions, our focus in this work is on micronutrient adequacy only.

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[1] Kennedy and Meyers 2005.
[2] **Appendix 5** excerpts the relevant questions from the model questionnaire; the entire questionnaire is available on the Opinion Research Corporation Macro International, Inc., (ORC Macro) DHS website at: http://www.measuredhs.com/aboutsurveys/dhs/questionnaires.cfm (accessed September 7, 2007).

2. Dietary Diversity

Dietary diversity – i.e., the number of foods consumed across and within food groups over a reference time period – is widely recognized as being a key dimension of diet quality. It reflects the concept that increasing the variety of foods and food groups in the diet helps to ensure adequate intake of essential nutrients, and promotes good health. There is ample evidence from developed countries showing that dietary diversity is indeed strongly associated with nutrient adequacy, and thus is an essential element of diet quality.[3]

There is less evidence from developing countries where monotonous diets, relying mostly on a few plant-based staple foods, are typical. Even fewer studies from developing countries have aimed to confirm this association specifically among adult women. The available studies have generally supported the association between diversity and nutrient adequacy.[4] One exception to this was reported in a study from urban Guatemala, but in this study diversity was defined as the number of unique foods consumed over fourteen 24 hour periods; this meant that even very infrequently consumed items counted in the score.[5]

Previous studies have generally been context-specific, and diversity has been operationalized differently in each study.[6] While this has made comparisons difficult, it has also suggested that the relationship is robust. This report, along with the companion reports from additional sites, extends knowledge of the relationship between simple diversity indicators and nutrient adequacy for women.

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[3] Randall, Nichaman and Contant Jr. 1985; Krebs-Smith et al. 1987; Kant 1996; Drewnowski et al. 1997; Cox et al. 1997; Lowik, Hulshof and Brussaard 1999; Bernstein et al. 2002; Foote et al. 2004.
[4] Ogle, Hung and Tuyet 2001; Torheim et al. 2003, 2004; Roche et al. 2007.
[5] Fitzgerald et al. 1992.
[6] Ruel 2003.

3. Objectives

To assess the potential of simple indicators of dietary diversity to function as proxy indicators of diet quality, the following main objectives were identified for the WDDP:

1. Develop a set of diversity indicators, varying in complexity, but all amenable to construction from simple survey data
2. Develop an indicator of diet quality, using current best practices to assess adequacy across a range of key micronutrients
3. Explore relationships among diversity indicators, energy intake, and the indicator of diet quality
4. Test the performance of various indicators using cut-points along the range of diversity scores; assess performance (sensitivity, specificity and total misclassification) relative to various cutoffs for diet quality, as data allow

As a secondary objective, the WDDP also aimed to characterize micronutrient adequacy for women of reproductive age in each study site.

Because indicator performance in just one site is not sufficient to address the broader objective of developing indicators for global use, the results for objective four above are most useful when considered across multiple sites. This discussion is provided in the WDDP summary report.[7]

[7] Arimond et al. 2009.

4. Cebu Longitudinal Health and Nutrition Survey: Original Research Objectives and Context

The data analyzed for this study are from a sample of adult women (ages 20-49) in the 2005 round of the Cebu (Philippines) Longitudinal Health and Nutrition Survey (CLHNS). The CLHNS began in 1983 as a prospective study of infant feeding patterns, their determinants and consequences. At the inception of the CLHNS, all pregnant women in selected communities were invited to participate in the survey. Since that time, extensive data have been collected on mothers and these offspring, as well as other family members and household residents. The initial phase led to an expanded focus on pregnancy outcomes, maternal and child health and birth spacing issues for which a prospective design was favorable for research.[8] No interventions have been conducted on the cohort. The 2005 survey contains data from 2,920 women (2,018 mothers and 902 adult daughters); of these women, 91 were pregnant and 190 were lactating.

The CLHNS is a community-based survey of metropolitan Cebu, which surrounds and includes Cebu City, the second largest city of the Philippines. Families surveyed live in a variety of circumstances, including densely populated urban areas, urban squatter settlements, peri-urban neighborhoods, rural areas stretching into the mountains and some small surrounding islands. Sampling for the first round of data collection consisted of two independent two-stage cluster samples, one urban and the other rural. Metropolitan Cebu comprises 243 barangays (administrative units, e.g., neighborhoods in the city, villages in the rural areas). In the first stage, 17 urban and 16 rural barangays were randomly selected for inclusion in the cohort, based on a desired sample size of 1,500 urban and 500 rural mothers after expected dropouts. In the second stage, all pregnant women residing in the 33 barangays and due to give birth between May 1, 1983 and April 30, 1984 were invited to enroll in the study. Greater than 95 percent enrolled, giving a total of 3,327 pregnant women. The CLHNS collected follow-up data on all singleton live births (n=3,080), regardless of low birth weight, pre-term and small-for-gestational-age status. Multiple births were excluded from the sample.

No sample weights exist given the cohort design of the study: CLHNS was not originally intended to be nationally or provincially representative of Filipino women but only to reflect typical mother/infant pairs in Cebu. However, women in the CLHNS are generally similar in socioeconomic status to women in the Philippine Demographic and Health Survey (DHS), as well as women in national surveys from the Food and Nutrition Research Institute of the Philippines (FNRI).[9]

[8] OPS 1989.
[9] Personal communication with Linda Adair, principal investigator for CLHNS, Aug. 1, 2008.

5. Methods

5.1. DATA COLLECTION FOR 24-HOUR RECALL AND CALCULATION OF NUTRIENT INTAKES

The data for this study were collected by trained staff from the Office of Population Studies (OPS) of the University of San Carlos in Cebu City. Individuals collecting the dietary recall data were nationally certified dietitians and underwent an intensive one-week methods training before data collection.

The methods used to collect the 24-h dietary recall data were designed to reflect standard practice and were not validated in the sample. Women in the study were asked to recall each food they had eaten the previous day from the time they woke up to the time they went to bed. Prompts were included (e.g., “before breakfast,” “breakfast,” “morning snack,” “lunch”) to aid memory of each individual meal and snack. Enumerators used a recall form and a kit containing measuring cups/spoons, a ruler and different sized food models to assist in recalling amounts eaten. Mixed dishes were itemized, and solid portions of foods eaten were estimated using these implements. Sauces in Filipino foods are minimal (usually present as marinades or dipping sauces) and are typically made of soy sauce and vinegar, or tomato sauce but seldom other ingredients. Sauces were considered to add negligible nutrients and were not estimated.[10] Meals and snacks eaten outside of the home were also recalled and recorded. Information was collected on where and how each dish was prepared and where meals were eaten. To provide complementary information about the reliability of the 24-h recall, subjects were asked to indicate the usual number of meals eaten, usual food items and whether meals on the recalled day represented “usual” intake. “Usual” was defined as occurring at least three to four times weekly.

Two rounds of dietary data were collected on all subjects to allow for an estimate of usual diet in the sample. Data were collected between January and August 2005, and methods of data collection were similar for both rounds. The second survey was generally consecutive – about half of the women were interviewed again the next day; for about 95 percent the second interview occurred within one week of the first. Within the larger survey (first round), dietary data were generally collected after about one hour of interviewing. The length of the full survey (including the dietary portion) was around two hours.[11]

After data collection, each food item was coded with its specific cooking preparation and matched to an appropriate preparation in the food composition table by OPS data analysts. The working OPS food composition table was originally based on tables produced by FNRI[12] and has been periodically revised and updated by OPS staff to suit project purposes. However, food identification numbers were changed in the early 1990s but not in correspondence with changes in the FNRI food composition table, making continuing updates difficult. Also, nutrient information for many foods in the FNRI food composition table are available only in raw form. However, early in the course of the CLHNS, OPS obtained yield factors from FNRI that have been used to adjust these nutrient profiles to represent various cooked forms of foods. Retention factors were not available.

For this current study, foods were linked via name and moisture content (where available) to the 2000 FNRI food composition table (FCT) to take advantage of FNRI food additions, nutrient profile updates and added English translations. Not all nutrients necessary for this study were available in the FNRI FCT. Data for vitamins B6, B12, folate, zinc and any other missing nutrient values were taken from the closest food match available in the USDA National Nutrient Database for Standard Reference Release 20 (USDA Release 20),[13] the Japanese FCT[14] or the Worldfood FCT.[15] Where correct data on cooked forms of

[10] Personal communication from Paulita Duazo, who works closely with field workers at OPS and is involved in coding dietary data. April 10, 2008.
[11] Personal communication from Paulita Duazo who works closely with field workers at OPS and is involved in coding dietary data. August 1, 2008.
[12] FNRI 1980.
[13] USDA 2007.
[14] Sugiyama Jogakuen University 2000.

foods were not available, raw forms were used and FNRI yield factors were applied systematically for all nutrient values (regardless of the source FCT). Because the database was very large, retention factors could not be added.

5.2. EXCLUSIONS FROM THE ORIGINAL SAMPLE

A total of 1,289 mothers still of reproductive age (≤ 49 years) and 902 daughters (age 20-22) were available for inclusion in the analysis. Four respondents lacked data on height or weight and were excluded. A small number of pregnant women (n=88) were also excluded, leaving 1,915 non-pregnant and non-lactating (NPNL) women and 184 lactating women.

Reported energy intakes have historically been low for the CLHNS data.[16] We used Goldberg's method[17] for estimating basal metabolic rate (BMR) based on data for height and weight and found that a large proportion of the sample had implausibly low energy intakes (45 percent had energy intakes < 0.9xBMR). To avoid excessive bias while eliminating the most extreme low outliers, we limited exclusions to those with energy intakes <0.3xBMR, excluding 2.4 percent of the sample (n=51) in the first round (R1) and 3.0 percent (n=62) in the second round (R2). A few individuals (n=27, R1; n=25, R2) with excessively high energy intake (energy intakes > 3.0xBMR) were also excluded. Individuals classified as ―poor reporters" in either round were then excluded uniformly from both rounds, resulting in a final sample with 1,798 NPNL women and 167 lactating women.

Dietary recall data were available for all women for both days of recalls (R1 and R2). Information from both rounds was used to calculate nutrient adequacy. Information from only one round could be used to calculate the dietary diversity indicators. Among the 1,798 NPNL women in the final sample, average intakes for all macronutrients were higher in R1. We concluded that survey fatigue might have caused less thorough reporting in R2, leading to lower reported intakes. Therefore, we selected data from R1 for calculation of the diversity indicators.

5.3. BRIEF PROTOCOL SUMMARY

A protocol outlining all aspects of analysis for the WDDP, including the basis for selection of the nutrients evaluated, requirement distributions referenced, diversity indicators constructed and statistical methods, was developed by Arimond et al.[18] Protocol details are outlined briefly below, along with a description of specific adaptations and refinements necessary for analyzing the Cebu data.

5.4. KEY NUTRIENTS

For the purposes of the WDDP, the following list of micronutrients was agreed to be of focus:

Vitamins	Minerals
Thiamin	Calcium
Riboflavin	Iron
Niacin	Zinc
Vitamin B6	
Folate	
Vitamin B12	
Vitamin A	
Vitamin C	

[15] Worldfood 1996.
[16] Bisgrove and Popkin 1996; Siega-Riz and Adair 1993.
[17] Goldberg et al. 1991.
[18] 2008.

These micronutrients were chosen based on their public health relevance and the likely availability of nutrient values in food composition tables. Vitamin D and iodine were among the nutrients considered but were excluded due to the lack of food composition data on these nutrients.

Data for major macronutrients (i.e., carbohydrates, fat, protein), energy and some subclasses of macronutrients (sugars, saturated fat, animal-source protein, plant-source protein) were also of interest to the WDDP. In spite of efforts to expand the working food composition table for the Cebu sample, we could not obtain complete data for sugars and saturated fats; therefore, summaries of these macronutrients are excluded from this report.

5.5. REQUIREMENTS AND REQUIREMENT DISTRIBUTIONS

Requirement distributions for individual nutrients were defined by estimated average requirements (EARs) and standard deviations (SD) selected during development of the protocol. Most requirements were taken from those defined by the World Health Organization/Food and Agriculture Organization of the United Nations.[19] In cases where the SD was not available, it was calculated using the provided coefficient of variation (CV). Because the WHO/FAO requirement for vitamin A did not provide the SD or CV value, the United States (US) values provided by the Institute of Medicine (IOM) were used.[20] Exceptions were made in the case of calcium, iron and zinc. For calcium, the US-recommended adequate intake (AI) values were used in conjunction with a measure of probability of adequacy (PA) recommended by Foote et al.[21] For iron, the PA for NPNL women available from the US IOM[22] were used. These values were subsequently adapted to represent the lower iron bioavailability likely among women in this study. In the case of zinc, the International Zinc Nutrition Consultative Group (IZiNCG) recently updated recommendations for international use[23] and these were adopted for the WDDP. A listing of EAR values and SDs for all nutrients and further discussion of the basis for their selection are provided in **Appendix 6**.

Individual WDDP researchers needed to select the most appropriate absorption levels for iron and zinc based on the intake of staples and animal source foods in their study sample. Referring to criteria from IZiNCG (2004) and FAO/WHO (2004), WDDP guided selection by specifying that unrefined, cereal-based diets were likely to be of lowest bioavailability, with mixed or refined vegetarian diets having slightly higher or ―intermediate bioavailability" (see **Appendix 6)**. In the CLHNS, refined white rice was the major dietary component, but all women also consumed non-dairy animal source foods (94% consumed >15 g, median intake was 98 g), with animal source protein providing 10% of total reported energy intake. Intermediate zinc (34 percent) and iron bioavailability (10 percent) were therefore assumed for the women in this study sample.

5.6. FOOD GROUP DIVERSITY INDICATORS

Because previous studies of dietary diversity have used a wide variety of indicator formulations, they are of limited comparability.[24] The purpose of developing a standardized analysis protocol for the WDDP was to facilitate comparisons of several carefully constructed food group dietary diversity indicators and evaluate the relationship of these simple indicators to an indicator of diet quality based on the probability of adequate micronutrient intake.

Diversity indicators based on food groups have been shown to be less sensitive to day-to-day diet variability and to have a stronger relationship with the micronutrient adequacy of the diet than indicators

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[19] WHO/FAO 2004.
[20] IOM 1997; IOM 2000a.
[21] 2004.
[22] Table I-7 in IOM 2000b.
[23] IZiNCG 2004; Hotz 2007.
[24] Ruel 2003.

based on individual foods.[25] Key considerations for selecting the indicator formulations used for the WDDP were feasibility for data collection in simple surveys and defining nutritionally relevant food groups for each indicator with respect to the 11 micronutrients of focus for the project (Arimond 2007). Four sets of food groups were used in the dietary diversity indicators evaluated for the WDDP: 6 food groups, 9 food groups, 13 food groups and 21 food groups (**Table A**). For each set of food groups (6, 9, 13 and 21 groups), two indicators were constructed. The first counted a food group as eaten if at least 1 g was consumed; these are referred to as FGI-6, FGI-9, FGI-13 and FGI-21. The second counted the food group if at least 15 g was consumed; these are referred to as FGI-6R, FGI-9R, FGI-13R and FGI-21R, with the "R" denoting the 15 g restriction.

No individual adaptations to these diversity indicators were made for this analysis, although some further discussion of the relevance of the food groups used in each indicator is provided later in the report.

5.7. SUMMARY OF ANALYTIC AND STATISTICAL METHODS

As specified in the WDDP protocol, nutrient adequacies were assessed through the probability approach, which incorporates information about the population distribution of nutrient requirements as well as intra-individual variation in intake. "Usual"[26] intake of given nutrients was calculated for each woman using her intake over two days and then used to calculate her PA for each nutrient informed by the population distribution of adequacy. The mean of all nutrient PA for the woman constitutes her "mean probability of adequacy" (MPA). PA and MPA were then averaged across the population to calculate, respectively, the prevalence of adequacy for individual nutrients and the population MPA for all nutrients. Correlations and simple linear regression models were used to describe the relationships between the diversity indicators, energy and nutrient intakes and MPA.

Nutrient intake distributions were strongly right-skewed (as is typical); MPA was as well. All nutrient distributions were transformed via the Box-Cox method (a power transformation) prior to calculating individual and population means. MPA was also transformed via Box-Cox before use in regressions and correlation analysis. P values < 0.05 were considered statistically "significant" for all analyses.

STATA 10[27] was used for data analysis.

[25] Hatloy 1998.
[26] The within- and between-person variance of transformed intake variables were used to calculate the "best linear unbiased predictor" (BLUP) of usual intake. This was used to calculate PA for all nutrients except iron and calcium, calculations for which are described in section 5.3b. See protocol for further details (Arimond et al. 2008).
[27] StataCorp 2007.

Table A. Food Groups Summed in Diversity Indicators [a, b]

6-group indicators	9-group indicators	13-group indicators	21-group indicators
All starchy staples	All starchy staples	All starchy staples	Grains and grain products
			All other starchy staples
All legumes and nuts	All legumes and nuts	All legumes and nuts	Cooked dry beans and peas
			Soybeans and soy products
			Nuts and seeds
All dairy	All dairy	All dairy	Milk/yogurt
			Cheese
Other animal source foods	Organ meat	Organ meat	Organ meat
	Eggs	Eggs	Eggs
	Flesh foods and other miscellaneous small animal protein	Small fish eaten whole with bones	Small fish eaten whole with bones
		All other flesh foods and miscellaneous small animal protein	Large whole fish/dried fish/shellfish and other seafood
			Beef, pork, veal, lamb, goat, game meat
			Chicken, duck, turkey, pigeon, guinea hen, game birds
			Insects, grubs, snakes, rodents and other small animals
Vitamin A-rich fruits and vegetables	Vitamin A-rich dark green leafy vegetables	Vitamin A-rich dark green leafy vegetables	Vitamin A-rich dark green leafy vegetables
	Other vitamin A-rich vegetables and fruits	Vitamin A-rich deep yellow/orange/red vegetables	Vitamin A-rich deep yellow/orange/red vegetables
		Vitamin A-rich fruits	Vitamin A-rich fruits
Other fruits and vegetables	Other fruits and vegetables	Vitamin C-rich vegetables	Vitamin C-rich vegetables
		Vitamin C-rich fruits	Vitamin C-rich fruits
		All other fruits and vegetables	All other vegetables
			All other fruits

[a] For each set of food groups (6, 9, 13, and 21 groups), two indicators were constructed. The first counted a food group as eaten if at least 1 g was consumed; the second counted the food group if at least 15 g was consumed; thus, a total of eight FGIs were constructed. Grams of intake were assessed based on foods as eaten (e.g., raw, cooked).
[b] —Vitamin A-rich" is defined as > 60 RAE/100 g; —vitamin C-rich" is defined as > 9 mg/100 g; these represent 15 percent of the NRV.

5.8. CHALLENGES IN PROTOCOL IMPLEMENTATION

The most substantial challenges in protocol implementation occurred in the preparation of the dataset. Challenges related to expanding and updating the FCT have been described above. Creation of diversity scores was also problematic. In the past, when nutrient profiles were not available for all individual foods, some similar food items were classified under a more general food composition code. This does not pose a large problem for estimates of food composition, but in cases where foods contained small amounts of different food groups, we could not characterize individual intakes of those food groups. For example, sample women consumed various flavored breads containing very small amounts of coconut, lemon, mung bean and mango; the breads had been lumped in coding so that the type of bread a woman actually ate was no longer known. This was not a major concern as only scores with the 1 g cutoff were likely to be affected by this and, in a field context where food group intakes are being collected, such minor ingredients might not be reported.

Other challenges in classifying food groups came from ―recipe foods." The women were asked to report individual recipe ingredients eaten. When this was very difficult for the respondent (roughly 100 foods), a recipe name was recorded, and food composition data for representative recipes were obtained from FNRI. However, a list of ingredients in these recipes had not been retained. To disaggregate these foods into their respective food groups, we estimated approximate recipes using recommended recipes from FNRI (FNRI 2000) and local cookbooks, and asked OPS staff to check whether the ingredients were realistic. These recipes were used to calculate g of each food group consumed, to determine the nutrients each food group contributed and to generate the dietary diversity indicators. For overall calculations of intake and adequacy, we reverted to the original food composition data, which we thought was a closer reflection of actual intake. Discrepancies between calculated and original food composition data for these ―recipe foods" led to some difficulties in calculating the proportion of nutrient intake individual food groups contributed.[28] Discrepancies might also have attenuated correlations, since MPA was based only on the original food composition data but food group indicators were partially based on these approximated recipes.

Canned processed foods such as spaghetti and meatballs, sardines in tomato sauce, and soups were commonly consumed and were also difficult to disaggregate into discrete food groups for the dietary diversity indicators. Twenty-nine canned foods were listed in the food composition table and 27 percent of women consumed at least one of these canned foods. About half of canned foods were mixed foods and, in some cases, both canned and home-prepared versions of mixed foods had been classified under the same food code.[29] Canned foods with one predominant ingredient (e.g., corned beef) were treated as a single food and grouped under their major ingredient to most closely approximate practices in a field survey of food groups eaten (e.g., DHS-type survey).[30] Canned foods consumed infrequently (fewer than 10 instances for total sample) were also categorized according to predominant ingredient. Frequently eaten mixed foods with the label ―canned" were categorized into food groups using approximated recipes as described above.

While the availability and consumption of fortified foods is increasing in the Philippines, only non-fortified food composition data are currently available. All calculated nutrient intakes in this study are therefore ―blind," i.e., they do not reflect to the presence of fortificants.[31]

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[28] Percentages were calculated for each individual and then averaged across the population. Percentages were rounded to 100 percent in cases where they exceeded. In cases where the original FCT showed 0 nutrient intake from a food group but calculated data showed intake, 0 intake was used. Rounding in this manner brought calculated values closer to original values and resolved most of the problems with the percentages.

[29] Personal communication from Paulita Duazo, who works closely with field workers at Office of Population Studies and is involved in coding dietary data. March 13, 2008

[30] Exceptions to this were two canned mixed foods that were rarely eaten (cream of chicken soup [2x] and cream of asparagus soup [4x]), which were classified into the dairy group. Other mixed foods that had small amounts of other ingredients and were rarely eaten (< 10 times by any study participant) were classified in food groups according to major ingredient.

[31] Folate values for grains are the notable exception to this. All folate values were obtained from other food composition tables. Bread values came almost exclusively from the USDA, and though care was taken to avoid breads labeled ―enriched," the resulting high folate values in the grain category likely are partially due to fortification.

6. Results

Results are provided in **Appendices 1-3**. **Appendix 1** presents results for all women (**Tables 1-20**), **Appendix 2** presents results for lactating women (**Tables L1-L20**) and **Appendix 3** presents results for NPNL women **(Tables N1-N20**). Results for lactating and NPNL women are the focus of discussion in the report, as clear differences in micronutrient adequacy and scores on the dietary diversity indicators were apparent between the two groups of women. Differences between lactating and NPNL women were tested for significance where relevant using Pearson's chi-squared test for categorical variables and T-tests for continuous variables. The non-parametric Kruskal-wallis (Kwallis) test was used for continuous comparisons when variables were not normally distributed (e.g., nutrient intakes) and is noted parenthetically when used.

6.1. CHARACTERISTICS OF WOMEN, AND ENERGY AND MACRONUTRIENT INTAKES

Summary characteristics of sample women appear in **Table 1**. Results for R2 are in **Appendix 4** (analogous to **Tables 1, 2** and **8**). **Table A4-1** is identical to **Table 1** because all women were included in the second round of dietary data collection.

Both mothers (age 35-49) and daughters (age 20-22) are represented in the lactating and NPNL subsamples. NPNL women were significantly older (N 35.9 years [y]; L 28.3 y; P<0.001), largely because mothers were less likely to be lactating (5 percent compared to 14 percent of daughters). In total, only 36 percent of NPNL women were daughters, compared with 64 percent of lactating women.

Women were generally of short stature (N 151.1 centimeters [cm]; L 150.2 cm) and moderate weight (N 52.8 g; L 49.4 g), although the range of body mass index (BMI) was wide. More than 15 percent of women were underweight (N 15.5 percent; L 15.6 percent) and more than 30 percent of women were overweight (N 32.1 percent; L 16.2 percent). Lactating women were slightly shorter than NPNL women (P=0.04) and weighed less (P<0.001).

Literacy is high in the Philippines (92.6 percent),[32] and women in this sample had completed eight-to-nine years of education on average. Lactating women had slightly less education than NPNL women (P=0.003).

Summaries of energy and macronutrient intakes are in **Table 2**. Reported median energy intakes were very low and were similar for both lactating and NPNL women (N 1,211.4 kcal; L 1,263.7 kcal; Kwallis P=0.54). Energy intakes were lower in the R2 of data collection for both groups of women (see **Table A4-2**) (N 1256.7; L 1276.1), possibly indicating respondent fatigue. As a result, R1 results were used for calculating diversity scores.

Given the low energy intakes reported, intakes of protein, carbohydrates and fat were also low. However, the proportion of total energy contributed by protein, carbohydrates and fat compared favorably with current WHO recommendations.[33] Protein contributed 14 percent to 16 percent of energy compared with the recommended 10 percent to 15 percent; fat contributed 15 percent to 20 percent compared with the recommended 15 percent to 30 percent; and carbohydrates contributed 65 percent to 70 percent compared with the recommended 55 percent to 75 percent.

Median protein intakes were not significantly different between lactating and NPNL women (N 44.6 g; L 42.5 g; Kwallis P=0.24), although lactating women ate more protein from plant sources (Kwallis P<0.001) and less animal protein (Kwallis P=0.01) than NPNL women.[34] Lactating women also consumed more

[32] CIA 2008.
[33] WHO/FAO 2003.
[34] The sum of animal and plant protein differs slightly from total protein because these were derived from estimated recipes rather than, as total protein, from the original food composition data. See the Methods section for further explanation of these two approaches.

carbohydrates (N 190.0; L 213.0 g; Kwallis P=0.001) and less fat (N 20.4 g; L 15.6 g; Kwallis P=0.003) than NPNL women.

6.2. DESCRIPTION OF DIETARY PATTERNS

Dietary patterns as measured by the eight dietary diversity indicators are depicted in **Tables 3-7**. **Tables 3a-d** show the percentage of women consuming the food groups that constitute each diversity indicator. Regardless of the number of food groups in the indicator or the women's physiological status (e.g., lactating or NPNL), all women in the sample ate grain products; a minimum intake requirement of 15 g did not alter this pattern. At the highest level of food group aggregation (6 food groups), the percentage of women consuming at least 15 g of each food group was similar for lactating and NPNL women: 13 percent of women consumed dairy, 94 percent consumed other animal-source foods, 30 percent consumed vitamin A-rich fruits and vegetables, and 26 percent of women consumed legumes/nuts. The only exception was the other fruits and vegetable group, which was consumed by 37 percent of lactating women and 46 percent of NPNL.

The 9 food group indicators subdivided other animal-source foods into the categories of organ meat and eggs (**Table 3b**: 9 groups) and again revealed no differences by physiological status. About 6 percent of women ate at least 15 g of organ meat, and 16 percent consumed 15 g or more of eggs. Vitamin A-rich fruits and vegetables were subdivided into the categories of dark green leafy vegetables and other vitamin A-rich fruits and vegetables, again with no significant difference in consumption by physiological status. Dark green leafy vegetables were the principal component of the vitamin A-rich fruits and vegetables category; about a quarter of women consumed at least 15 g of these foods, while <10 percent consumed 15 g of other vitamin A-rich fruits and vegetables.

The 21 food group indicators subdivided other animal-source foods into various categories, including beef/pork (e.g., beef, pork, lamb), poultry (e.g., chicken, turkey), large fish/shellfish and small fish with bones. The proportion of women eating meat from beef/pork (≥15 g: N 54 percent; L 41 percent; P=0.001) and poultry (≥15 g: N 18 percent; L 9 percent; P=0.003) was less among lactating women than among NPNL women. The proportion of women consuming fish was higher among lactating women than NPNL women, although only differences for small fish were statistically significant (≥15 g small fish: N 7 percent; L 11 percent; P=0.049); (≥15 g large fish: N 62 percent; L 67 percent; P=0.22).

The disaggregation of other food groups showed very little difference by physiological status. About 20 percent of women ate at least 15 g of starchy staples other than grains (≥15 g: N 22 percent; L 19 percent). Major foods in this category included potatoes, cassava and starchy bananas that are typically cooked. Consumption of vitamin C-rich vegetables was slightly higher for NPNL women, but differences were not significant (≥15 g: N 21 percent; L 16 percent; P=0.13).[35] Vitamin C-rich fruits were rarely consumed and were slightly more common among NPNL women (≥15 g: N 7 percent; L 3 percent; P=0.03).[36]

Tables 4a-d depict the mean g and energy intake for each food group for all women and for those who consumed the food group. Broad patterns are most visible for FGI-6 (**Table 4a**). For both lactating and NPNL women, grains and starches (usually white rice) provided the majority of total g and energy in the diet (N 73 percent of total g intake and 62 percent of kcal; L: 79 percent of g intake and 71 percent of kcal). The proportion of total g and energy represented by animal-flesh foods was also substantial (N 17 percent of g intake and 33 percent of kcal; L 13 percent of g intake and 23 percent of kcal). Combined, other food categories provided ~10 percent g intake and ~5 percent of kcal for both NPNL and lactating women.

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[35]The proportion of women who consumed vitamin C-rich vegetables is actually slightly higher than this as several of the dark green leafy vegetables met both the vitamin A and vitamin C-rich criteria, but were preferentially categorized as vitamin A-rich.
[36] Bananas were included in the starch group because of high caloric content, though they also met the cutoff for a vitamin C-rich fruit.

The beef/pork category was the major source of energy from animal-flesh foods for both lactating and NPNL women. Energy intake distributions from beef/pork were strongly right skewed for both lactating and NPNL women because women often ate very high-fat pork products (e.g., fried fatty ham, pork belly, sausages). In fact, the majority of energy contributed by the beef/pork category came from meats with > 50 percent fat by weight (N 62 percent of beef/pork kcal; L 56 percent of beef/pork kcal). Foods in the large fish/shellfish category were eaten more frequently and in slightly smaller amounts, but provided far less energy. The few women who ate poultry consumed more meat on average, and meats were less energy dense.

Ranges, means and medians for the eight dietary diversity indicators appear in **Table 5**. For the 6 food group indicators, lactating and NPNL women had diversity scores ranging from 2-6 when a 1 g minimum consumption requirement was used (FGI-6) and from 1-6 when a 15 g minimum consumption requirement was used (FGI-6R). FGI-9 was the only other indicator that achieved the highest possible diversity score (9), but that was only among NPNL women. For FGI-9R, the range fell to 1-7 for both lactating and NPNL women. For FGI-13 and FGI-21, NPNL women had somewhat higher ranges than lactating women. However, the range for FGI-13R was identical among the two groups (range 1-9), and the range for FGI-21R was very similar (L range 1-10; N range 1-11).

Table 6 shows that for each diversity indicator, there is a clustering of dietary diversity scores within the score range possible. The clustering of scores was tighter for indicators with fewer food groups and a 15 g minimum consumption requirement. The extent to which scores clustered did not vary by physiological status.

Cross-tabulations of dietary diversity scores and food groups show how diets diversity. The results for FGI-21R reveal the following pattern (**Table 7h**). Starchy staples were included first in the diet (at a dietary diversity score of 1) and were consumed by all women. Large fish/shellfish were added next to the diet by both groups of women (L 60 percent, N 54 percent). At a dietary diversity score of 3, beef/pork was most commonly added by both groups of women (L 33 percent, N 47 percent). Among lactating women, dry beans were also added (L 26 percent). At a score of 4, other vegetables were most often added (L 29 percent; N 24 percent). Among lactating women, vitamin A-rich dark green leafy vegetables (27 percent) and eggs (21 percent) were also commonly added and, among NPNL women, cooked dry beans (22 percent) and other starches (21 percent) were commonly added. At a score of 5, vitamin C-rich vegetables were common for both groups (L33 percent; N 29 percent). Other starches (38 percent) and small fish (21 percent) were also added by lactating women; and vitamin A-rich dark green leafy vegetables (33 percent), poultry (24 percent) and eggs (22 percent) were added by NPNL women. Milk, fruits and vitamin A-rich deep yellow/orange/red vegetables were the food groups most frequently added among the highest-scoring NPNL women. Neither group of women frequently ate the other food groups comprising FGI-21R (soy, cheese, nuts, organ meats and vitamin A-rich fruits).

6.3. DISTRIBUTIONS OF MICRONUTRIENT INTAKES AND FOOD GROUP DIVERSITY SCORE

Low micronutrient intakes were observed in our sample, resulting in skewed intake distributions (see **Figures 1-11**). The distributions of intra-individual SD of nutrient intakes were also skewed (see **Figures 12-22**). **Figures 23-30** show the score distributions for the various diversity indicators, which were closer to normally distributed despite being composed of a few discrete categories.

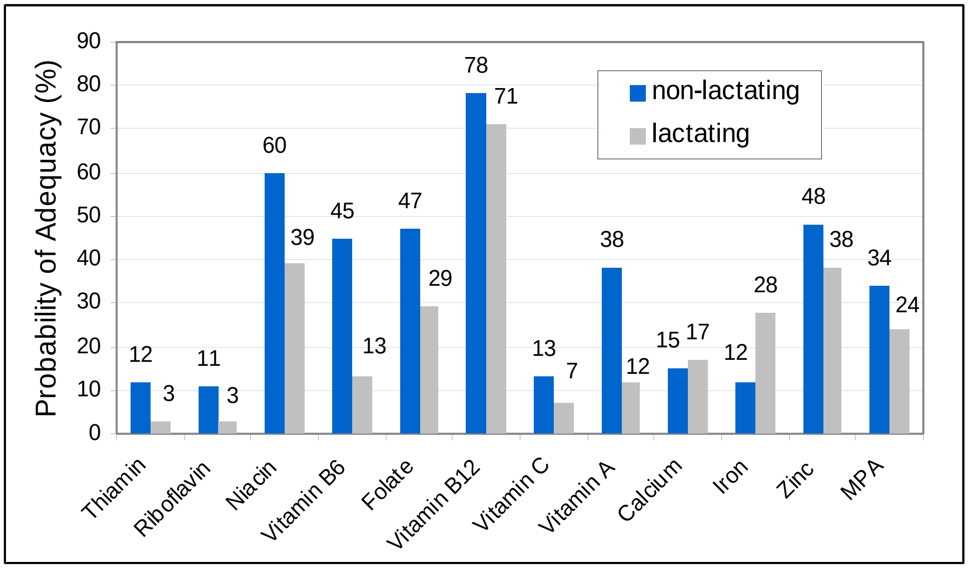
6.4. AVERAGE MICRONUTRIENT INTAKES AND PROBABILITY OF ADEQUACY

The mean and median intakes for the 11 micronutrients appear in **Table 8** with the corresponding PA. EARs specific to physiological status are also shown for reference.

With exception of niacin and folate, nutrient intakes of lactating and NPNL women were not significantly different. Niacin intake was somewhat lower (Kwallis P=0.04), and folate intake was somewhat higher

(Kwallis P=0.001) for lactating women, which corresponds to their slightly lower intake of animal-flesh foods and slightly higher intake of grain. The median intake of vitamin B12 was higher than the EAR for both groups of women. Median niacin intake exceeded the EAR for NPNL women and was not far below it for lactating women. The median intakes of vitamin B6, folate, vitamin A and zinc were slightly below corresponding EARs in NPNL women and in all cases fell well below the higher nutrient requirements of lactating women. The standard deviation for Vitamin A was notably high as 11 percent of women consumed organ meat, commonly chicken and pork liver (see **Table 4b**). All other median nutrient intakes were well below the EARs. Median nutrient intakes in R2 (**Tables A4-8**) were similar to R1 or lower. Among NPNL women differences in median intake between R1 and R2 were significant for thiamin, riboflavin, vitamin A, iron, zinc, vitamin B6 and folate. Among lactating women, the differences in median intake were not statistically significant for any nutrient. In R2, the median vitamin B12 and niacin intakes again exceeded the EARs for NPNL women and fell slightly below the EARs for lactating women. All other nutrient intakes were well below the EARs.

Figure A. Mean Probability of Adequacy for 11 Micronutrients



Distributions of probabilities of adequacy are shown in **Figures 31-41**. Distributions are in all cases right-skewed, similar to intake distributions. However, adequacy is truncated at 100 percent, and all individuals with very high nutrient intakes are clustered at 1, making distributions appear bimodal in many cases. This trend is strongly visible in the distributions of niacin, folate, vitamin B12 and zinc for both groups of women, as well as vitamins B6 and A among NPNL women.

For NPNL women, the PA (**Table 8** and **Figure A**) was high for vitamin B12 (78 percent) and niacin (60 percent); moderate for zinc (48 percent), folate (47 percent), vitamin B6 (45 percent) and vitamin A (38 percent); and very low (< 20 percent) for the remaining nutrients. For lactating women, the PA were generally very low (< 20 percent). Only the PA for vitamin B12 exceeded 50 percent, and only the PA for niacin (39 percent), zinc (38 percent), folate (29 percent) and iron (28 percent) exceeded 20 percent.

6.5. CONTRIBUTIONS OF FOOD GROUPS TO NUTRIENT INTAKES

The low energy intakes reported by this sample of women triggered concern that underreporting of intakes might have varied by food group. Food group contributions to individual nutrient intakes might therefore be misleading and are not presented here.[37]

[37] In other WDDP site reports, these results are presented in Table 9.

6.6. RELATIONSHIP BETWEEN DIVERSITY INDICATORS AND ESTIMATED INTAKES OF INDIVIDUAL MICRONUTRIENTS

Among NPNL women, all eight diversity indicators were positively and significantly correlated with all nutrient intakes except for FGI-6, which was not significantly correlated with vitamin B12 (**Table 10**). Correlations for each nutrient intake increased fairly steadily with the number of food groups in the indicators; correlations for FGI-6 were lowest and correlations for FGI-21 were highest in most cases (except vitamin C); correlations for FGI-9 and FGI-13 were not clearly different. In all cases correlations were increased with addition of the 15 g minimum requirement. Low correlations (less than 0.20) were more common for FGI-6, FGI-6R, FGI-9 and FGI-13 (occurred respectively for six of 11 micronutrient; three of 11; four of 11; and four of 11), while FGI-9R, FGI-13R and FGI-21 each had only two of 11 correlations less than 0.20. FGI-21R had no correlations less than 0.20; most were greater than 0.30.

Controlling for energy intake reduced the correlations for thiamin, niacin and vitamin B12 to non-significant or negative for many of the diversity indicators. However, most of the unadjusted correlations were already low. FGI-9R and FGI-13R performed relatively well, with no reversals in the direction of the correlation coefficient and only one nutrient (niacin) becoming non-significant after adjusting for energy intake. Among the eight indicators, FGI-21R performed best, retaining positive correlations and statistical significance for all nutrients.

Among lactating women, the diversity indicators performed more poorly. Correlations between the diversity indicators and nutrient intakes did not improve consistently with increasing disaggregation of food groups in the indicators. Many of the correlations observed for FGI-6, FGI-6R, FGI-9 and FGI-13 were less than 0.20. FGI-9R and FGI-13R each had three correlations less than 0.20. FGI-21R and FGI-21 were the only diversity indicators for which the correlations all 11 nutrient intakes were statistically significant. Most other indicators had at least three correlations that were not statistically significant. Of the eight indicators, FGI-21R again performed best, with only one correlation less than 0.20.

Adjustment for energy intake attenuated many correlations, and although many were already non-significant, many more became negative. This occurred particularly for correlations with thiamin, niacin and (rather than vitamin B12 as above) folate. The most robust correlations were observed for vitamins A and C, iron and zinc. With one exception (iron for FGI-6R), these nutrients all remained significantly correlated with each dietary diversity indicator after adjusting for energy. For FGI-21R, seven of the 11 correlations remained significant; after adjusting for energy, four became non-significant and one became negative.

6.7. RELATIONSHIP BETWEEN ENERGY FROM SPECIFIC FOOD GROUPS AND MEAN PROBABILITY OF ADEQUACY

The MPA, an average of the probabilities of adequacy across the 11 micronutrients, provides a useful summary of a diet's overall nutrient adequacy. Correlations between MPA and energy intakes from each food group reflect frequency and quantity of intake from each group, the nutrient density of foods consumed and the variability observed in MPA.

The distributions of MPA for NPNL and lactating women appear in **Figures N42** and **L42** (see also **Tables N8** and **L8**). MPA had a broader distribution for NPNL women, with a mean of 0.34 and a range extending from 0 to 0.94. For lactating women, the distribution mean was 0.24 and the range extended from 0 to 0.80. Both distributions were heavily right-skewed and were transformed to approximately normal distributions for correlation and linear regression analyses.

Tables 11a-d present the correlation of MPA with the energy intake contributed by each food group used in the diversity indicators. Correlations tended to be highest for the most aggregated food groups. For NPNL women, energy correlations with MPA were significant for all six food groups that constitute the most aggregated diversity indicator (**Table 11a**). Correlations ranged from 0.10 (vitamin A-rich fruits and vegetables) to 0.51 (other animal-source foods). Of the 21 food groups that constitute the most disaggregated diversity indicator (**Table 11d**), only the vitamin A-rich dark green leafy vegetables group was not significantly correlated with MPA. Aside from grains (0.43), correlations were best for animal-source foods (0.39 for beef/pork, 0.26 for fish, 0.23 for poultry, 0.19 for milk/yogurt, 0.18 for eggs). Correlations were consistently low for legumes (~0.10 for beans, soy and nuts) and various types of fruits and vegetables (range 0.02-0.16).

Among lactating women, correlations for the 6 food group indicator were of similar magnitude. The two lowest correlations (vitamin A-rich fruits and vegetables and other fruits and vegetables) did not achieve statistical significance, presumably because of the smaller sample size. For the 21 food group indicator, nearly all correlations were lower. Those above 0.20 were significant, including grains (0.56) and most animal-source foods (e.g., beef/pork) (0.31), large fish/shellfish (0.39) and milk/yogurt (0.34). Few other correlations reached statistical significance.

Partial correlations controlling for total energy intakes isolate the relationship of food groups to nutrient adequacy. Correlations that remain positive reflect increasing nutrient density with increasing energy intakes from the representative food group. For NPNL women (see **Tables N11a** and **N11d**), the beef/pork category became significantly negative after adjusting for total energy intake. Grains and grain products were no longer statistically significant. Other starchy staples, soy and soy products, vitamin C-rich vegetables and all other fruits were also attenuated and became non-significant. Correlations for both large and small fish, and vitamin-A rich dark green leafy vegetables were higher after adjusting for total energy intake, although the latter category did not reach statistical significance. Other correlations remained positive and significant after controlling for energy intake.

For lactating women, the correlations that remained significant included milk/yogurt, organ meat, large fish/shellfish and eggs. Correlations for beef/ pork and grains became negative and non-significant after adjusting for total energy intake. Starchy staples also became non-significant. The correlation for chicken/duck became significantly negative. The correlations for vitamin-A rich dark green leafy vegetables and all other fruits became slightly higher but not statistically significant.

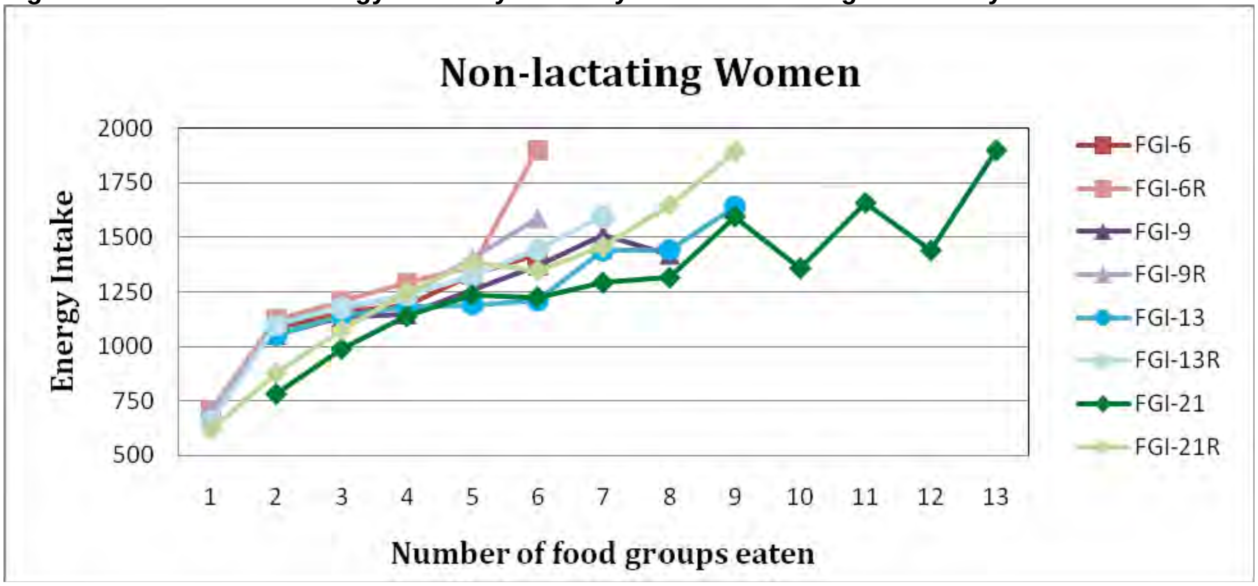
6.8. RELATIONSHIP BETWEEN DIVERSITY INDICATORS AND TOTAL ENERGY INTAKE

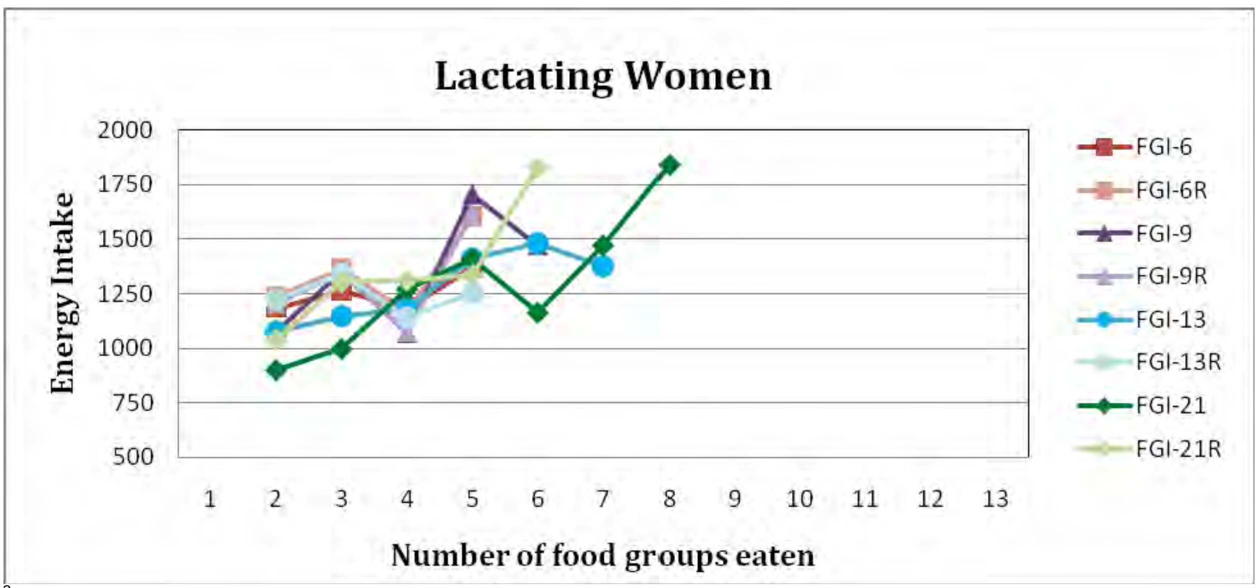
For all diversity indicators, median energy intake tended to increase with the number of food groups eaten (**Table 12** and **Figure B**). Compared with the 1 g indicator, median energy intake was higher at the corresponding score for the 15 g indicator.

Among NPNL women, correlations between the diversity indicators and total energy intake were low (most were between 0.17 and 0.24) but positive and significant for all indicators (see **Table N13**). Correlations were largest for indicators with the most food group disaggregation (FGI-21 and FGI-21R), and smallest for the most aggregated indicators (FGI-6 and FGI-6R). Correlations were slightly higher for the 15 g indicators in all cases.

Among lactating women, correlations with energy were also positive but were slightly lower. Correlations were, again, largest for FGI-21 and FGI-21R, and smallest for FGI-6 and FGI-6R. The correlation with FGI-6R was not significant and was slightly lower than with FGI-6. All other correlations were statistically significant.

Figure B. Median Total Energy Intake by Diversity Score Across Eight Diversity Indicators [a]





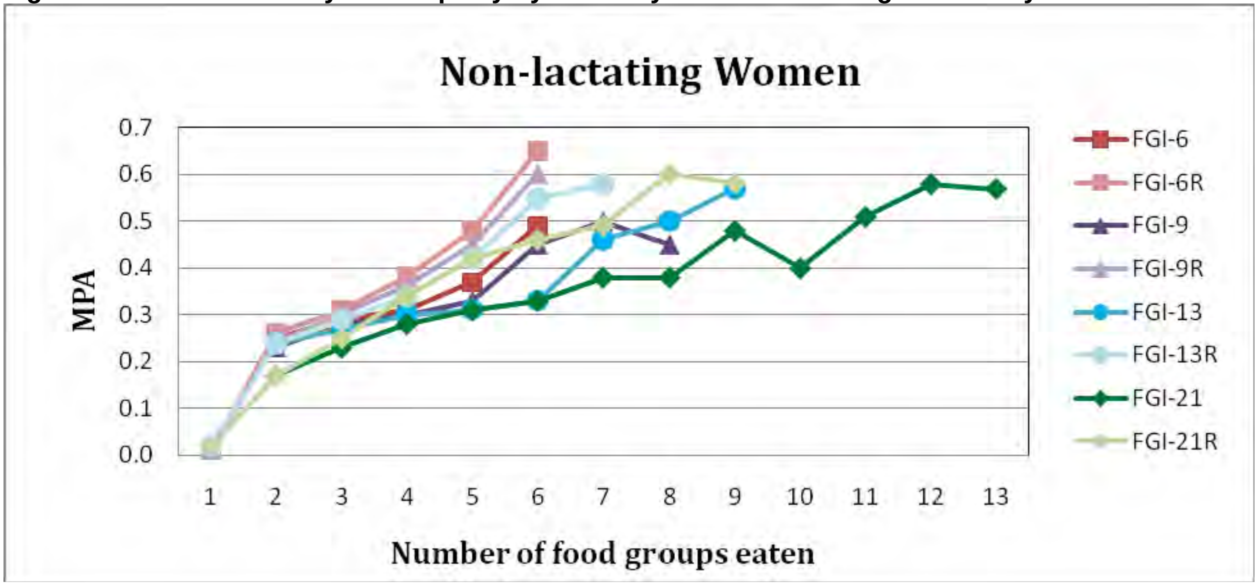
[a] Only scores with greater than 10 women are depicted.

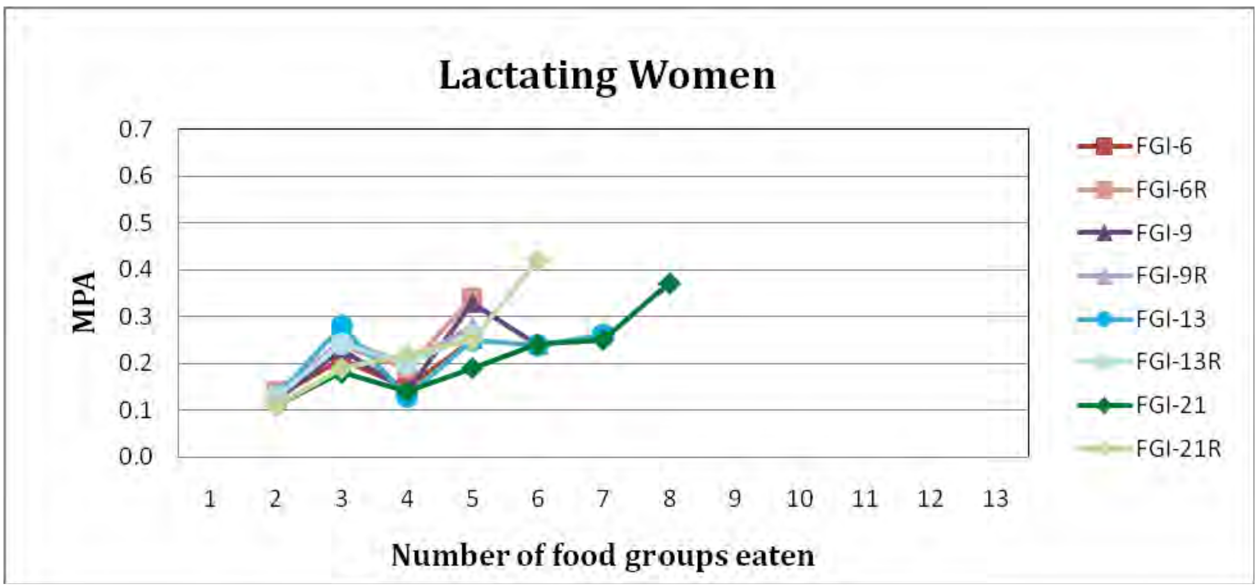
6.9. RELATIONSHIP BETWEEN DIVERSITY INDICATORS AND MEAN PROBABILITY OF ADEQUACY

Among NPNL women, MPA (**Table 14** and **Figure C**) increased consistently with dietary diversity scores across a respectable range (0.1 to ~0.60) for all eight indicators. At comparative score levels, MPA was similar or higher for indicators with the 15 g cutoff.

Among lactating women, MPA increased consistently with dietary diversity score only for FGI-21R. However, the total range of MPA observed across dietary diversity scores was reduced (0.1 to ~0.40), and MPA was not consistently higher for indicators with the 15 g cutoff.

Figure C. Mean Probability of Adequacy by Diversity Score Across Eight Diversity Indicators





All dietary diversity indicators were positively and significantly correlated with MPA (**Table 15**) for both groups of women. Among NPNL women, correlations ranged from 0.21 to 0.45. Correlations for FGI-9 and FGI-13 were very similar, whereas FGI-21 had somewhat higher correlations. This pattern persisted after controlling for total energy intake. In all cases, using the 15 g cutoff improved correlations.

Among lactating women, correlations were slightly lower but were consistently improved by using the 15 g cutoff. Correlations were highest for FGI-9R (r=0.32), FGI-13R (r=0.30) and FGI-21R (r=0.39). Partial correlations controlling for energy were also consistently improved with use of the 15 g cutoff.

Linear regressions models (**Table 16**) were used to evaluate whether the relationship between diversity indicators and MPA remained significant after accounting for the women's age and height. All diversity indicators were significant in these models among both NPNL and lactating women, and overall explanatory power of the models (adjusted R^2) was consistently increased when indicators used the 15 g cutoff. FGI-21R had the greatest explanatory power among both groups of women (N: adjusted R^2=0.24; L: adjusted R^2=0.21).

Inclusion of energy intake in these models tested whether the diversity indicators still had significant explanatory power after accounting for their correlations with energy. Among NPNL women, all indicators retained significance; in contrast, only indicators with a 15 g cutoff remained significant for lactating women. For both groups, the overall explanatory power of all models continued to be greatest for indicators when the 15 g cutoff was used. Among NPNL women, the adjusted R^2 value was highest for FGI-21R (adjusted R^2=0.55). Among lactating women, the adjusted R^2 value was similar for four indicators (FGI-21R: adjusted R^2=0.59; FGI-13R: adjusted R^2=0.60; FGI-9R: adjusted R^2=0.60; and FGI-6R: adjusted R^2=0.59).

7. Summary and Discussion

This study of women in metropolitan Cebu provides useful information for the improvement of simple dietary diversity indicators for use among women of reproductive age.

7.1. DIETARY PATTERNS

The diets of Cebu women were of very limited diversity. Diets were rice-based (rice was eaten 2.2 times daily, on average), but cornmeal was also eaten, along with a variety of other grain products (i.e., rice, corn, wheat products), including various commercial products (i.e., breads, crackers, cookies, noodles). Nearly all women regularly ate meats (**Table 3a**) (usually fish and often pork), but quantities were small and cuts of pork were often very fatty. A wide variety of other food items were also available including various fruits and vegetables, but these were eaten less regularly. Slightly less than half of women had eaten fruits or vegetables high in vitamin A in the past 24 hours, and only a third in quantities greater than 15 g. Fewer than half had consumed over 15 g of any other fruit or vegetable. Only a quarter had consumed 15 g or more of legumes, and fewer still had consumed dairy.

Dietary differences were observed between lactating and NPNL women. Fewer lactating women had eaten foods in the beef/pork and poultry categories in the preceding 24 hours. The two groups had both eaten fish with equal frequency, but lactating women had consumed somewhat larger amounts. Also, a greater percentage of lactating women had consumed dry beans and eggs than NPNL women. This resulted in lactating women consuming a diet with lower fat content (N: 20 percent energy from fat; L: 15 percent energy from fat). However, due to higher carbohydrate intakes, overall energy intake was similar between the two groups of women. Fewer lactating women had eaten vitamin C-rich fruits and vegetables, but slightly more had eaten vitamin A-rich dark green leafy vegetables, compared to NPNL women.

The difference in dietary patterns between NPNL women and lactating women might be related to socioeconomic and generational factors. Breastfeeding has been previously linked to low socioeconomic status in this sample, with poorer mothers tending to breastfeed much longer.[38] Also, lactating women were unevenly distributed between the two generations (mothers and daughters) and apparent dietary differences due to lactational status might actually be attributable to generational differences in eating habits. Future efforts to characterize micronutrient adequacy among lactating women should be contextualized by exploration of the factors driving their diet pattern differences.

Food groups that showed the most promise to increase the nutrient density of diets in this study sample were (in descending order) large fish/shellfish, milk/yogurt, organ meat, all other vegetables, vitamin C-rich fruits and eggs; greater consumption of these foods should be encouraged. It should be noted that these foods were identified based on the foods commonly consumed by this sample of women. Other nutrient dense foods might also wisely be encouraged. Energy from meats in the beef/pork group were also very highly correlated with MPA but became negative after controlling for total energy (indicating a low ability to improve nutrient density). This probably reflects the consumption of meats with high fat content. The consumption of leaner meats would also be likely to improve the nutrient density of the diet.

7.2. MICRONUTRIENT INTAKES AND ADEQUACY

In our sample of NPNL Filipino women, median intakes exceeded the EARs for only two of the 11 micronutrients (vitamin B12 and niacin) of focus for the WDDP. Four micronutrients were not far below the EARs (vitamin B6, folate, vitamin A and zinc), and five nutrients (thiamin, riboflavin, vitamin C, calcium and iron) were far below the EARs. Probabilities of adequacy mirrored these trends. NPNL and lactating women had similar intakes for all nutrients except niacin, which was slightly higher among lactating women, and folate, which was slightly lower among lactating women. In spite of similar nutrient intakes

[38] Daniels and Adair 2005.

among NPNL and lactating women, the PA was dramatically lower for lactating women for most nutrients (see **Figure A**). This is due to the increased nutrient requirements for women during lactation. For NPNL women, MPA was 0.34 for lactating women MPA was 0.24. The distribution of MPA was broader for NPNL women, and this increased variability provided a somewhat stronger platform for evaluating relationships between MPA and the dietary diversity indicators through correlations and linear regressions.

Estimates of nutrient intake in this analysis are likely to be conservative. Given the unusually low energy intakes reported in this sample (see **Section 5.5** for further discussion), it seems likely that actual nutrient intakes and probabilities of adequacy were underestimated.

7.3. FOOD GROUP DIVERSITY IN RELATION TO DIET QUALITY AND ENERGY INTAKE

In this study, the dietary diversity indicators correlated significantly with intakes of most micronutrients, although correlations were low to moderate. Niacin and vitamin B12 were poorly correlated with the indicators that had the most aggregated food groups. One important concept this analysis illustrates is that nutrients provided solely by one or two food groups will not be correlated with a dietary diversity indicator if there is no variation in the consumption of those food groups. Vitamin B12 came almost completely from animal-flesh foods (95 percent) and > 90 percent of niacin came from animal-flesh foods and starchy staples (**Table 9a**), both of which were ubiquitously consumed (**Table N3a**). Correlations improved slightly as animal-flesh foods were subdivided into multiple categories in the FGI-9 and FGI-13 food group indicators, and correlations were considerably better in the FGI-21 food group indicator, where animal-flesh foods were most disaggregated. The poultry, large fish and beef/pork categories in the FGI-21 food group indicator were consumed frequently and with variability. This pattern also explains why correlations improved steadily across **Table N10** for thiamin, riboflavin, vitamin B6 and iron (all of which were largely provided by meat and grains in our sample) and why correlations improved less for vitamins C and A, which were provided more by other food groups.

For both groups of women, all eight dietary diversity indicators were correlated positively and significantly with MPA (**Tables 15** and **16**). Among NPNL women, scores from indicators using the 15 g cutoff correlated more strongly with MPA than all 1 g scores (except FGI-21). Among lactating women, the difference was not as great, though indicators with the 15 g cutoff did show stronger correlations than those with the 1 g cutoff. Among the indicators with the 15 g consumption requirement, indicators with greater food group disaggregation correlated better with MPA. Among NPNL women, correlations for FGI-6R were lowest; FGI-9R and FGI-13R were similar (including similar explanatory power in regressions controlling for height and age); and FGI-21R had the strongest correlation with MPA (N: 0.45) and the best explanatory power in regressions. Among lactating women, similar patterns existed. Among NPNL women, median MPA by diversity scores (**Table 14** and **Figure C**) increased largely monotonically with the number of food groups consumed for each indicator. This shows that these diversity indicators might have potential for distinguishing groups of women with different levels of micronutrient adequacy. Indicators showed less promise among lactating women, as graphs of median MPA by diversity score were not clearly monotonic among indicators, and correlations were lower.

Ideally, a higher score for a dietary diversity indicator reflects increased dietary nutrient density and not just greater food intakes. A significant relationship between MPA and a dietary diversity indicator after controlling for energy intake is evidence that this is occurring. Use of the 15 g cutoff proved to be an important innovation toward this end. For these indicators, correlations with MPA persisted after energy adjustment (see partial correlations, **Table 15**). Among lactating women, the 15 g indicator was critical to indicator performance: Apart from FGI-9, only indicators with the 15 g cutoff remained significantly correlated with MPA after energy adjustment.

The ability of dietary diversity indicators to reflect nutrient density was also confirmed in regression models. In a post hoc analysis for NPNL women, explanatory power was lower (compared to all models in **Table N16**) for an identical model containing energy, women's age, and height but not diversity scores (adjusted R^2= 0.508). However, the variance explained by this model was only 5 percentage points lower than a model which also included FGI-21 R, the diversity indicator most strongly correlated with MPA (adjusted R^2= 0.552). In other words, the dietary diversity indicators have some explanatory power attributable to nutrient density, but their reflection of quantities of food eaten accounts for the greater part of their relationship with MPA.

7.4. IMPLICATIONS FOR FUTURE DIVERSITY SCORES

Simple dietary diversity indicators have the potential to provide valuable information about dietary patterns and nutrient intake among populations. This analysis demonstrated some alterations to the construction of typical diversity indicators that might improve their validity for use in household surveys.

Indicators using the 15 g cutoff were better suited to represent a diet's micronutrient adequacy. Not only were the 15 g indicators more strongly correlated with MPA, but they remained more correlated after energy adjustment, demonstrating a stronger link to nutrient density. However, consumption cutoffs characterized by exact g amounts might not be practical in field settings. Other approaches for approximating a 15 g consumption minimum should be evaluated, such as excluding condiments and spices or asking whether a small and common volume amount of the food (such as a tablespoon) was consumed.

In this study, we found that the dietary diversity indicators were not sensitive to nutrients confined to one food group, if that food group was consumed ubiquitously. For populations such as Cebu women, where some type of meat is eaten by all, disaggregation of animal-source foods into a few commonly eaten (but not ubiquitous) food groups can greatly improve the indicators' sensitivity to nutrients such as B12 and niacin, which are most abundant in those foods. Subcategories of other frequently eaten foods would also be useful, if they were particularly tailored to capture the nutrient of interest. From this we also see that a diversity indicator aiming to detect adequacy of intake for several nutrients might need to be tailored to the known dietary patterns and nutrient-rich foods available and consumed in an area. This is not likely to be practical for widely administered surveys such as the DHS, which must maintain comparability across regions. However, it might be useful in smaller studies for regional and longitudinal comparisons. Also, indicators focused on a few micronutrients of concern in an area (rather than overall diet quality) could be similarly tailored and might be more informative for potential interventions.

In this sample, the relationship evaluated between the dietary diversity indicators, nutrient intakes and MPA was stronger for NPNL women than lactating women. This was partially due to the smaller sample of lactating women and the corresponding lower power. Also, nutrient intakes of lactating women were similar to NPNL women, but nutrient requirements are much higher. This resulted in somewhat narrower ranges of adequacy (NPNL MPA median 0.32, range [0 to 0.94]; lactating MPA median 0.20, range [0 to 0.80]) and might have attenuated correlations slightly. Given the likelihood of narrower adequacy ranges for these women, indicators must be increasingly sensitive. Separate indicators developed with greater focus on key nutrients in pregnancy and lactation might be more helpful for assessing the micronutrient adequacy of the diet among these populations.

7.5. GENERALIZABILITY

The low energy intakes in our sample are difficult to explain. Clearly, reported intakes are much lower than is biologically plausible. NPNL women in our sample had an average BMI of 23.1 and reported consuming a mean of 1,367 kcal. In the US, estimated energy requirements for sedentary women with the age and height set at the mean for our NPNL sample (age=36 years; height=150 cm) are 1,583 kcal/d for women with a BMI of 18.5 and 1,720 kcal/d for a BMI of 24.99.[39]

Although comparable data are difficult to find, reported intakes are also lower than in at least one other sample of Filipino women. FNRI's 2003 National Nutrition survey estimated energy intakes of 1,759 kcal for a national sample of lactating women, based on two non-consecutive 24-h recalls (FNRI, 2008) (see **Table B**). CLHNS is, on average, 19 percent lower, and differences are non-uniform across nutrients.

[39] IOM 2002; IOM 2005.

Table B. Mean Nutrient Intakes for Lactating Women in Two Philippine Samples [a]

Nutrients	CLHNS	FNRI	CLHNS as a % of FNRI
Energy (kcal)	1,367.4	1,759	77.7%
Protein (g)	49.7	57.6	86.3%
Iron (mg)	10.5	9.6	109.4%
Calcium (g)	0.37	0.41	90.2%
Vitamin A (mcg RE)	405.2	500.2	81.0%
Thiamin (mg)	0.57	0.92	62.0%
Riboflavin (mg)	0.61	0.77	79.2%
Niacin (mg)	14.1	21	67.1%
Vitamin C (mg)	36.3	49	74.1%

[a] Both samples are based on two non-consecutive 24-h recalls.

Possible explanations for lower intakes in the CLHNS data could include the exclusion of liquid components of dishes from intake data collection (see description in the Methods section above) and respondent fatigue. OPS personnel administering the project have indicated that liquid components of dishes are minimal and of negligible nutritional importance and suggested that respondent fatigue is a more likely cause of low energy intakes due to the duration and repetition of the survey.[40] OPS personnel also indicated there might be a greater likelihood of underreporting among physically larger women.[41] However, in post hoc analysis, BMI values of women reporting low intakes (<9 x basal metabolic rate [BMR]) were normally distributed around the sample mean, which does not support this hypothesis.

Inaccurate estimations of dietary fat intake are another possible cause of low energy intakes, as fat intakes were not directly measured but estimated based on the amount and type of food consumed and cooking method used. Energy intakes from fat were generally low (L: 15 percent, N: 20 percent) in spite of the high intake of fatty meats, which supports this hypothesis. However, this is unlikely to be the only cause of underestimation because this would result in energy intakes that were proportionately lower than nutrient intakes, which was the case for some but not all nutrients.

There does appear to be an age-related reporting bias in the sample relative to energy intake, although the cause of this is unclear. Underreporting of intakes appears to be greater among mothers: 56 percent of mothers vs. 27 percent of daughters reported an intake less than 9 x BMR before exclusions. Among our analyzed sample, average reported intakes were 1,232 kcal/day for mothers and 1,523 kcal/day for daughters; however BMI was higher among mothers (mean BMI = 24.7 for mothers, 20.4 for daughters). In addition, reported energy intakes were lower for daughters in 2005 than they were in 2002. Eckhardt cited an average intake of 1,777±762 kcal/day (kcal/d) for sample girls at 18.5 years old.[42] Estimates were also somewhat lower for mothers in 2005 than previously (NPNL 1,444 ± 26; lactating 1,335 ± 22).[43] Differences in survey exposure are unlikely to explain this trend: While mothers had participated in the dietary survey a few more times than daughters,[44] daughters had been included in the dietary survey in all rounds conducted in the last 10 years.

Low reported intakes posed a serious challenge to accurately estimating micronutrient adequacy and MPA in this analysis. Adequacy is likely to be higher in this sample; therefore this analysis is conservative and unlikely to underestimate actual needs. In spite of this problem, the sample remains useful for

[40] Personal communication from Paulita Duazo, who works closely with field workers at OPS and is involved in coding dietary data. May 17, 2008.

[41] Personal communication from Connie Gultiano, Former Director, Office of Population Studies, Cebu, Philippines. June 23, 2008.

[42] Eckhardt, Suchindran et al. 2005.

[43] Bisgrove and Popkin 1996.

[44] Mothers participated during pregnancy, at two, six and 14 months postpartum, and in 1991. Daughters began reporting their own diets in 1994 with assistance. Both reported intakes in 1998, 2002 and 2005.

evaluating the relationship between simple dietary diversity indicators and micronutrient adequacy (in terms of correlations and regressions), since both diversity scores and adequacy assessments were based on the same reported intakes.

Strengths of the dataset include the large sample size, a wide range of ages (two generations) and a wide variety of foods consumed. The study evaluated the micronutrient adequacy and diversity of the diet using the most current methods and evaluated the relationship between these measures of diet quality using multiple analysis procedures.

8. Conclusions

These results from Metropolitan Cebu revealed very low intakes of many micronutrients among women of reproductive age. Despite the high likelihood of underreporting, intakes for a range of nutrients are likely to be inadequate; even if intakes doubled, many probabilities of adequacy would still fall short of desired levels. Intakes of thiamin, riboflavin, vitamin C, calcium and iron were far below the EARs, and interventions to increase these nutrient intakes are especially needed. Public health messages encouraging greater consumption of whole grains, dairy and fresh fruits should be considered. Intakes of several other nutrients were also low. Only vitamin B12 and niacin intakes were near the EARs. Given this, broad messages about the importance of dietary variety might also be useful.

Lactating women in our sample had much lower probabilities of nutrient adequacy than NPNL women, in large part because of their increased requirements. Previously studies have demonstrated lower socioeconomic status among lactating women in this cohort, which further underscores the magnitude of risk in this subsample of women. Interventions might be needed to increase the availability of nutrient-dense foods to this subset of women, as well as improving the visibility of health foods.

This analysis supports the use of simple dietary diversity indicators as promising tools for assessing the micronutrient adequacy of the diet among women of reproductive age in developing countries. Positive relationships with MPA were the result of clear and significant individual relationships of the dietary diversity indicators with each of several micronutrients. These correlations were in most cases robust to energy adjustment, supporting a relationship between indicators and dietary nutrient density. When nutrient intakes were not closely related to all dietary diversity indicators, clear reasons for this were apparent. Findings also support the potential for improving indicator performance through the use of minimum intake requirements and careful selection of representative food groups.

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Appendix 1. Tables and Figures, All Women

Table 1. Description of Sample, All Women, R1

	n	Mean	SD	Median	Range
Age (year)	2045	34.8	11.6	41.0	20.0-49.0
Height (cm)	2045	151.0	5.2	150.8	132.7-168.8
Weight (kg)	2045	52.4	10.7	51.0	29.7-105.0
BMI	2045	23.0	4.4	22.4	13.4-41.9
Education[a]	2045	9.02	3.6	10	1-18
% Literate[b]	2045	96.6			
% Lactating	2045	8.2			
% Pregnant	2045	3.9			
	n	**Percent**			
BMI < 16	44	2.2			
BMI 16-16.9	69	3.4			
BMI 17-18.49	199	9.7			
BMI 18.5-24.9	1,112	54.4			
BMI 25-29.9	477	23.3			
BMI ≥ 30	144	7.0			

[a] Years of schooling completed.
[b] Percent completing 3rd grade.

Table 2. Energy and Macronutrient Intakes, All Women, R1

	Mean	SD	Median	Range	Percent of kcal
Energy (kcal)	1,346.0	627.3	1,219.4	334.0-4,155.0	
Protein (g)	51.9	31.4	44.4	7.3-299.6	16
Animal source (g)	34.6	29.8	26.7	0.0-280.5	10
Plant source (g)	17.5	8.5	16.0	1.6-59.7	6
Total carbohydrate (g)	207.9	87.9	192.7	22.9-641.0	65
Total fat (g)	1.0	0.0	1.0	1.0-1.0	1

Table 3a. Percent of Women Who Consumed 6 Major Food Groups, All Women, R1

	≥ 1 g	≥ 15 g
All starchy staples	100	100
All legumes and nuts	41	26
All dairy	26	13
Other animal source foods	100	94
Vitamin A-rich fruits and vegetables [a]	46	30
Other fruits and vegetables	63	46

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table 3b. Percent of Women Who Consumed 9 Sub-Food Groups, All Women, R1

	≥ 1 g	≥ 15 g
All starchy staples	100	100
All legumes and nuts	41	26
All dairy	26	13
Organ meat	11	6
Eggs	26	16
Flesh foods and other miscellaneous small animal protein	99	93
Vitamin A-rich dark green leafy vegetables [a]	30	23
Other vitamin A-rich vegetables and fruits [a]	22	9
Other fruits and vegetables	63	46

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table 3c. Percent of Women Who Consumed 13 Sub-Food Groups, All Women, R1

	≥ 1 g	≥ 15 g
All starchy staples	100	100
All legumes and nuts	41	26
All dairy	26	13
Organ meat	11	6
Eggs	26	16
Small fish eaten whole with bones	12	8
All other flesh foods and miscellaneous small animal protein	98	90
Vitamin A-rich dark green leafy vegetables [a]	30	23
Vitamin A-rich deep yellow/orange/red vegetables [a]	19	6
Vitamin C-rich vegetables [b]	36	20
Vitamin A-rich fruits [a]	3	3
Vitamin C-rich fruits [b]	8	7
All other fruits and vegetables	49	29

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.
[b] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table 3d. Percent of Women Who Consumed 21 Sub-Food Groups, All Women, R1

	≥ 1 g	≥ 15 g
Grains and grain products	100	100
All other starchy staples	30	22
Cooked dry beans and peas	32	24
Soybeans and soy products	17	1
Nuts and seeds	2	2
Milk/yogurt	20	11
Cheese	7	2
Beef, pork, veal, lamb, goat, game meat	62	53
Organ meat	11	6
Chicken, duck, turkey, pigeon, guinea hen, game birds	19	17
Large whole fish/dried fish/shellfish and other seafood	80	62
Small fish eaten whole with bones	12	8
Insects, grubs, snakes, rodents and other small animal	0	0
Eggs	26	16
Vitamin A-rich dark green leafy vegetables [a]	30	23
Vitamin A-rich deep yellow/orange/red vegetables [a]	19	6
Vitamin C-rich vegetables [b]	36	20
All other vegetables	47	28
Vitamin A-rich fruits [a]	3	3
Vitamin C-rich fruits [b]	8	7
All other fruits	7	2

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.
[b] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table 4a. Summary of Food Group Intake (FGI-6) for All Women, for All R1 Observation Days and for Days When the Food Was Consumed

	All (n = 2,045)					Among those who consume			
Food group	Mean amount (g)	Mean energy (kcal)	Median amount (g)	Median energy (kcal)	Percent consuming	Mean amount (g)	Mean energy (kcal)	Median amount (g)	Median energy (kcal)
All starchy staples	531.3	759.2	490.0	695.5	100	531.3	759.2	490.0	695.5
All legumes and nuts	16.3	20.5	0.0	0.0	41	40.1	50.3	26.6	22.2
All dairy	6.4	16.8	0.0	0.0	26	24.9	65.7	12.3	42.2
Other animal source foods	121.7	388.0	98.3	236.4	100	122.2	389.7	99.9	239.3
Vitamin A-rich fruits and vegetables [a]	16.9	9.3	0.0	0.0	46	36.4	20.0	22.5	11.2
Other fruits and vegetables	31.8	16.1	10.0	4.7	63	50.7	25.7	29.7	11.7

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table 4b. Summary of Food Group Intake (FGI-9) for All Women, for All R1 Observation Days and for Days When the Food Was Consumed

	All (n = 2,045)					Among those who consume			
Food group	Mean amount (g)	Mean energy (kcal)	Median amount (g)	Median energy (kcal)	Percent consuming	Mean amount (g)	Mean energy (kcal)	Median amount (g)	Median energy (kcal)
All starchy staples	531.3	759.2	490.0	695.5	100	531.3	759.2	490.0	695.5
All legumes and nuts	16.3	20.5	0.0	0.0	41	40.1	50.3	26.6	22.2
All dairy	6.4	16.8	0.0	0.0	26	24.9	65.7	12.3	42.2
Organ meat	3.7	6.8	0.0	0.0	11	34.3	64.2	20.0	21.8
Eggs	8.2	12.6	0.0	0.0	26	31.3	48.2	20.0	32.2
Flesh foods and other miscellaneous small animal protein	109.8	368.5	85.0	214.5	99	110.6	371.0	85.9	217.6
Vitamin A-rich dark green leafy vegetables [a]	10.1	5.3	0.0	0.0	30	33.5	17.6	22.9	12.6
Other vitamin A-rich vegetables and fruits [a]	6.8	4.0	0.0	0.0	22	31.1	18.2	10.0	5.1
Other fruits and vegetables	31.8	16.1	10.0	4.7	63	50.7	25.7	29.7	11.7

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table 4c. Summary of Food Group Intake (FGI-13) for All Women, for All R1 Observation Days and for Days When the Food Was Consumed

Food group	All (n = 2,045)					Among those who consume			
	Mean amount (g)	Mean energy (kcal)	Median amount (g)	Median energy (kcal)	Percent consuming	Mean amount (g)	Mean energy (kcal)	Median amount (g)	Median energy (kcal)
All starchy staples	531.3	759.2	490.0	695.5	100	531.3	759.2	490.0	695.5
All legumes and nuts	16.3	20.5	0.0	0.0	41	40.1	50.3	26.6	22.2
All dairy	6.4	16.8	0.0	0.0	26	24.9	65.7	12.3	42.2
Organ meat	3.7	6.8	0.0	0.0	11	34.3	64.2	20.0	21.8
Eggs	8.2	12.6	0.0	0.0	26	31.3	48.2	20.0	32.2
Small fish eaten whole with bones	3.5	4.7	0.0	0.0	12	28.6	38.7	20.0	24.4
All other flesh foods and miscellaneous small animal protein	106.3	363.7	80.0	209.9	98	108.2	370.3	82.5	217.6
Vitamin A-rich dark green leafy vegetables [a]	10.1	5.3	0.0	0.0	30	33.5	17.6	22.9	12.6
Vitamin A-rich deep yellow/orange/red vegetables [a]	2.4	1.2	0.0	0.0	19	12.5	6.1	9.3	4.4
Vitamin C-rich vegetables [b]	8.2	2.5	0.0	0.0	36	22.5	6.9	20.0	4.8
Vitamin A-rich fruits [a]	4.4	2.8	0.0	0.0	3	144.7	92.5	120.0	70.4
Vitamin C-rich fruits [b]	10.6	7.0	0.0	0.0	8	133.8	88.6	80.0	67.9
All other fruits and vegetables	13.0	6.6	0.8	0.7	49	26.4	13.4	20.0	9.1

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.
[b] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table 4d. Summary of Food Group Intake (FGI-21) for All Women, for All R1 Observation Days and for Days When the Food Was Consumed

Food group	All (n = 2,045)					Among those who consume			
	Mean amount (g)	Mean energy (kcal)	Median amount (g)	Median energy (kcal)	Percent consuming	Mean amount (g)	Mean energy (kcal)	Median amount (g)	Median energy (kcal)
Grains and grain products	515.1	734.6	475.0	667.8	100	515.1	734.6	475.0	667.8
All other starchy staples	16.2	24.6	0.0	0.0	30	53.7	81.7	39.6	41.2
Cooked dry beans and peas	14.2	17.2	0.0	0.0	32	45.0	54.3	36.3	26.6
Soybeans and soy products	1.1	1.1	0.0	0.0	17	6.9	6.4	4.8	4.2
Nuts and seeds	0.9	2.3	0.0	0.0	2	46.5	92.6	25.0	74.6
Milk/yogurt	5.7	14.8	0.0	0.0	20	27.9	72.3	15.0	50.8
Cheese	0.7	2.0	0.0	0.0	7	9.7	29.5	6.0	17.8
Beef, pork, veal, lamb, goat, game meat	49.7	253.2	20.0	83.1	62	80.4	409.6	60.0	252.7
Organ meat	3.7	6.8	0.0	0.0	11	34.3	64.2	20.0	21.8
Chicken, duck, turkey, pigeon, guinea hen, game birds	19.0	50.5	0.0	0.0	19	99.2	264.3	80.0	226.0
Large whole fish/dried fish/shellfish and other seafood	37.6	60.0	22.5	37.0	80	46.9	74.8	40.0	53.8
Small fish eaten whole with bones	3.5	4.7	0.0	0.0	12	28.6	38.7	20.0	24.4
Insects, grubs, snakes, rodents and other small animal	0.0	0.0	0.0	0.0	0	–	–	–	–
Eggs	8.2	12.6	0.0	0.0	26	31.3	48.2	20.0	32.2
Vitamin A-rich dark green leafy vegetables [a]	10.1	5.3	0.0	0.0	30	33.5	17.6	22.9	12.6
Vitamin A-rich deep yellow/orange/red vegetables [a]	2.4	1.2	0.0	0.0	19	12.5	6.1	9.3	4.4
Vitamin C-rich vegetables [b]	8.2	2.5	0.0	0.0	36	22.5	6.9	20.0	4.8
All other vegetables	10.9	4.5	0.5	0.4	47	23.3	9.5	20.0	7.3
Vitamin A-rich fruits [a]	4.4	2.8	0.0	0.0	3	144.7	92.5	120.0	70.4
Vitamin C-rich fruits [b]	10.6	7.0	0.0	0.0	8	133.8	88.6	80.0	67.9
All other fruits	2.1	2.1	0.0	0.0	7	30.4	31.0	5.7	13.2

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.
[b] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table 5. Diversity Scores for Various Diversity Indicators, All Women, R1

Indicator	Number of food groups and level	Mean	SD	Median	Range
FGI-6	6 major food groups	3.8	1.2	4.0	2-6
FGI-6R [a]	6 major food groups	3.1	1.0	3.0	1-6
FGI-9	9 food subgroups	4.2	1.5	4.0	2-9
FGI-9R [a]	9 food subgroups	3.3	1.1	3.0	1-7
FGI-13	13 food subgroups	4.6	1.8	4.0	2-11
FGI-13R [a]	13 food subgroups	3.5	1.3	3.0	1-9
FGI-21	21 food subgroups	5.7	2.4	5.0	2-15
FGI-21R [a]	21 food subgroups	4.1	1.6	4.0	1-11

[a] "R" indicates that at least 15 g must be consumed in order for the food group/subgroup to ―count" in the score.

Table 6. Percent of Observation Days at Each Food Group Diversity Score, All Women, R1

Number of food groups eaten	Diversity indicators							
	FGI-6	FGI-6R	FGI-9	FGI-9R	FGI-13	FGI-13R	FGI-21	FGI-21R
1	0	2	0	2	0	2	0	2
2	17	32	14	26	13	25	6	12
3	25	33	21	32	18	30	12	25
4	30	25	27	25	21	22	17	26
5	20	8	20	11	19	13	18	17
6	8	1	11	3	14	6	15	9
7			6	1	9	2	11	6
8			2	0	4	0	8	2
9			0	0	2	0	5	1
10					0	0	3	0
11					0	0	2	0
12					0	0	1	0
13					0	0	1	0
14							0	0
15							0	0
16							0	0
17							0	0
18							0	0
19							0	0
20							0	0
21							0	0

Table 7a. Percent of Observation Days on Which Different Food Groups Were Consumed, By Food Group Diversity Score, All Women, R1 (FGI-6 - 1 g Minimum)

	Number of food groups eaten					
	1	**2**	**3**	**4**	**5**	**6**
Percent (number) of observation days at each diversity score	0 (0)	17 (355)	25 (520)	30 (610)	20 (399)	8 (161)
Food groups	**Percent of observation days on which each food group was consumed**					
All starchy staples	–	100	100	100	100	100
All legumes and nuts	–	0	27	40	72	100
All dairy	–	0	15	18	43	100
Other animal source foods	–	100	99	100	100	100
Vitamin A-rich fruits and vegetables [a]	–	0	19	56	87	100
Other fruits and vegetables	–	0	40	86	98	100

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table 7b. Percent of Observation Days on Which Different Food Groups Were Consumed, By Food Group Diversity Score, All Women, R1 (FGI-6R - 15 g Minimum)

	Number of food groups eaten					
	1	**2**	**3**	**4**	**5**	**6**
Percent (number) of observation days at each diversity score	2 (30)	32 (652)	33 (672)	25 (508)	8 (169)	1 (14)
Food groups	**Percent of observation days on which each food group was consumed**					
All starchy staples	100	100	100	100	100	100
All legumes and nuts	0	1	30	36	78	100
All dairy	0	1	10	19	43	100
Other animal source foods	0	94	93	99	99	100
Vitamin A-rich fruits and vegetables [a]	0	1	22	61	82	100
Other fruits and vegetables	0	3	45	85	98	100

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table 7c. Percent of Observation Days on Which Different Food Groups Were Consumed, By Food Group Diversity Score, All Women, R1 (FGI-9 - 1 g Minimum)

	Number of food groups eaten								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Percent (number) of observation days at each diversity score	0 (0)	14 (287)	21 (432)	27 (548)	20 (403)	11 (214)	6 (119)	2 (38)	0 (4)
Food groups	**Percent of observation days on which each food group was consumed**								
All starchy staples	–	100	100	100	100	100	100	100	100
All legumes and nuts	–	0	25	33	61	69	92	100	100
All dairy	–	0	14	15	31	53	86	100	100
Organ meat	–	0	3	6	8	17	58	71	100
Eggs	–	0	13	21	38	59	47	79	100
Flesh foods and other miscellaneous small animal protein	–	99	98	100	100	100	100	100	100
Vitamin A-rich dark green leafy vegetables [a]	–	0	12	39	43	53	33	58	100
Other vitamin A-rich vegetables and fruits [a]	–	0	7	10	27	52	85	92	100
Other fruits and vegetables	–	0	28	77	93	97	100	100	100

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table 7d. Percent of Observation Days on Which Different Food Groups Were Consumed, By Food Group Diversity Score, All Women, R1 (FGI-9R - 15 g Minimum)

	Number of food groups eaten								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Percent (number) of observation days at each diversity score	2 (31)	26 (530)	32 (659)	25 (514)	11 (234)	3 (66)	1 (11)	0 (0)	0 (0)
Food groups	**Percent of observation days on which each food group was consumed**								
All starchy staples	100	100	100	100	100	100	100	–	–
All legumes and nuts	0	2	24	34	56	80	100	–	–
All dairy	0	1	8	15	34	44	64	–	–
Organ meat	0	0	5	7	15	21	27	–	–
Eggs	0	0	15	19	37	58	73	–	–
Flesh foods and other miscellaneous small animal protein	0	91	92	97	97	100	100	–	–
Vitamin A-rich dark green leafy vegetables [a]	0	2	14	41	49	61	64	–	–
Other vitamin A-rich vegetables and fruits [a]	0	0	5	11	25	39	73	–	–
Other fruits and vegetables	0	4	37	76	87	97	100	–	–

[a] Vitamin A-rich fruits and vegetables are defined as those with >≥ 120 RE/100 g as eaten.

Table 7e. Percent of Observation Days on Which Different Food Groups Were Consumed, By Food Group Diversity Score, All Women, R1 (FGI-13 - 1 g Minimum)

	Number of food groups eaten												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Percent (number) of observation days at each diversity score	0 (0)	13 (263)	18 (375)	21 (422)	19 (379)	14 (281)	9 (189)	4 (84)	2 (43)	0 (8)	0 (1)	0 (0)	0 (0)
Food groups	**Percent of observation days on which each food group was consumed**												
All starchy staples	–	100	100	100	100	100	100	100	100	100	100	–	–
All legumes and nuts	–	0	26	33	46	63	66	83	98	100	100	–	–
All dairy	–	0	15	15	25	30	60	74	93	88	100	–	–
Organ meat	–	0	4	6	7	12	32	39	44	88	0	–	–
Eggs	–	0	12	20	28	42	50	57	77	75	100	–	–
Small fish eaten whole with bones	–	1	8	14	14	16	16	20	16	50	0	–	–
All other flesh foods and miscellaneous small animal protein	–	98	97	98	98	99	100	100	100	100	100	–	–
Vitamin A-rich dark green leafy vegetables [a]	–	0	13	31	42	45	42	50	61	88	100	–	–
Vitamin A-rich deep yellow/orange/red vegetables [a]	–	0	4	8	13	28	58	73	81	75	100	–	–
Vitamin C-rich vegetables [b]	–	0	6	24	49	68	69	77	93	88	100	–	–
Vitamin A-rich fruits [a]	–	0	4	2	3	4	3	6	5	13	100	–	–
Vitamin C-rich fruits [b]	–	0	5	7	6	11	13	20	33	38	100	–	–
All other fruits and vegetables	–	0	8	43	68	81	91	100	100	100	100	–	–

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.
[b] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table 7f. Percent of Observation Days on Which Different Food Groups Were Consumed, By Food Group Diversity Score, All Women, R1 (FGI-13R - 15 g Minimum)

	Number of food groups eaten												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Percent (number) of observation days at each diversity score	2 (35)	25 (515)	30 (606)	22 (456)	13 (271)	6 (115)	2 (38)	0 (7)	0 (2)	0 (0)	0 (0)	0 (0)	0 (0)
Food groups	**Percent of observation days on which each food group was consumed**												
All starchy staples	100	100	100	100	100	100	100	100	100	–	–	–	–
All legumes and nuts	0	2	26	34	44	55	68	100	100	–	–	–	–
All dairy	0	1	9	16	23	37	37	57	50	–	–	–	–
Organ meat	0	0	5	8	12	14	11	29	0	–	–	–	–
Eggs	0	1	14	20	27	39	47	71	100	–	–	–	–
Small fish eaten whole with bones	0	2	6	12	11	10	26	29	50	–	–	–	–
All other flesh foods and miscellaneous small animal protein	0	90	89	93	96	97	97	100	100	–	–	–	–
Vitamin A-rich dark green leafy vegetables [a]	0	2	15	31	49	58	76	43	50	–	–	–	–
Vitamin A-rich deep yellow/orange/red vegetables [a]	0	0	1	7	12	28	32	57	100	–	–	–	–
Vitamin C-rich vegetables [b]	0	1	10	25	43	61	84	71	100	–	–	–	–
Vitamin A-rich fruits [a]	0	0	3	3	6	4	8	43	50	–	–	–	–
Vitamin C-rich fruits [b]	0	0	6	8	15	17	26	29	0	–	–	–	–
All other fruits and vegetables	0	2	16	41	62	82	87	71	100	–	–	–	–

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.
[b] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table 7g. Percent of Observation Days on Which Different Food Groups Were Consumed, By Food Group Diversity Score, All Women, R1 (FGI-21 - 1 g Minimum)

	Number of food groups eaten																				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
Percent (number) of observation days at each diversity score	0 (0)	6 (123)	12 (254)	17 (340)	18 (364)	15 (310)	11 (234)	8 (164)	5 (100)	3 (67)	2 (45)	1 (24)	1 (12)	0 (6)	0 (2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Food groups	Percent of observation days on which each food group was consumed																				
Grains and grain products	–	100	100	100	100	100	100	100	100	100	100	100	100	100	100	–	–	–	–	–	–
All other starchy staples	–	0	8	15	24	35	42	46	53	72	80	83	100	100	100	–	–	–	–	–	–
Cooked dry beans and peas	–	0	13	17	25	33	46	43	58	75	82	96	100	100	100	–	–	–	–	–	–
Soybeans and soy products	–	0	0	5	10	15	21	28	34	52	73	92	92	100	100	–	–	–	–	–	–
Nuts and seeds	–	0	1	1	2	3	3	4	7	3	13	4	0	0	50	–	–	–	–	–	–
Milk/yogurt	–	0	6	13	16	20	23	25	40	52	69	92	75	100	100	–	–	–	–	–	–
Cheese	–	0	1	1	4	3	7	17	31	28	18	8	33	33	0	–	–	–	–	–	–
Beef, pork, veal, lamb, goat, game meat	–	12	36	52	59	65	77	85	94	97	98	100	100	100	100	–	–	–	–	–	–
Organ meat	–	0	3	3	7	7	11	11	23	39	58	67	83	100	50	–	–	–	–	–	–
Chicken, duck, turkey, pigeon, guinea hen, game birds	–	2	13	17	18	19	21	26	29	31	29	29	50	33	50	–	–	–	–	–	–
Large whole fish/dried fish/shellfish and other seafood	–	81	79	77	81	82	82	81	77	79	80	83	92	100	100	–	–	–	–	–	–
Small fish eaten whole with bones	–	2	9	11	13	15	17	13	12	13	13	17	17	0	50	–	–	–	–	–	–
Insects, grubs, snakes, rodents and other small animal	–	0	0	0	0	0	0	0	0	0	0	0	0	0	0	–	–	–	–	–	–
Eggs	–	1	8	14	22	28	36	50	53	54	49	50	50	67	50	–	–	–	–	–	–
Vitamin A-rich dark green leafy vegetables[a]	–	1	11	24	30	37	40	48	47	43	40	38	42	50	100	–	–	–	–	–	–
Vitamin A-rich deep yellow/orange/red vegetables[a]	–	0	1	4	8	16	24	43	48	70	80	79	92	100	100	–	–	–	–	–	–
Vitamin C-rich vegetables[b]	–	0	2	15	30	50	56	73	71	64	53	63	83	100	100	–	–	–	–	–	–
All other vegetables	–	0	4	24	39	58	71	81	90	91	100	100	100	100	100	–	–	–	–	–	–
Vitamin A-rich fruits[a]	–	0	2	2	3	4	3	6	2	3	9	8	0	0	50	–	–	–	–	–	–
Vitamin C-rich fruits[b]	–	0	3	6	5	7	12	15	16	16	16	25	25	17	50	–	–	–	–	–	–
All other fruits	–	0	0	2	3	5	10	6	15	16	40	67	67	100	50	–	–	–	–	–	–

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.
[b] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table 7h. Percent of Observation Days on Which Different Food Groups Were Consumed, By Food Group Diversity Score, All Women, R1 (FGI-21R - 15 g Minimum)

	Number of food groups eaten																				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
Percent (number) of observation days at each diversity score	2 (40)	12 (247)	25 (509)	26 (524)	17 (353)	9 (193)	6 (113)	2 (44)	1 (16)	0 (5)	0 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Food groups	**Percent of observation days on which each food group was consumed**																				
Grains and grain products	100	100	100	100	100	100	100	100	100	100	100	–	–	–	–	–	–	–	–	–	–
All other starchy staples	0	0	10	21	29	46	49	61	69	40	100	–	–	–	–	–	–	–	–	–	–
Cooked dry beans and peas	0	6	16	22	30	42	48	59	75	100	0	–	–	–	–	–	–	–	–	–	–
Soybeans and soy products	0	0	1	1	1	2	1	9	0	0	100	–	–	–	–	–	–	–	–	–	–
Nuts and seeds	0	0	1	1	1	4	5	7	13	20	0	–	–	–	–	–	–	–	–	–	–
Milk/yogurt	0	1	5	10	15	20	26	39	38	60	0	–	–	–	–	–	–	–	–	–	–
Cheese	0	0	0	0	3	2	7	18	6	0	100	–	–	–	–	–	–	–	–	–	–
Beef, pork, veal, lamb, goat, game meat	0	20	45	60	63	68	73	75	100	100	100	–	–	–	–	–	–	–	–	–	–
Organ meat	0	0	3	6	9	12	11	14	13	0	0	–	–	–	–	–	–	–	–	–	–
Chicken, duck, turkey, pigeon, guinea hen, game birds	0	4	16	18	22	20	29	36	44	20	0	–	–	–	–	–	–	–	–	–	–
Large whole fish/dried fish/shellfish and other seafood	0	53	58	62	72	68	75	82	81	100	100	–	–	–	–	–	–	–	–	–	–
Small fish eaten whole with bones	0	3	7	8	9	8	12	16	13	40	0	–	–	–	–	–	–	–	–	–	–
Insects, grubs, snakes, rodents and other small animal	0	0	0	0	0	0	0	0	0	0	0	–	–	–	–	–	–	–	–	–	–
Eggs	0	2	9	15	22	26	33	43	56	60	100	–	–	–	–	–	–	–	–	–	–
Vitamin A-rich dark green leafy vegetables [a]	0	3	12	20	33	46	56	57	44	60	0	–	–	–	–	–	–	–	–	–	–
Vitamin A-rich deep yellow/orange/red vegetables [a]	0	0	0	3	7	13	29	21	38	40	100	–	–	–	–	–	–	–	–	–	–
Vitamin C-rich vegetables [b]	0	3	5	17	28	47	50	50	75	100	100	–	–	–	–	–	–	–	–	–	–
All other vegetables	0	3	8	24	41	54	76	68	81	80	100	–	–	–	–	–	–	–	–	–	–
Vitamin A-rich fruits [a]	0	0	1	3	3	7	2	7	19	20	100	–	–	–	–	–	–	–	–	–	–
Vitamin C-rich fruits [b]	0	0	3	7	9	14	14	30	19	40	0	–	–	–	–	–	–	–	–	–	–
All other fruits	0	0	1	1	2	2	5	9	19	20	0	–	–	–	–	–	–	–	–	–	–

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.
[b] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table 8. Mean and Median Nutrient Intake and PA, All Women [a]

Nutrient	Mean	SD	Median	EAR [b]	SD [b]	PA (Mean)	PA (Median)	Lambda (Box-Cox transformation) [c]
Energy	1,346	627	1,219					
Protein (All Sources) (% of kcal)	15	6	14					
Protein from animal sources (% of kcal)	10	7	9					
Total carbohydrate (% of kcal)	65	16	68					
Total fat (% of kcal)	19	14	15					
Thiamin (mg/d)	0.63	0.53	0.48	0.9	0.1	0.11	0.00	0.021
Riboflavin (mg/d)	0.68	1.26	0.49	0.9	0.1	0.10	0.00	-0.133
Niacin (mg/d)	15.49	11.07	12.78	11.0	1.6	0.58	0.75	0.069
Vitamin B6 (mg/d)	1.23	0.74	1.07	1.1	0.1	0.41	0.15	0.076
Folate (µg/d)	350.06	220.62	317.78	320	32	0.44	0.28	0.438
Vitamin B12 (µg/d)	5.23	6.94	3.38	2.0	0.2	0.77	1.00	0.197
Vitamin C (mg/d)	37.52	91.49	12.65	38	3.8	0.13	0.00	0.224
Vitamin A (RE/d)	538.74	2,133.81	232.21	270	54	0.36	0.14	0.028
Calcium (mg/d)	336.44	258.06	267.27	1,000 [d]	– [d]	0.16	0.25	-0.080
Iron (mg/d)	9.88	6.70	8.24	See table [e]	See table [e]	0.14	0.04	-0.160
Zinc (mg/d)	5.91	3.52	5.03	6	0.75	0.46	0.31	0.131
MPA across 11 micronutrients	0.33	0.22	0.30					

[a] Mean and median nutrient intakes are for the first observation day; PA are based on estimated usual intake calculated from both rounds of dietary data for the full sample. Pregnant women were excluded from this study sample.
[b] SeeTable A6-1 for sources for each EAR and SD. Requirements for NPNL women are presented here; see Tables A6-1 and L8 for requirements for lactating women.
[c] This documents the transformation parameters selected for each nutrient. The power transformations result in approximately normal distributions.
[d] There is no EAR and no SD for calcium; 1,000 mg is the Adequate intake (AI) for NPNL women.
[e] Iron requirements are nonsymetric for NPNL women of reproductive age: see Table A6-2 for iron requirements for NPNL women. See Table A6-1 and L8 for requiremnts for lactating women.

Table 10. Correlations between Food Group Diversity Scores and Estimated Usual Intakes of Individual Nutrients, All Women [a, b]

	FGI-6		FGI-6R		FGI-9		FGI-9R		FGI-13		FGI-13R		FGI-21		FGI-21R	
Nutrients	**Not controlling for energy**	**Controlling for energy**	**Not controlling for energy**	**Controlling for energy**	**Not controlling for energy**	**Controlling for energy**	**Not controlling for energy**	**Controlling for energy**	**Not controlling for energy**	**Controlling for energy**	**Not controlling for energy**	**Controlling for energy**	**Not controlling for energy**	**Controlling for energy**	**Not controlling for energy**	**Controlling for energy**
Total energy	0.168 ***		0.182 ***		0.205 ***		0.234 ***		0.203 ***		0.238 ***		0.285 ***		0.349 ***	
Thiamin	0.153 ***	0.034	0.207 ***	0.105 ***	0.178 ***	0.026	0.246 ***	0.103 ***	0.177 ***	0.027	0.239 ***	0.085 ***	0.250 ***	0.041	0.333 ***	0.100 ***
Riboflavin	0.208 ***	0.124 ***	0.250 ***	0.176 ***	0.269 ***	0.177 ***	0.336 ***	0.251 ***	0.258 ***	0.162 ***	0.322 ***	0.223 ***	0.317 ***	0.159 ***	0.411 ***	0.237 ***
Niacin	0.070 **	-0.074 ***	0.140 ***	0.014	0.092 ***	-0.082 ***	0.180 ***	0.017	0.089 ***	-0.083 ***	0.183 ***	0.018	0.181 ***	-0.035	0.319 ***	0.105 ***
Vitamin B6	0.179 ***	0.078 ***	0.221 ***	0.128 ***	0.206 ***	0.075 ***	0.263 ***	0.132 ***	0.205 ***	0.076 ***	0.263 ***	0.127 ***	0.298 ***	0.125 ***	0.401 ***	0.219 ***
Folate	0.136 ***	0.038	0.197 ***	0.107 ***	0.168 ***	0.048 *	0.238 ***	0.119 ***	0.166 ***	0.048 *	0.235 ***	0.111 ***	0.196 ***	0.019	0.261 ***	0.053 *
Vitamin B12	0.038	-0.027	0.103 ***	0.038	0.076 ***	0.000	0.158 ***	0.078 ***	0.078 ***	0.002	0.162 ***	0.081 ***	0.112 ***	0.006	0.240 ***	0.126 ***
Vitamin C	0.318 ***	0.286 ***	0.385 ***	0.353 ***	0.291 ***	0.247 ***	0.367 ***	0.322 ***	0.303 ***	0.261 ***	0.359 ***	0.312 ***	0.308 ***	0.246 ***	0.383 ***	0.315 ***
Vitamin A	0.285 ***	0.236 ***	0.307 ***	0.253 ***	0.331 ***	0.269 ***	0.385 ***	0.318 ***	0.317 ***	0.253 ***	0.366 ***	0.293 ***	0.329 ***	0.225 ***	0.419 ***	0.301 ***
Calcium	0.234 ***	0.169 ***	0.311 ***	0.257 ***	0.249 ***	0.162 ***	0.340 ***	0.257 ***	0.266 ***	0.185 ***	0.345 ***	0.261 ***	0.296 ***	0.165 ***	0.404 ***	0.262 ***
Iron	0.216 ***	0.137 ***	0.230 ***	0.143 ***	0.280 ***	0.194 ***	0.314 ***	0.214 ***	0.268 ***	0.178 ***	0.302 ***	0.191 ***	0.325 ***	0.173 ***	0.374 ***	0.178 ***
Zinc	0.193 ***	0.097 ***	0.191 ***	0.071 **	0.248 ***	0.143 ***	0.263 ***	0.124 ***	0.237 ***	0.126 ***	0.255 ***	0.103 ***	0.326 ***	0.165 ***	0.372 ***	0.153 ***

[a] Usual intake of energy and individual nutrients are estimated by the BLUP following the method described in section 11 of the protocol (Arimond et al. 2008).
[b] A "*" indicates a coefficient that is statistically significant at $p < 0.05$; ** indicates $p < 0.01$, and *** indicates $p < 0.001$.

Table 11a. Correlation between Energy from 6 Major Food Groups and MPA, With and Without Controlling for Total Energy Intake, All Women [a, b, c]

Major food groups	Correlation between MPA and energy from each food group:	Partial correlation coefficients for energy from each food group (controlling for total energy)
All starchy staples	0.426 ***	-0.015
All legumes and nuts	0.128 ***	0.043
All dairy	0.215 ***	0.162 ***
Other animal source foods	0.511 ***	-0.029
Vitamin A-rich fruits and vegetables [d]	0.094 ***	0.081 ***
Other fruits and vegetables	0.184 ***	0.072 **

[a] Numbers in bold indicate coefficients that changed direction when total energy was controlled for, with both coefficients being significant. A "*" indicates a coefficient that is statistically significant at $p < 0.05$; ** indicates $p < 0.01$, and *** indicates $p < 0.001$.
[b] Energy from food groups is from first observation day; MPA is based on estimated usual intake, calculated using repeat observations for the entire sample.
[c] MPA was normalized using the Box Cox transformation method.
[d] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table 11b. Correlation between Energy from 9 Sub-Food Groups and MPA, With and Without Controlling for Total Energy Intake, All Women [a, b, c]

Major food groups	Correlation between MPA and energy from each food group:	Partial correlation coefficients for energy from each food group (controlling for total energy)
All starchy staples	0.426 ***	-0.015
All legumes and nuts	0.128 ***	0.043
All dairy	0.215 ***	0.162 ***
Organ meat	0.183 ***	0.132 ***
Eggs	0.171 ***	0.090 ***
Flesh foods and other miscellaneous small animal protein	0.490 ***	-0.058 **
Vitamin A-rich dark green leafy vegetables [d]	0.013	0.040
Other vitamin A-rich vegetables and fruits [d]	0.109 ***	0.073 ***
Other fruits and vegetables	0.184 ***	0.072 **

[a] Numbers in bold indicate coefficients that changed direction when total energy was controlled for, with both coefficients being significant. A "*" indicates a coefficient that is statistically significant at $p < 0.05$; ** indicates $p < 0.01$, and *** indicates $p < 0.001$.
[b] Energy from food groups is from first observation day; MPA is based on estimated usual intake, calculated using repeat observations for the entire sample.
[c] MPA was normalized using the Box Cox transformation method.
[d] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table 11c. Correlation between Energy from 13 Sub-Food Groups and MPA, With and Without Controlling for Total Energy Intake, All Women [a, b, c]

Major food groups	Correlation between MPA and energy from each food group:	Partial correlation coefficients for energy from each food group (controlling for total energy)
All starchy staples	0.426 ***	-0.015
All legumes and nuts	0.128 ***	0.043
All dairy	0.215 ***	0.162 ***
Organ meat	0.183 ***	0.132 ***
Eggs	0.171 ***	0.090 ***
Small fish eaten whole with bones	0.035	0.043
All other flesh foods and miscellaneous small animal protein	0.487 ***	-0.061 **
Vitamin A-rich dark green leafy vegetables [d]	0.013	0.040
Vitamin A-rich deep yellow/orange/red vegetables [d]	0.133 ***	0.078 ***
Vitamin C-rich vegetables [e]	0.049 *	0.021
Vitamin A-rich fruits [d]	0.085 ***	0.058 **
Vitamin C-rich fruits [e]	0.147 ***	0.069 **
All other fruits and vegetables	0.110 ***	0.020

[a] Numbers in bold indicate coefficients that changed direction when total energy was controlled for, with both coefficients being significant. A "*" indicates a coefficient that is statistically significant at $p < 0.05$; ** indicates $p < 0.01$, and *** indicates $p < 0.001$.
[b] Energy from food groups is from first observation day; MPA is based on estimated usual intake, calculated using repeat observations for the entire sample.
[c] MPA was normalized using the Box Cox transformation method.
[d] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.
[e] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table 11d. Correlation between Energy from 21 Sub-Food Groups and MPA, With and Without Controlling for Total Energy Intake, All Women [a, b, c]

Major food groups	Correlation between MPA and energy from each food group:	Partial correlation coefficients for energy from each food group (controlling for total energy)
Grains and grain products	0.410 ***	-0.021
All other starchy staples	0.109 ***	0.024
Cooked dry beans and peas	0.088 ***	0.033
Soybeans and soy products	0.106 ***	0.006
Nuts and seeds	0.097 ***	0.030
Milk/yogurt	0.188 ***	0.146 ***
Cheese	0.145 ***	0.088 ***
Beef, pork, veal, lamb, goat, game meat	0.392 ***	-0.158 ***
Organ meat	0.183 ***	0.132 ***
Chicken, duck, turkey, pigeon, guinea hen, game birds	0.220 ***	0.061 **
Large whole fish/dried fish/shellfish and other seafood	0.268 ***	0.287 ***
Small fish eaten whole with bones	0.035	0.043
Insects, grubs, snakes, rodents and other small animal	–	–
Eggs	0.171 ***	0.090 ***
Vitamin A-rich dark green leafy vegetables [d]	0.013	0.040
Vitamin A-rich deep yellow/orange/red vegetables [d]	0.133 ***	0.078 ***
Vitamin C-rich vegetables [e]	0.049 *	0.021
All other vegetables	0.126 ***	0.100 ***
Vitamin A-rich fruits [d]	0.085 ***	0.058 **
Vitamin C-rich fruits [e]	0.147 ***	0.069 **
All other fruits	0.061 **	-0.028

[a] Numbers in bold indicate coefficients that changed direction when total energy was controlled for, with both coefficients being significant. A "*" indicates a coefficient that is statistically significant at $p < 0.05$; ** indicates $p < 0.01$, and *** indicates $p < 0.001$.

[b] Energy from food groups is from first observation day; MPA is based on estimated usual intake, calculated using repeat observations for the entire sample.

[c] MPA was normalized using the Box Cox transformation method.

[d] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

[e] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table 12. Total Energy Intake (kcal), by Food Group Diversity Scores, All Women, R1 [a]

Number of food groups eaten	Diversity indicators															
	FGI-6		FGI-6R		FGI-9		FGI-9R		FGI-13		FGI-13R		FGI-21		FGI-21R	
	Median total energy intake (range)															
1	–	–	706	(404-1209)	–	–	684	(404-1209)	–	–	644	(404-1209)	–	–	664	(404-1222)
2	1098	(334-3800)	1132	(334-3800)	1068	(334-3800)	1109	(334-3800)	1060	(334-3800)	1107	(334-3800)	843	(334-2332)	901	(334-2570)
3	1189	(373-3985)	1232	(369-3985)	1136	(373-3481)	1208	(369-3948)	1124	(373-3481)	1198	(369-3948)	988	(373-2917)	1082	(369-3297)
4	1196	(376-4055)	1280	(376-4155)	1149	(376-3985)	1237	(376-3985)	1187	(425-3985)	1243	(386-4155)	1157	(376-3985)	1259	(386-3985)
5	1327	(369-4155)	1383	(429-2990)	1311	(369-4055)	1408	(429-4155)	1226	(369-3207)	1322	(376-4055)	1261	(369-3481)	1388	(376-3948)
6	1441	(491-3363)	1937	(1171-2998)	1389	(429-4155)	1602	(713-2969)	1210	(391-3667)	1511	(588-3667)	1225	(391-3249)	1354	(429-4155)
7					1511	(491-3363)	1892	(992-2998)	1466	(429-4155)	1623	(713-2969)	1314	(410-3948)	1512	(607-3667)
8					1417	(734-3234)	–	–	1442	(610-3363)	2182	(1189-2238)	1355	(429-3297)	1629	(803-4055)
9					–	–	–	–	1604	(734-3330)	–	–	1588	(676-4155)	1865	(1047-2687)
10									2000	(804-2755)	–	–	1383	(491-4055)	2238	(992-2634)
11									–	–	–	–	1652	(789-3363)	–	–
12									–	–	–	–	1431	(916-2736)	–	–
13									–	–	–	–	1900	(1177-3234)	–	–
14													1799	(734-2182)	–	–
15													–	–	–	–
16													–	–	–	–
17													–	–	–	–
18													–	–	–	–
19													–	–	–	–
20													–	–	–	–
21													–	–	–	–

[a] Light shading indicates impossible values (beyond range of possible scores). A — indicates that a cell has fewer than 5 observations. Cells with fewer than 10 observations have dark shading.

Table 13. Relationship between Food Group Diversity Scores and Total Energy Intake, All Women [a]

	Food group diversity score		Total energy intake		Correlation Coefficient [b]
	(mean)	(median)	(mean)	(median)	
FGI-6	3.8	4.0	1346	1219	0.168 ***
FGI-6R [c]	3.1	3.0	1346	1219	0.182 ***
FGI-9	4.2	4.0	1346	1219	0.205 ***
FGI-9R [c]	3.3	3.0	1346	1219	0.234 ***
FGI-13	4.6	4.0	1346	1219	0.203 ***
FGI-13R [c]	3.5	3.0	1346	1219	0.238 ***
FGI-21	5.7	5.0	1346	1219	0.285 ***
FGI-21R [c]	4.1	4.0	1346	1219	0.349 ***

[a] Food group diversity scores and mean and median energy intakes are from first observation day; BLUP for energy intake (calculated using repeat observations for the entire sample) is used for correlation analysis.
[b] A "*" indicates a coefficient that is statistically significant at $p < 0.05$; ** indicates $p < 0.01$, and *** indicates $p < 0.001$.
[c] Refers to minimum intake of 15 g for each of the food groups/sub food groups.

Table 14. MPA by Food Group Diversity Scores, All Women [a, b]

Number of food groups eaten	FGI-6		FGI-6R		FGI-9		FGI-9R		FGI-13		FGI-13R		FGI-21		FGI-21R	
	Median MPA (range)															
1	–	–	0.01	(0.00-0.21)	–	–	0.01	(0.00-0.21)	–	–	0.01	(0.00-0.26)	–	–	0.01	(0.00-0.31)
2	0.23	(0.00-0.85)	0.25	(0.00-0.85)	0.22	(0.00-0.83)	0.23	(0.00-0.85)	0.22	(0.00-0.83)	0.23	(0.00-0.85)	0.17	(0.00-0.83)	0.17	(0.00-0.83)
3	0.28	(0.00-0.91)	0.30	(0.00-0.92)	0.26	(0.00-0.86)	0.29	(0.00-0.92)	0.26	(0.00-0.86)	0.28	(0.00-0.92)	0.21	(0.00-0.77)	0.23	(0.00-0.85)
4	0.30	(0.00-0.92)	0.35	(0.00-0.94)	0.29	(0.00-0.92)	0.34	(0.00-0.91)	0.28	(0.00-0.92)	0.33	(0.00-0.91)	0.27	(0.00-0.86)	0.33	(0.00-0.89)
5	0.36	(0.00-0.94)	0.45	(0.01-0.92)	0.32	(0.00-0.92)	0.43	(0.01-0.92)	0.31	(0.00-0.89)	0.41	(0.00-0.91)	0.30	(0.00-0.91)	0.40	(0.00-0.92)
6	0.45	(0.00-0.91)	0.63	(0.19-0.91)	0.42	(0.00-0.92)	0.58	(0.17-0.94)	0.32	(0.00-0.92)	0.50	(0.06-0.94)	0.33	(0.00-0.90)	0.45	(0.00-0.91)
7					0.47	(0.03-0.94)	0.58	(0.10-0.91)	0.42	(0.00-0.94)	0.58	(0.17-0.90)	0.35	(0.00-0.92)	0.47	(0.06-0.94)
8					0.45	(0.05-0.83)	–	–	0.47	(0.04-0.90)	0.58	(0.45-0.91)	0.37	(0.00-0.86)	0.59	(0.17-0.91)
9					–	–	–	–	0.57	(0.05-0.90)	–	–	0.47	(0.01-0.94)	0.57	(0.24-0.75)
10									0.54	(0.14-0.91)	–	–	0.38	(0.03-0.91)	0.77	(0.10-0.90)
11									–	–	–	–	0.52	(0.04-0.91)	–	–
12									–	–	–	–	0.58	(0.19-0.90)	–	–
13									–	–	–	–	0.57	(0.19-0.83)	–	–
14													0.63	(0.05-0.73)	–	–
15													–	–	–	–
16													–	–	–	–
17													–	–	–	–
18													–	–	–	–
19													–	–	–	–
20													–	–	–	–
21													–	–	–	–

[a] Food group diversity scores are from first observation day; MPA is based on estimated usual intake, calculated using repeat observations for the entire sample.
[b] Light shading indicates impossible values (beyond range of possible scores). A "–" indicates that a cell has fewer than 5 observations. Cells with fewer than 10 observations have dark shading.

Table 15. Relationship between MPA and Food Group Diversity Scores, All Women [a]

	Food group diversity score		MPA		Correlation Coefficient [b]		Partial correlation controlling for total energy intake [b]	
	(mean)	(median)	(mean)	(median)				
FGI-6	3.8	4.0	0.33	0.30	0.205	***	0.119	***
FGI-6R [c]	3.1	3.0	0.33	0.30	0.263	***	0.199	***
FGI-9	4.2	4.0	0.33	0.30	0.251	***	0.148	***
FGI-9R [c]	3.3	3.0	0.33	0.30	0.328	***	0.240	***
FGI-13	4.6	4.0	0.33	0.30	0.251	***	0.150	***
FGI-13R [c]	3.5	3.0	0.33	0.30	0.325	***	0.231	***
FGI-21	5.7	5.0	0.33	0.30	0.321	***	0.161	***
FGI-21R [c]	4.1	4.0	0.33	0.30	0.438	***	0.283	***

[a] Food group diversity scores are from first observation day, MPA is based on the first observation day and repeat observations for the entire sample. MPA was transformed to approximate normality, and transformed MPA and BLUP for total energy intake were used for correlation analysis.
[b] A "*" indicates a coefficient that is statistically significant at $p < 0.05$; ** indicates $p < 0.01$, and *** indicates $p < 0.001$.
[c] Refers to minimum intake of 15 g for each of the food groups/sub food groups.

Table 16. Results of Ordinary Least Squares Regression Analysis of the Determinants of MPA, All Women [a, b]

	FGI-6		FGI-6R		FGI-9		FGI-9R		FGI-13		FGI-13R		FGI-21		FGI-21R	
	Not controlling for energy															
	B	**Standard error**	**B**	**Standard error**	**B**	**Standard error**	**B**	**Standard error**	**B**	**Standard error**	**B**	**Standard error**	**B**	**Standard error**	**B**	**Standard error**
Constant	-1.558 ***	0.202	-1.598 ***	0.198	-1.564 ***	0.200	-1.617 ***	0.194	-1.532 ***	0.199	-1.584 ***	0.194	-1.514 ***	0.196	-1.617 ***	0.186
Woman's height	0.005 ***	0.001	0.005 ***	0.001	0.005 ***	0.001	0.005 ***	0.001	0.005 ***	0.001	0.005 ***	0.001	0.005 ***	0.001	0.005 ***	0.001
Age	-0.007 ***	0.001	-0.007 ***	0.001	-0.007 ***	0.001	-0.007 ***	0.001	-0.007 ***	0.001	-0.007 ***	0.001	-0.006 ***	0.001	-0.006 ***	0.001
Lactating (0/1)	-0.192 ***	0.025	-0.197 ***	0.025	-0.190 ***	0.025	-0.194 ***	0.024	-0.190 ***	0.025	-0.194 ***	0.024	-0.176 ***	0.025	-0.174 ***	0.023
Pregnant	-0.215 ***	0.036	-0.214 ***	0.035	-0.214 ***	0.036	-0.214 ***	0.035	-0.213 ***	0.036	-0.217 ***	0.035	-0.207 ***	0.035	-0.200 ***	0.033
Dietary diversity score	0.051 ***	0.006	0.082 ***	0.007	0.049 ***	0.005	0.088 ***	0.006	0.041 ***	0.004	0.075 ***	0.005	0.039 ***	0.003	0.083 ***	0.004
Adjusted R^2	0.125 ***		0.155 ***		0.141 ***		0.185 ***		0.141 ***		0.184 ***		0.171 ***		0.254 ***	
	Controlling for energy															
	B	**Standard error**	**B**	**Standard error**	**B**	**Standard error**	**B**	**Standard error**	**B**	**Standard error**	**B**	**Standard error**	**B**	**Standard error**	**B**	**Standard error**
Constant	-1.437 ***	0.149	-1.488 ***	0.146	-1.444 ***	0.148	-1.498 ***	0.144	-1.432 ***	0.147	-1.478 ***	0.144	-1.416 ***	0.147	-1.485 ***	0.143
Woman's height	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Age	-0.003 ***	0.000	-0.003 ***	0.000	-0.003 ***	0.000	-0.003 ***	0.000	-0.003 ***	0.000	-0.003 ***	0.000	-0.003 ***	0.000	-0.003 ***	0.000
Lactating (0/1)	-0.181 ***	0.019	-0.182 ***	0.018	-0.180 ***	0.019	-0.181 ***	0.018	-0.180 ***	0.019	-0.181 ***	0.018	-0.175 ***	0.019	-0.172 ***	0.018
Pregnant	-0.186 ***	0.026	-0.185 ***	0.026	-0.186 ***	0.026	-0.186 ***	0.026	-0.185 ***	0.026	-0.188 ***	0.026	-0.183 ***	0.026	-0.180 ***	0.026
Dietary diversity score	0.023 ***	0.004	0.050 ***	0.005	0.023 ***	0.003	0.052 ***	0.004	0.020 ***	0.003	0.045 ***	0.004	0.017 ***	0.002	0.044 ***	0.003
Total energy intake [c]	0.346 ***	0.008	0.340 ***	0.008	0.343 ***	0.008	0.334 ***	0.008	0.343 ***	0.008	0.334 ***	0.008	0.336 ***	0.008	0.316 ***	0.008
Adjusted R^2	0.526 ***		0.542 ***		0.530 ***		0.551 ***		0.531 ***		0.551 ***		0.533 ***		0.561 ***	

[a] A"*" indicates a coefficient that is statistically significant at $p < 0.05$; ** indicates $p < 0.01$, and *** indicates $p < 0.001$. For the adjusted R^2, the stars indicate the significance level of the F statistic of the regression.
[b] MPA was transformed to approximate a normal distribution and the transformed variable was used in the regressions.
[c] Energy was divided by 1,000 before running the regressions to take into account the large scale of the energy variable and the small scale of MPA.

FIGURES

Histograms of intakes for 11 micronutrients (R1 data): Figures 1-11

Histograms for intra-individual SDs of intake, based on data from two rounds: Figures 12-22

Histograms for FGIs (R1 data): Figures 23-30

Histograms of PA for 11 micronutrients, based on data from two rounds: Figures 31-41

Histogram of MPA, based on data from two rounds: Figure 42

Figure 1. Distribution of Thiamin Intakes, All Women

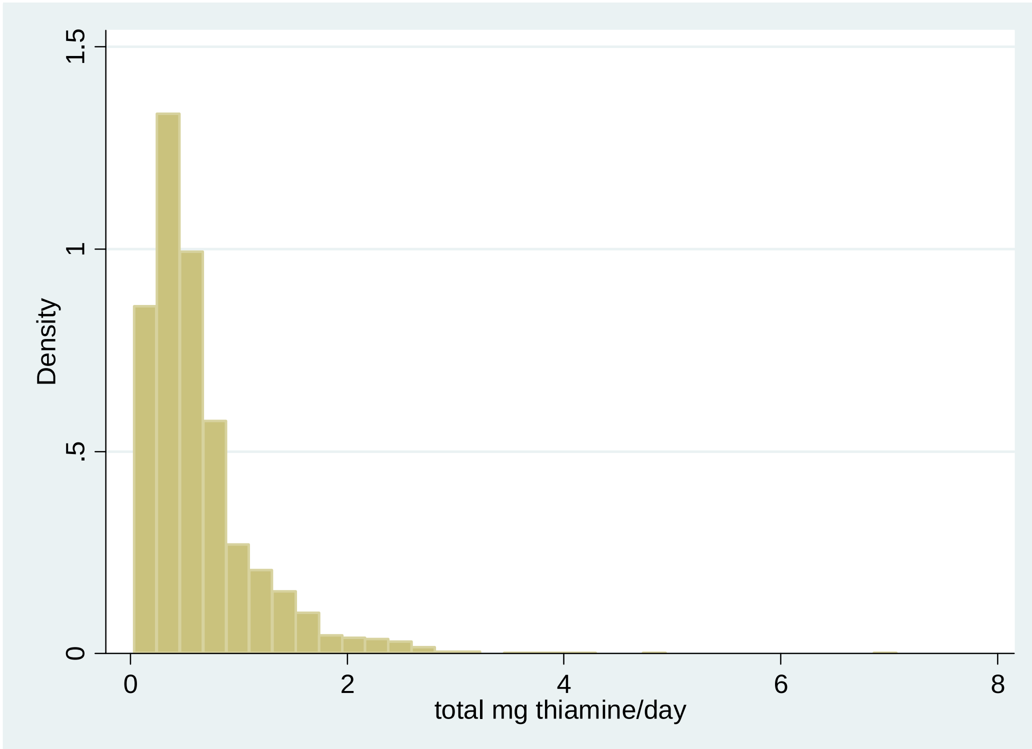


Figure 2. Distribution of Riboflavin Intakes, All Women

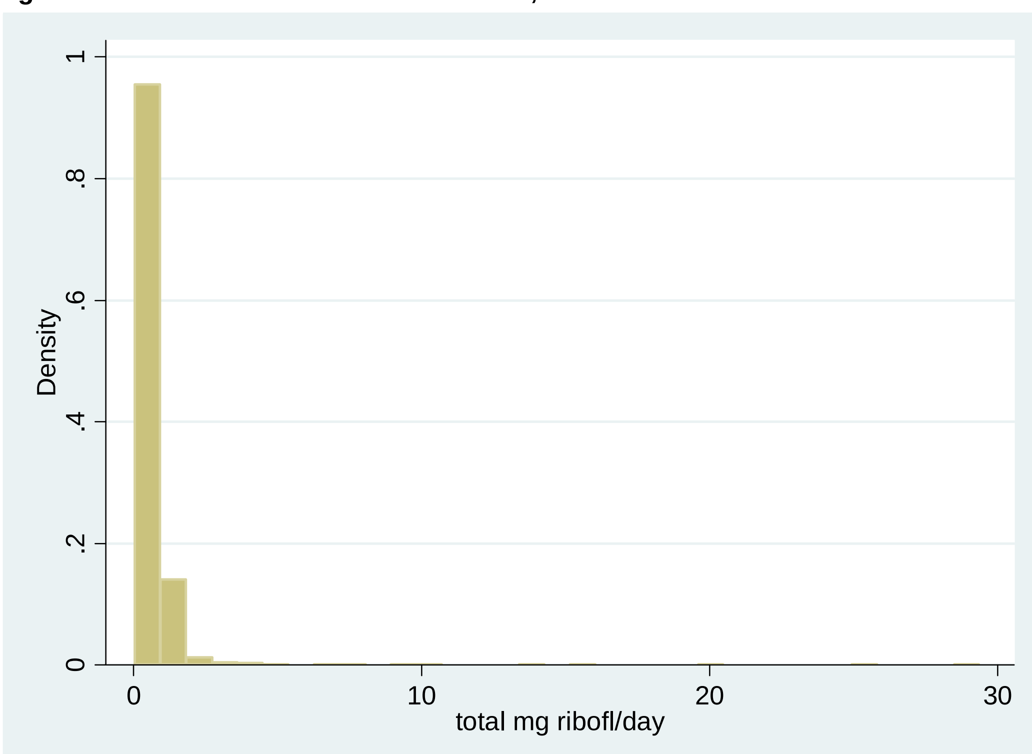


Figure 3. Distribution of Niacin Intakes, All Women

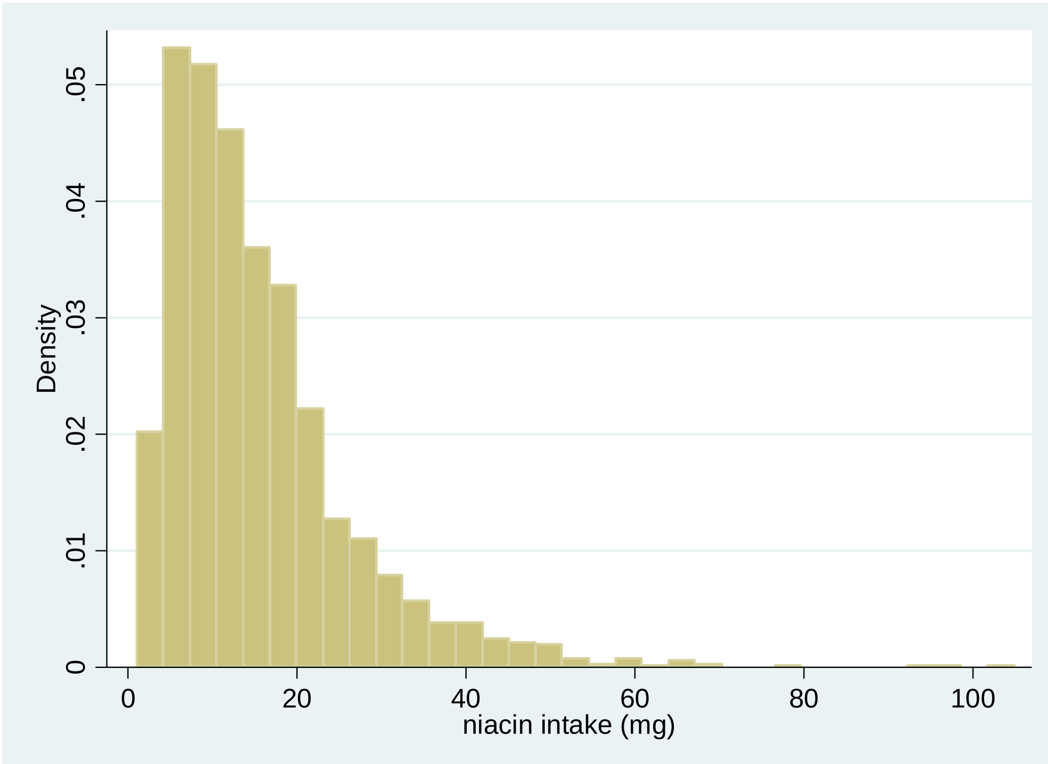


Figure 4. Distribution of Vitamin B6 Intakes, All Women

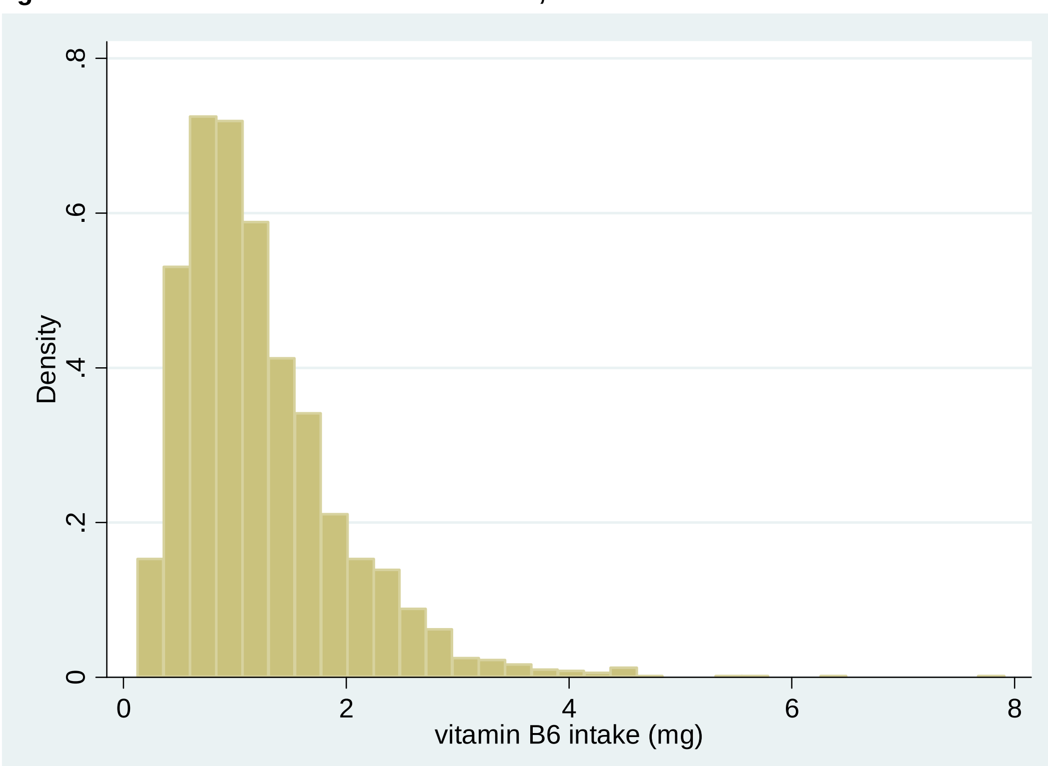


Figure 5. Distribution of Folate Intakes, All Women

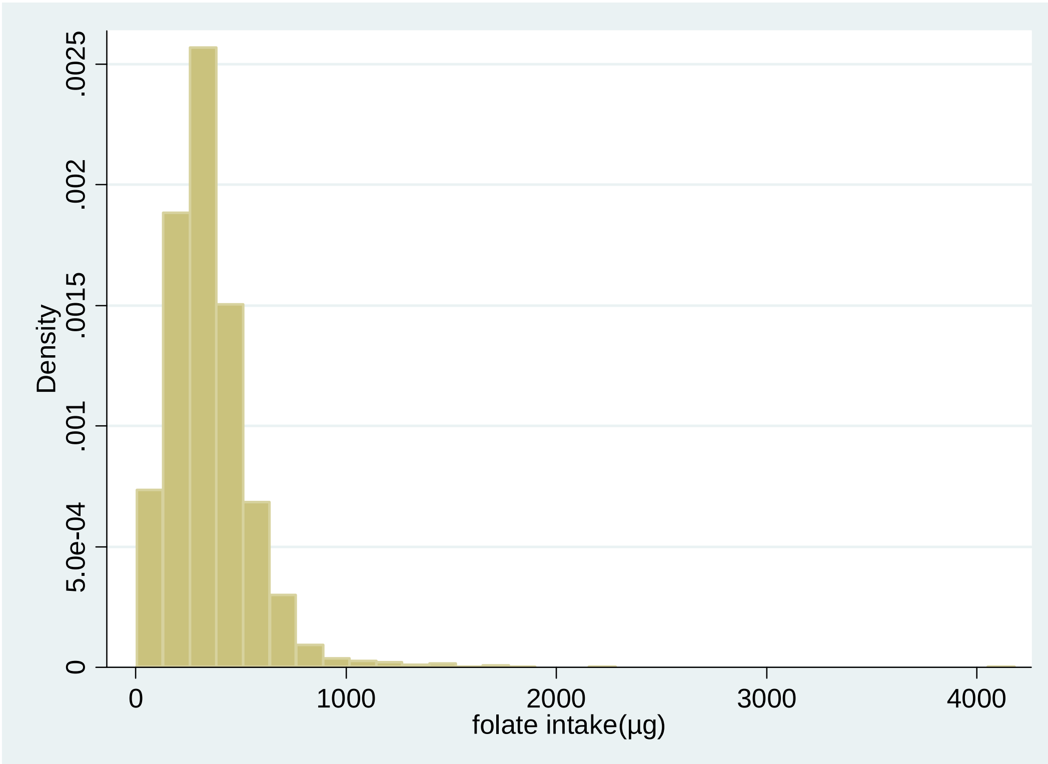


Figure 6. Distribution of Vitamin B12 Intakes, All Women

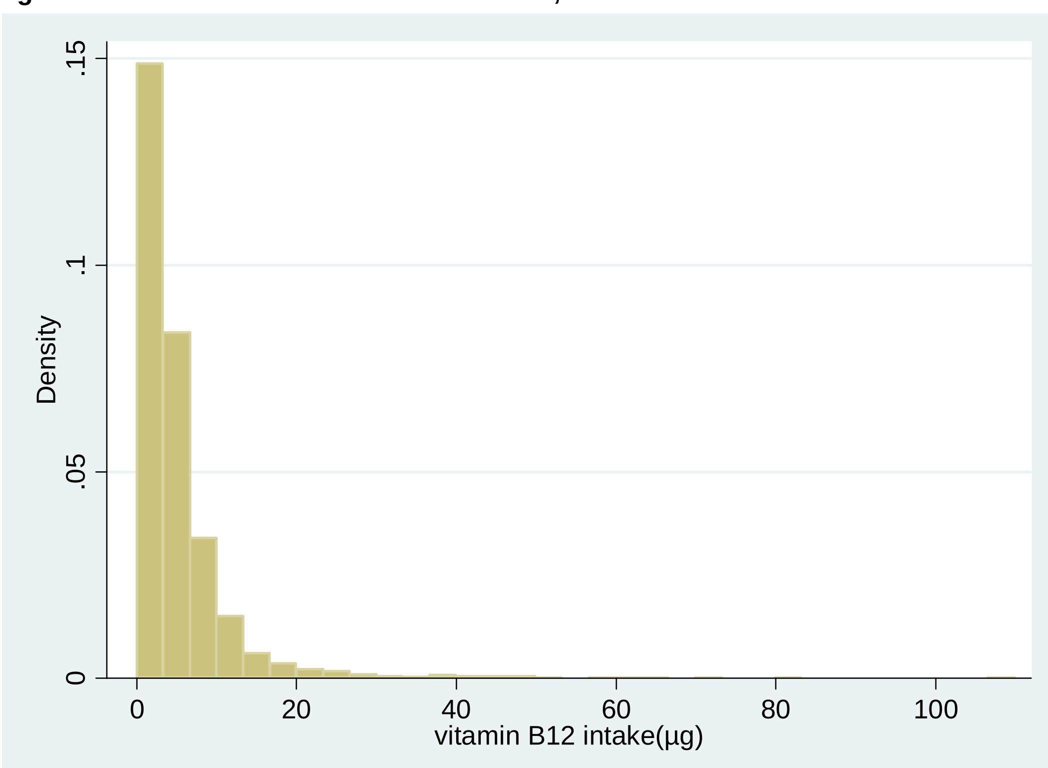


Figure 7. Distribution of Vitamin C Intakes, All Women

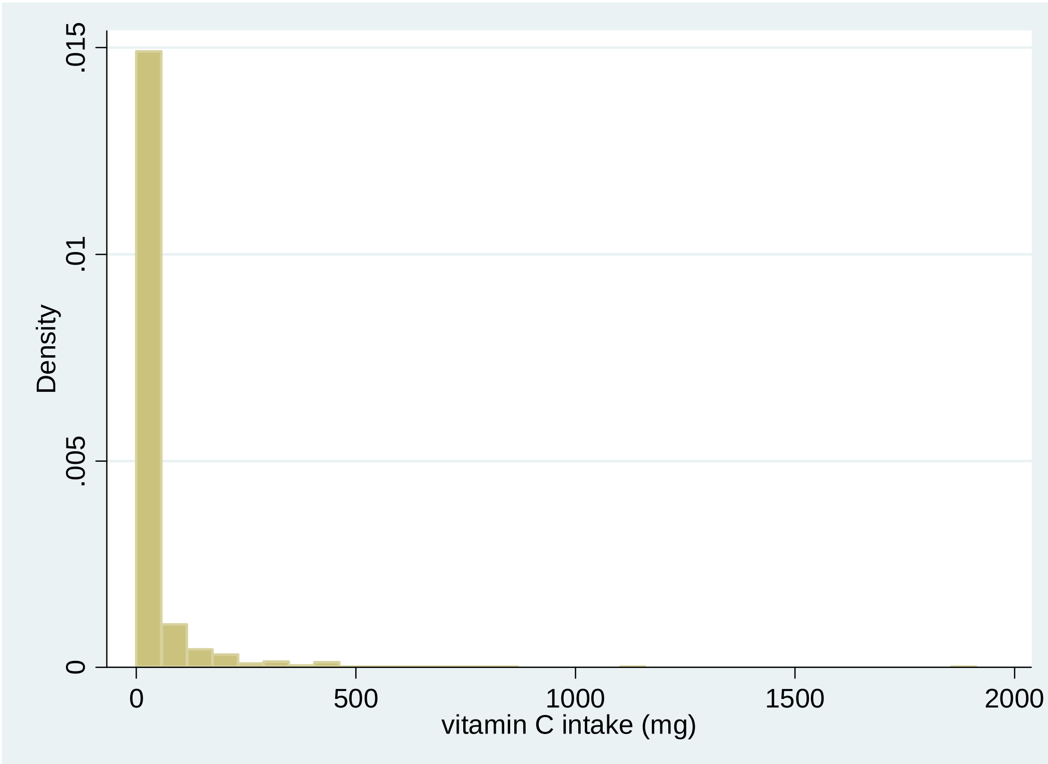


Figure 8. Distribution of Vitamin A Intakes, All Women

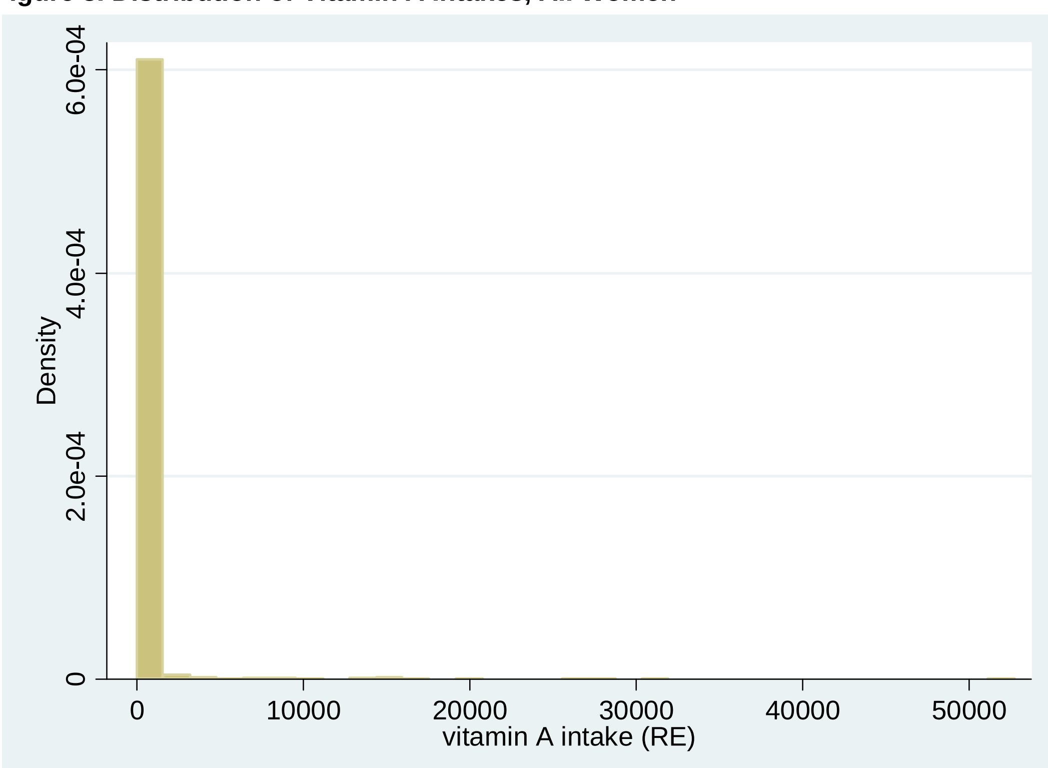


Figure 9. Distribution of Calcium Intakes, All Women

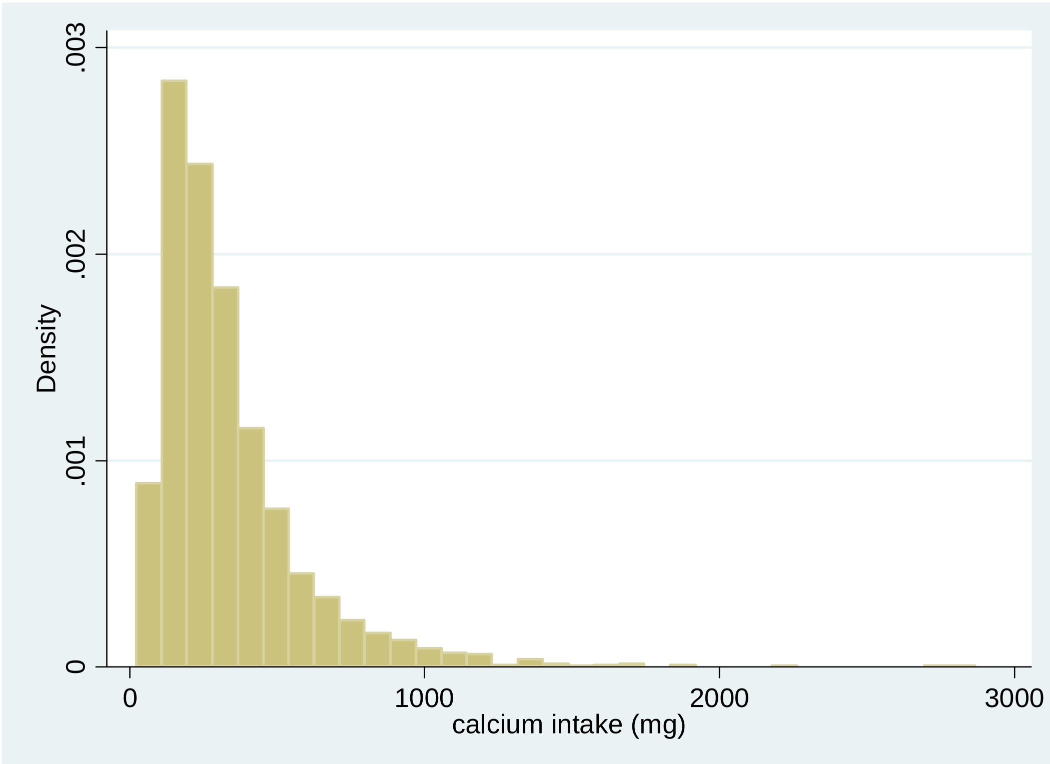


Figure 10. Distribution of Iron Intakes, All Women

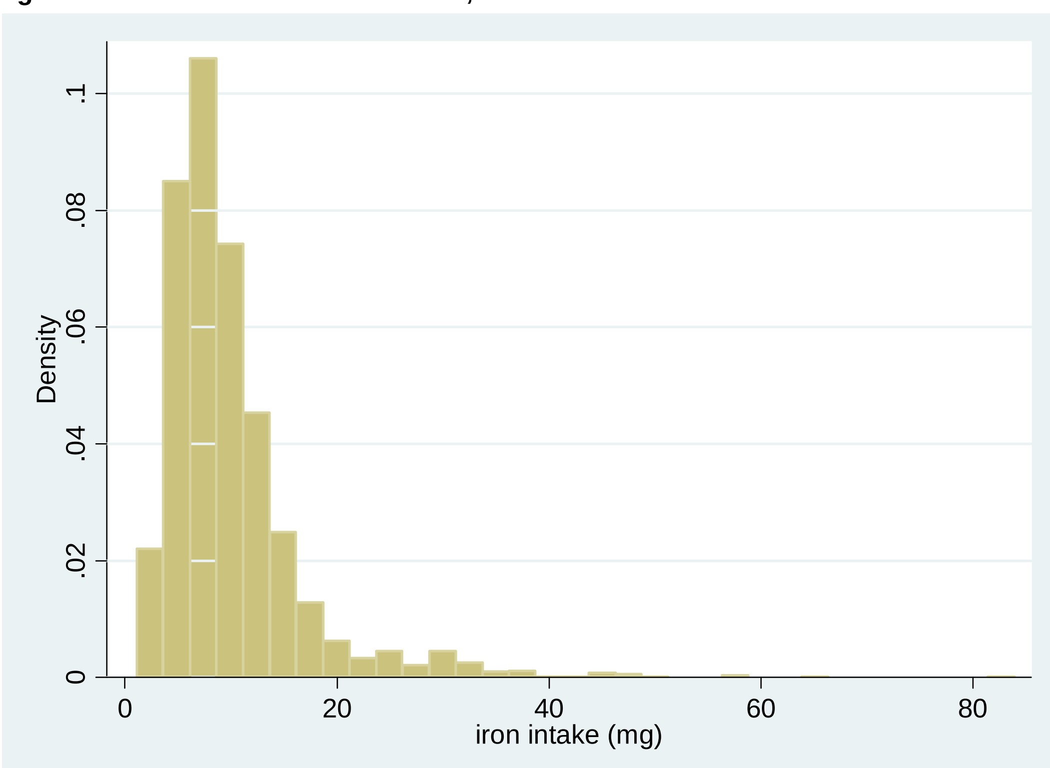


Figure 11. Distribution of Zinc Intake, All Women

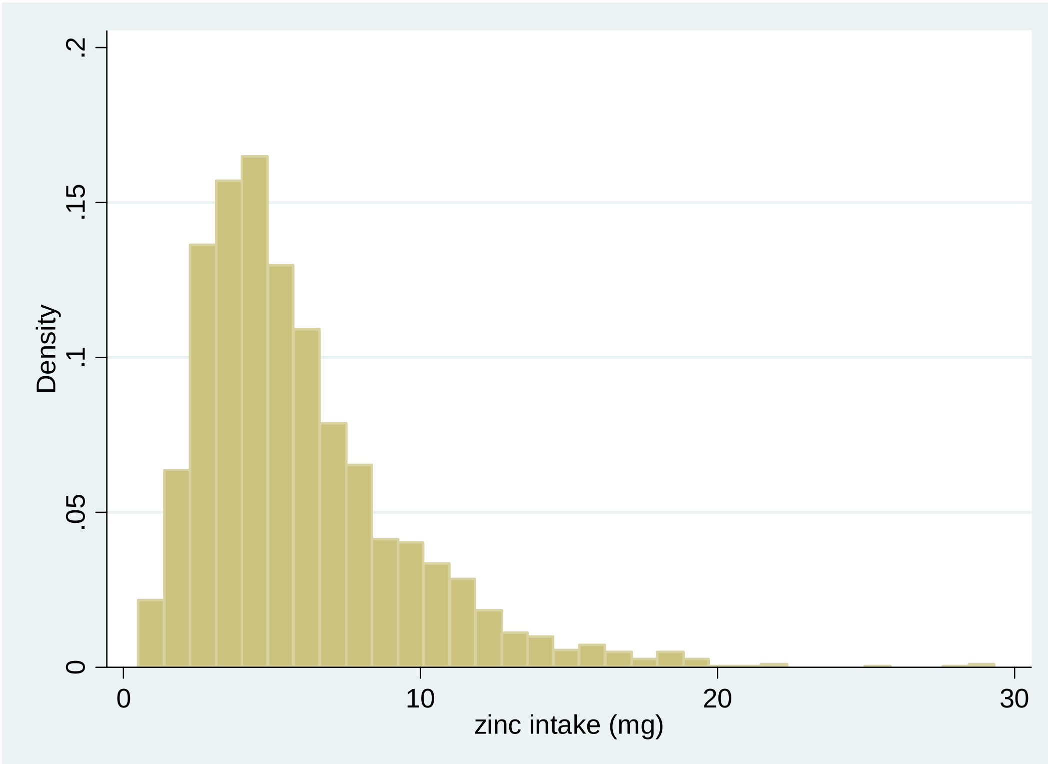


Figure 12. Intra-Individual SD of Thiamin Intakes, All Women

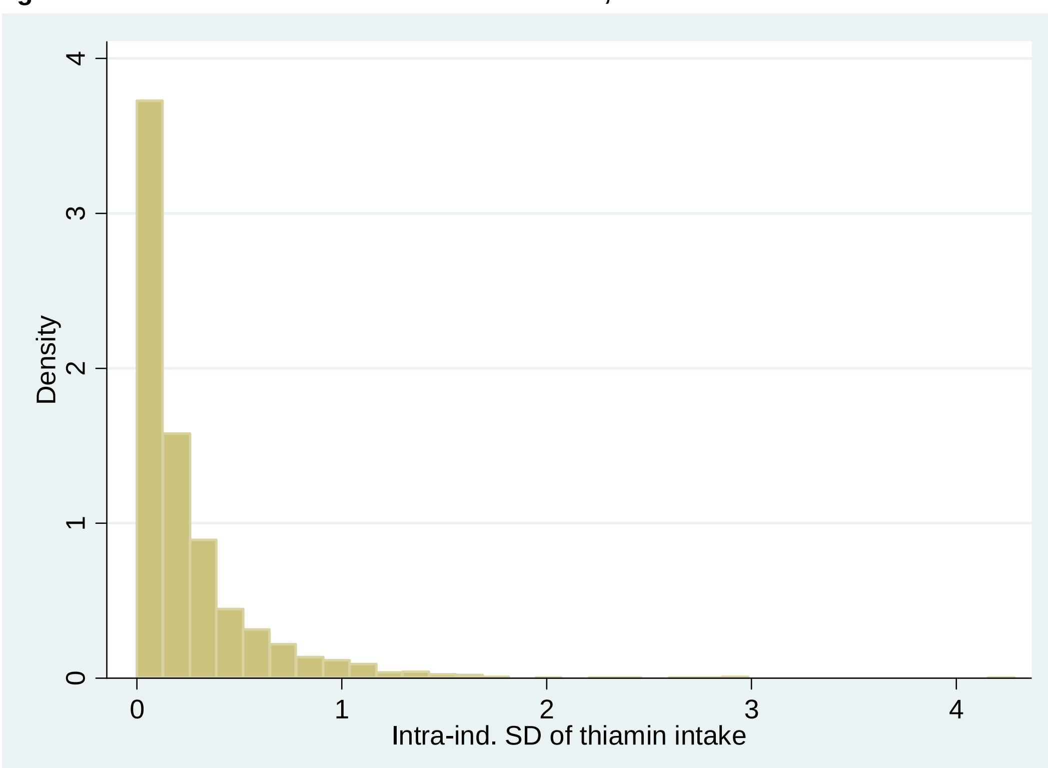


Figure 13. Intra-Individual SD of Riboflavin Intakes, All Women

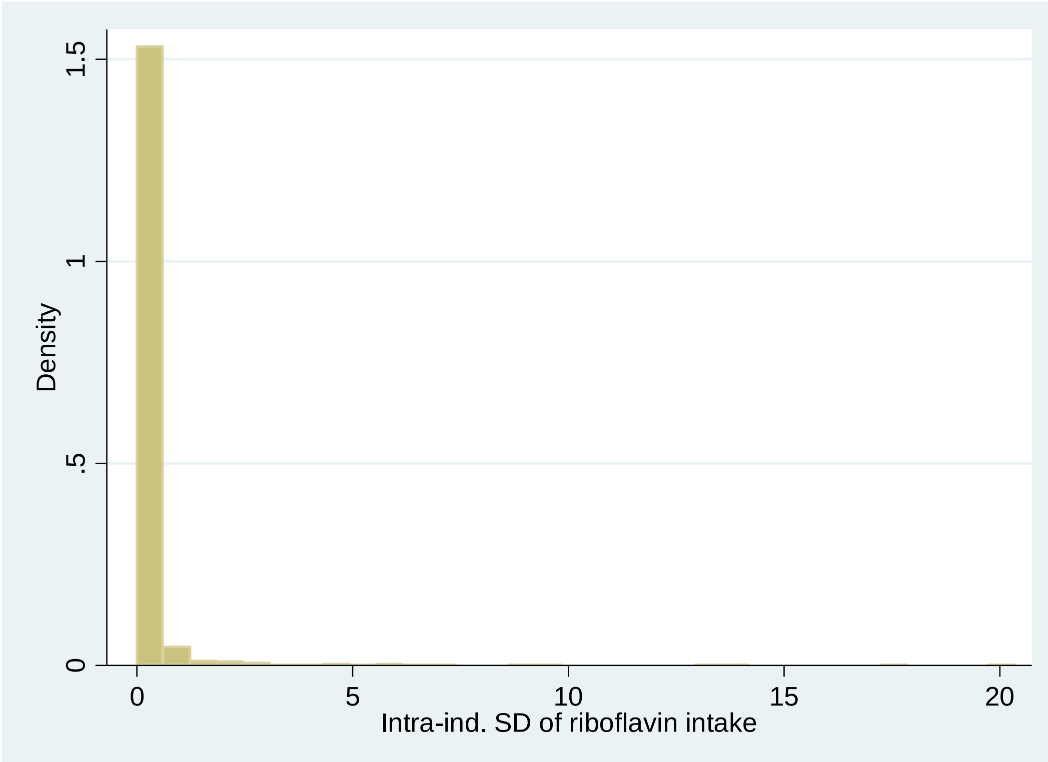


Figure 14. Intra-Individual SD of Niacin Intakes, All Women

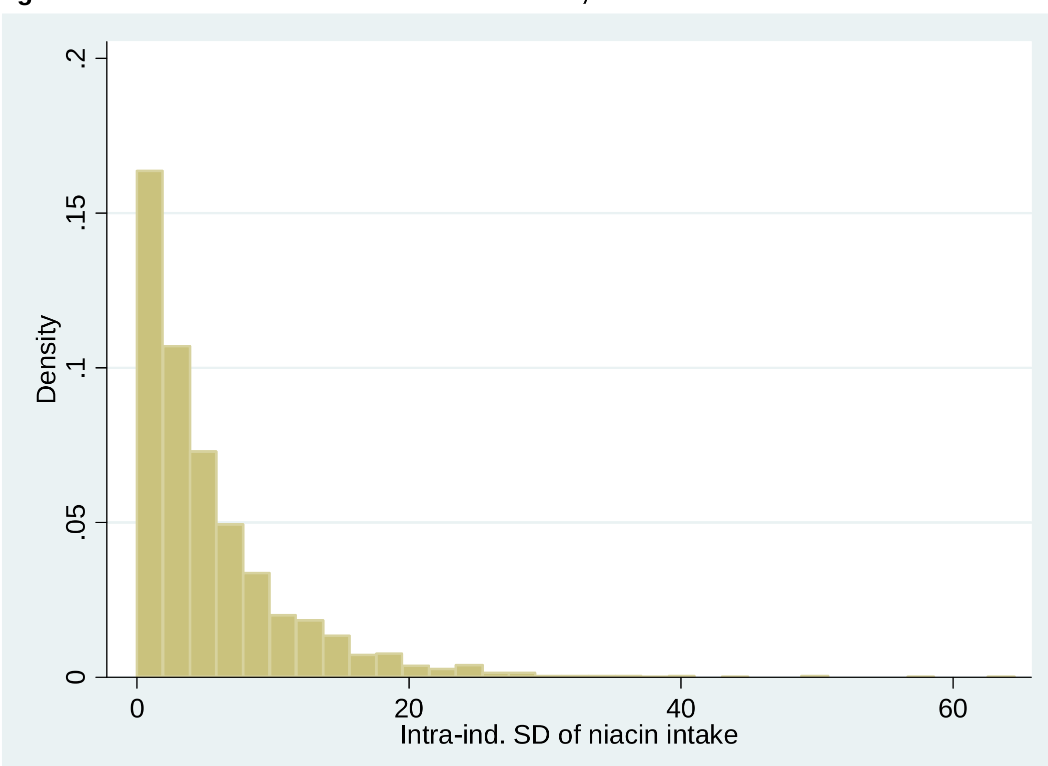


Figure 15. Intra-Individual SD of Vitamin B6 Intakes, All Women

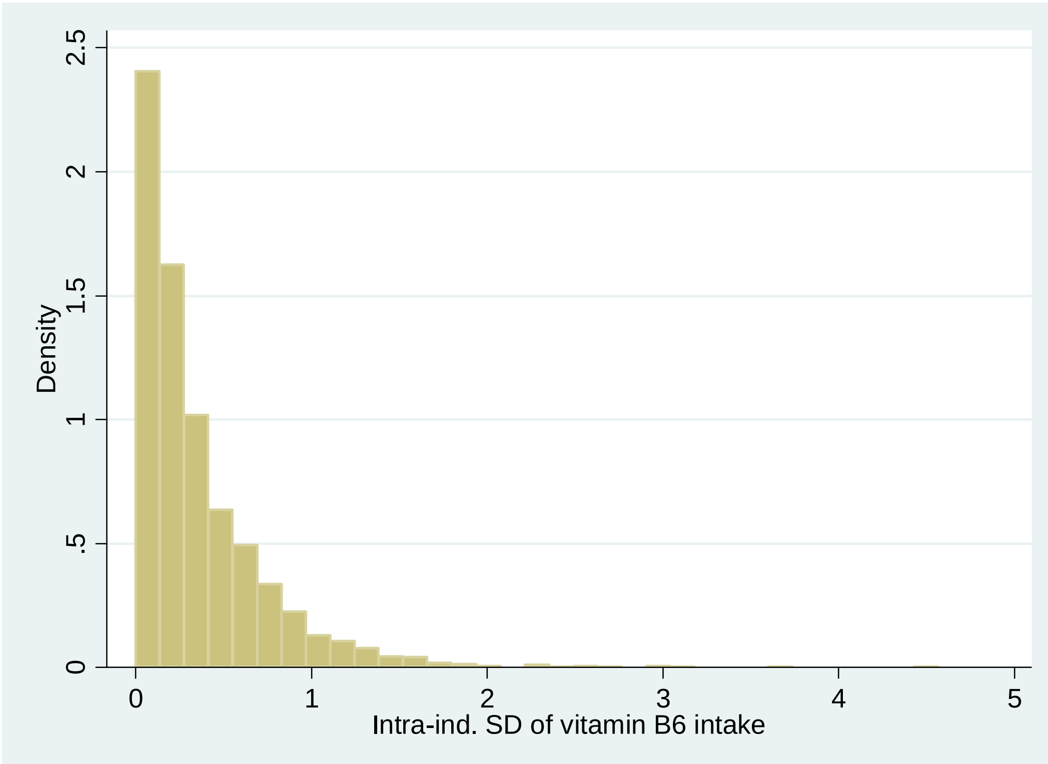


Figure 16. Intra-Individual SD of Folate Intakes, All Women

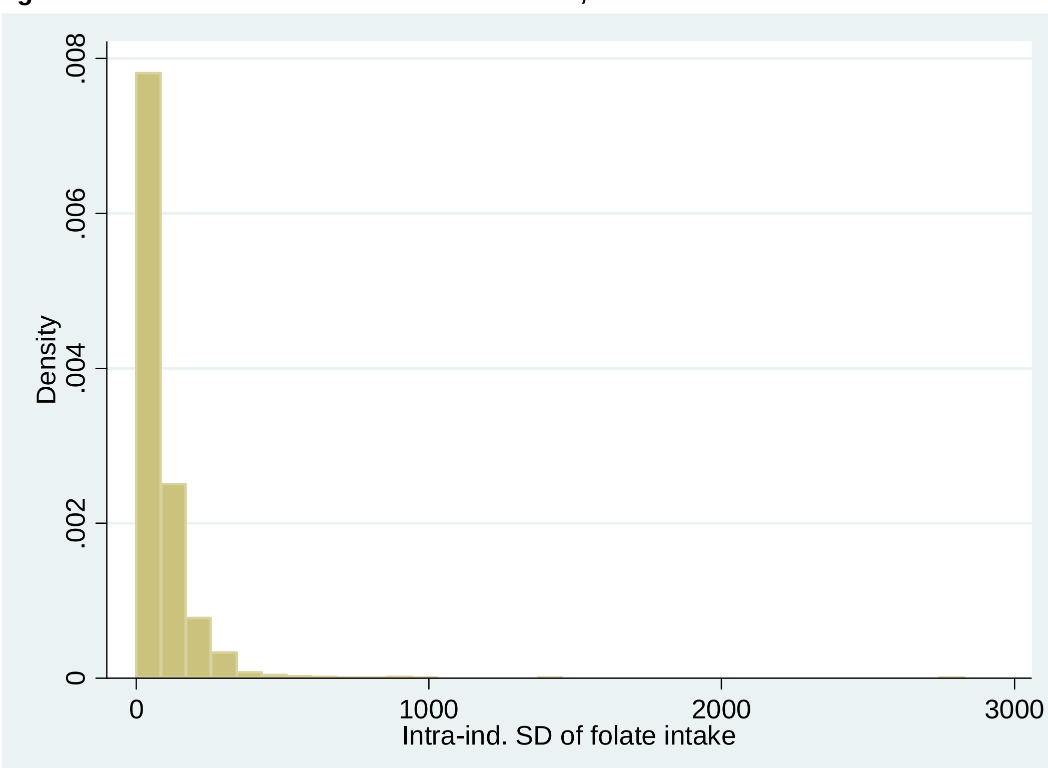


Figure 17. Intra-Individual SD of Vitamin B12 Intakes, All Women

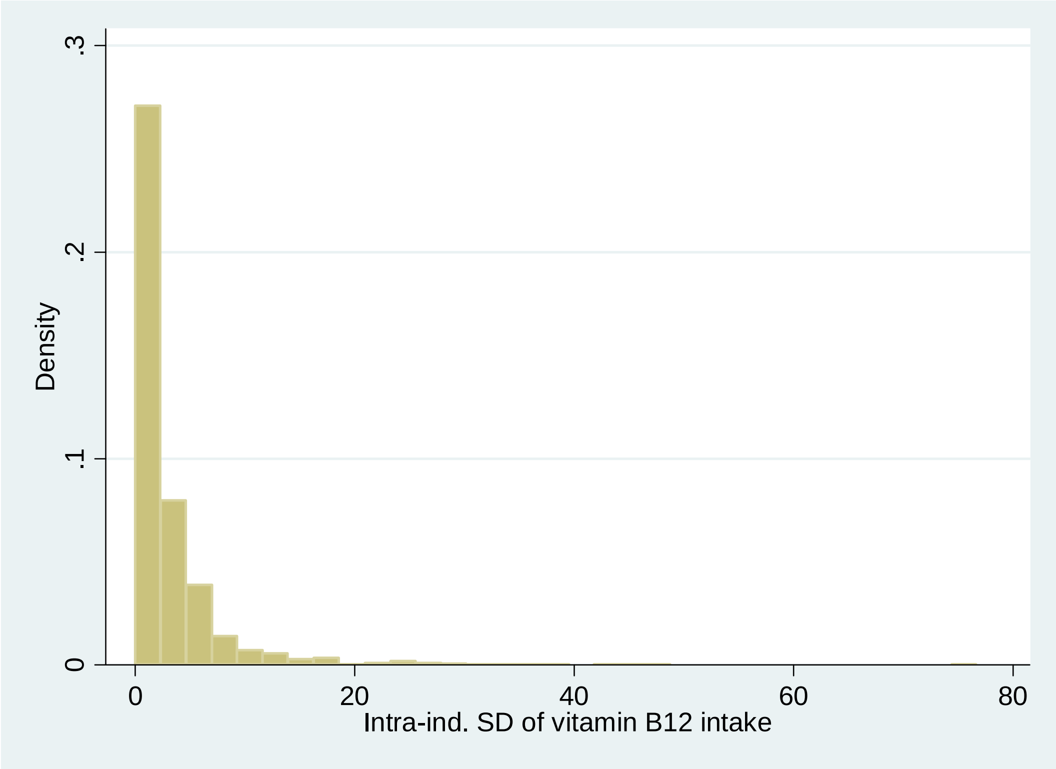


Figure 18. Intra-Individual SD of Vitamin C Intakes, All Women

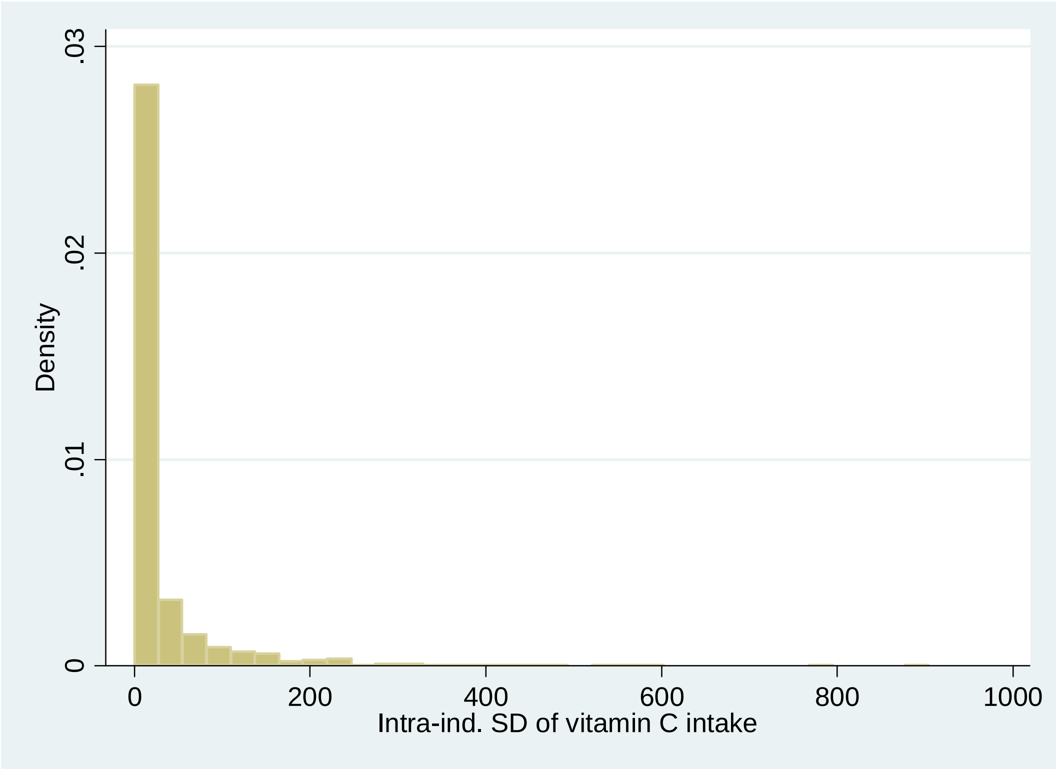


Figure 19. Intra-Individual SD of Vitamin A Intakes, All Women

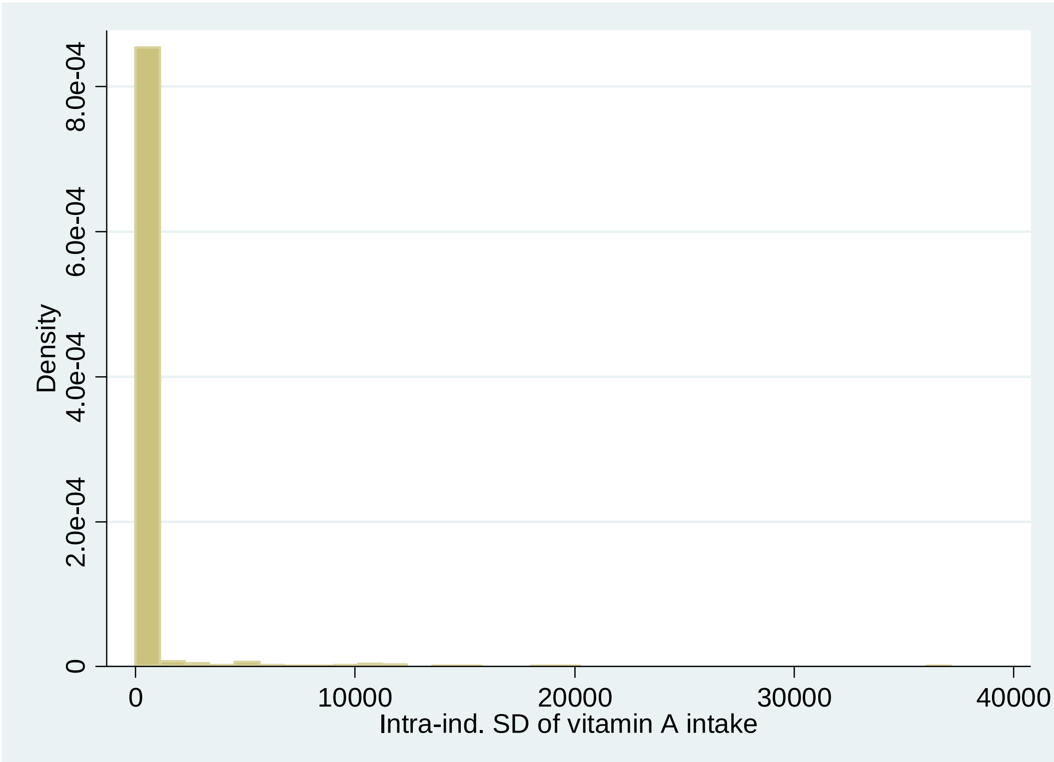


Figure 20. Intra-Individual SD of Calcium Intakes, All Women

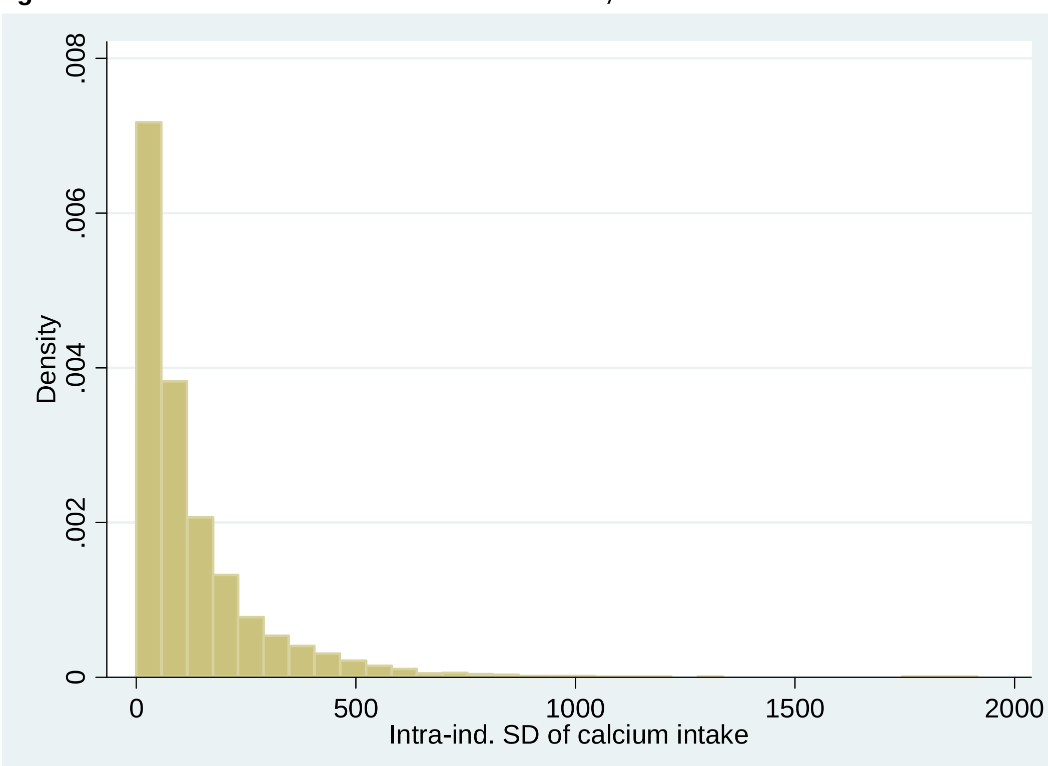


Figure 21. Intra-Individual SD of Iron Intakes, All Women

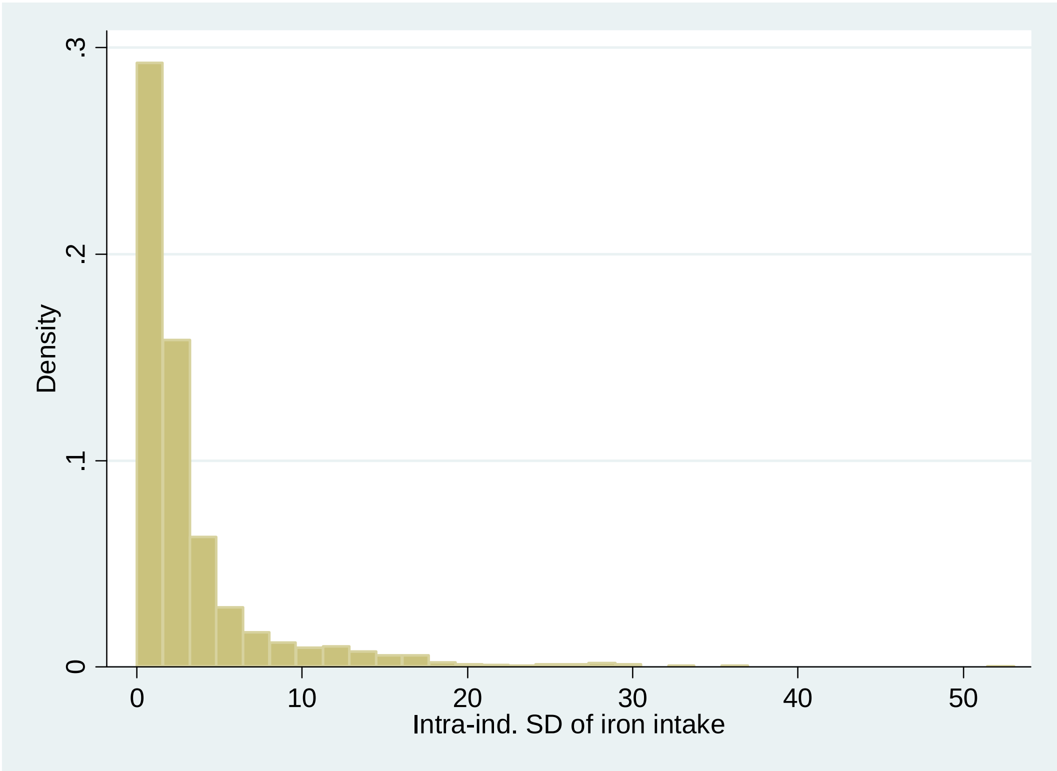


Figure 22. Intra-Individual SD of Zinc Intakes, All Women

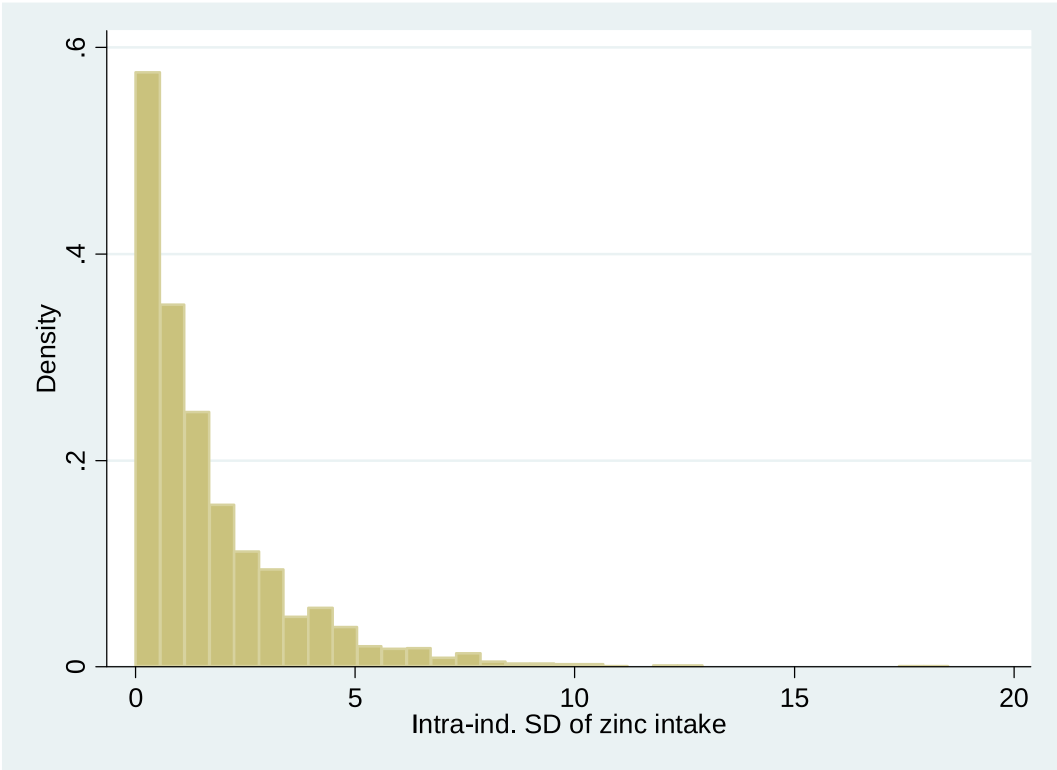


Figure 23. Distribution of Scores for FGI-6, All Women

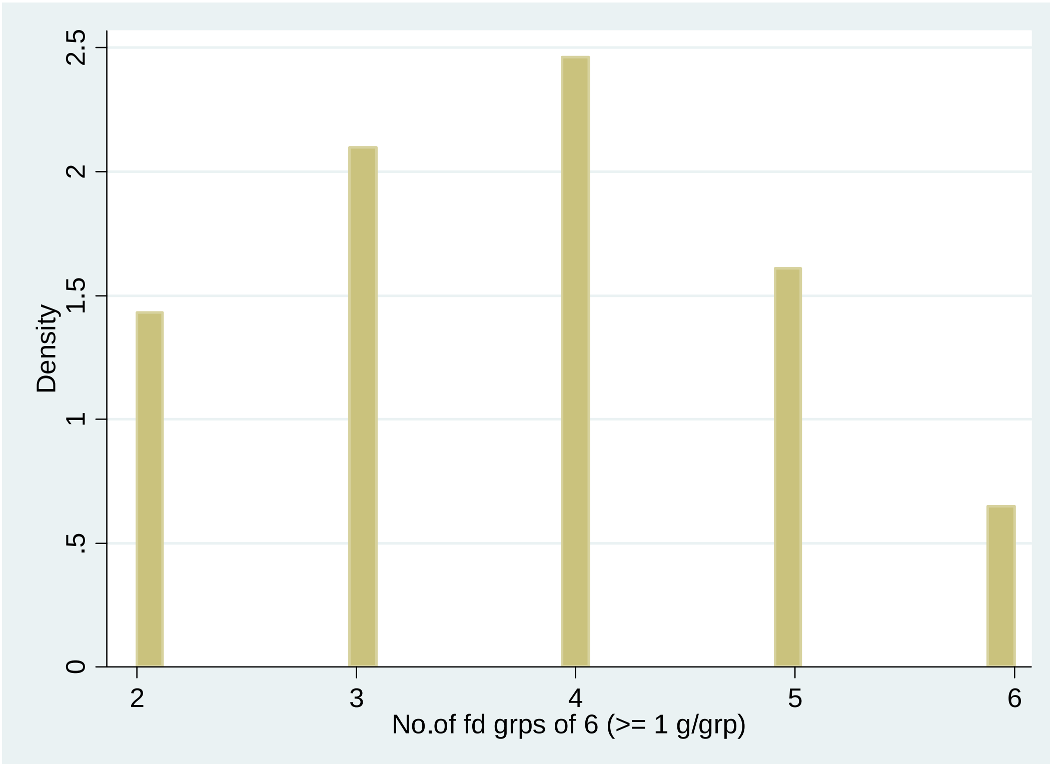


Figure 24. Distribution of Scores for FGI-6R, All Women

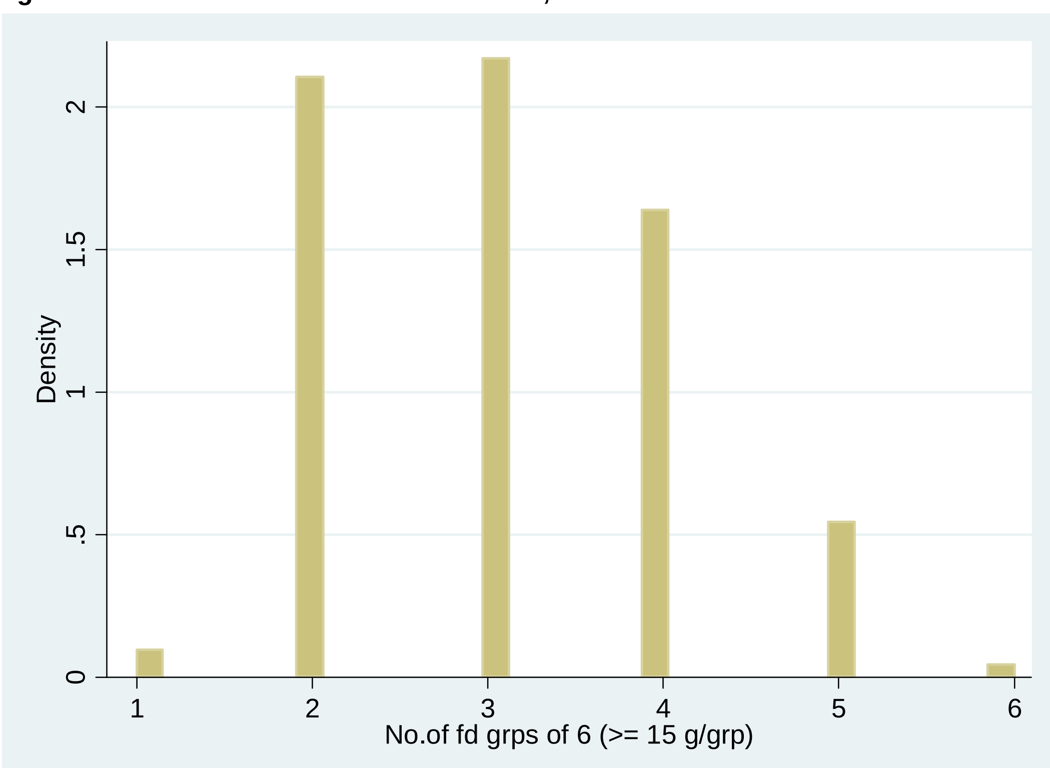


Figure 25. Distribution of Scores for FGI-9, All Women

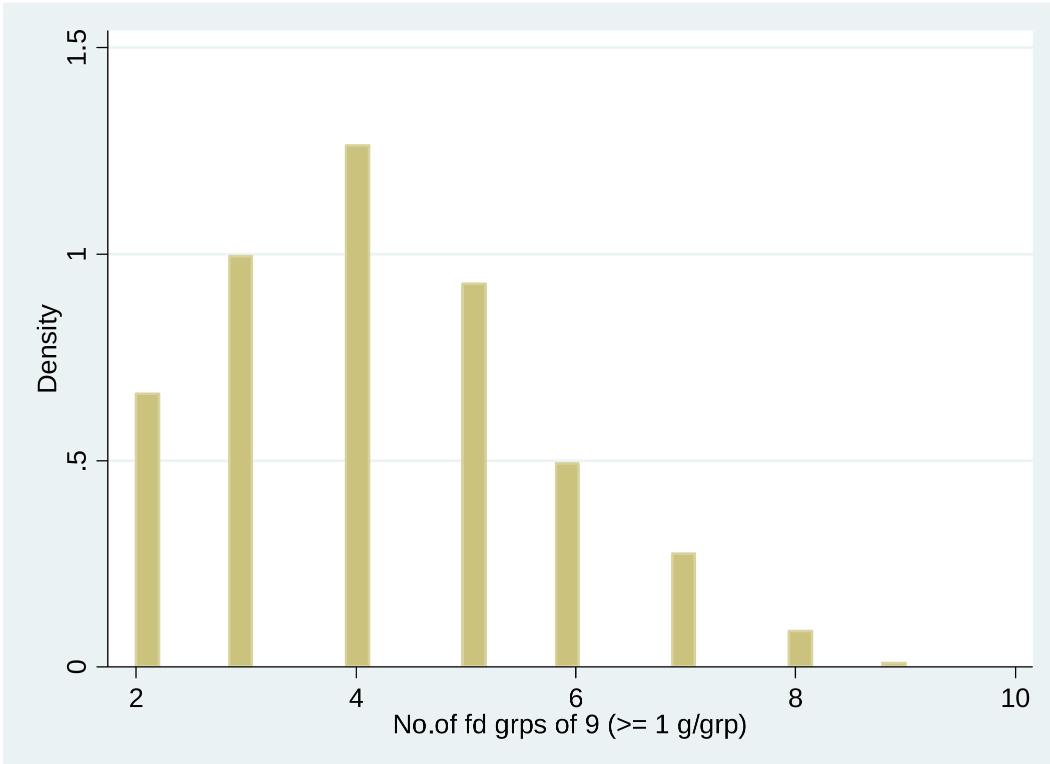


Figure 26. Distribution of Scores for FGI-9R, All Women

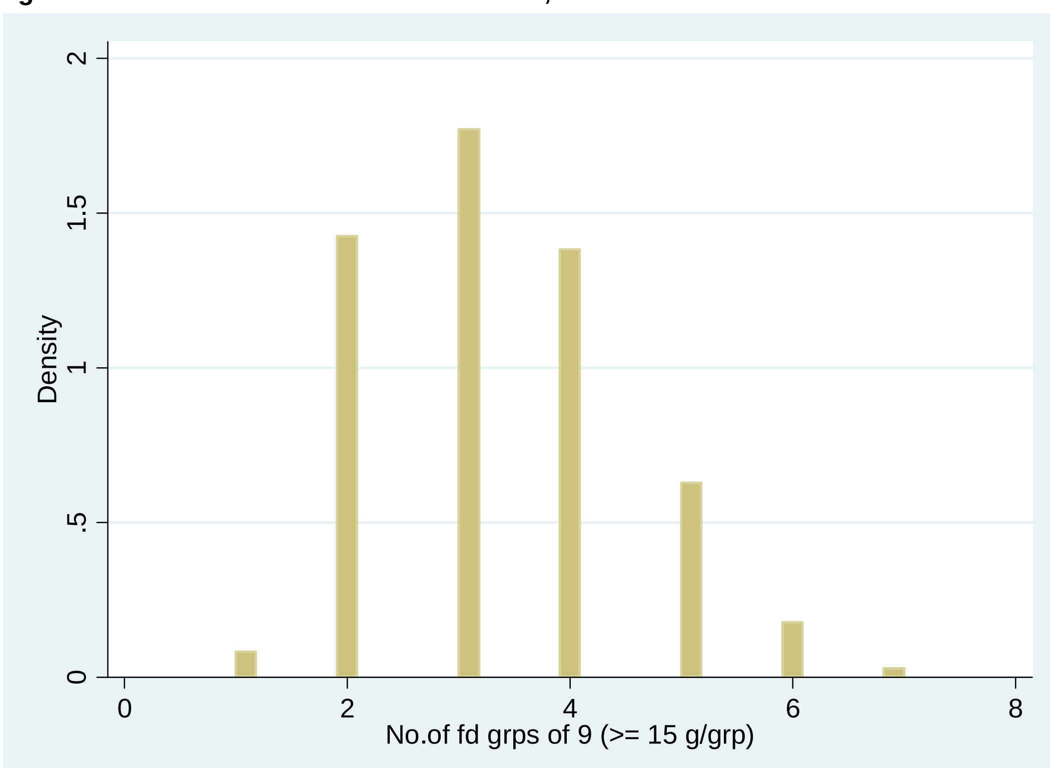


Figure 27. Distribution of Scores for FGI-13, All Women

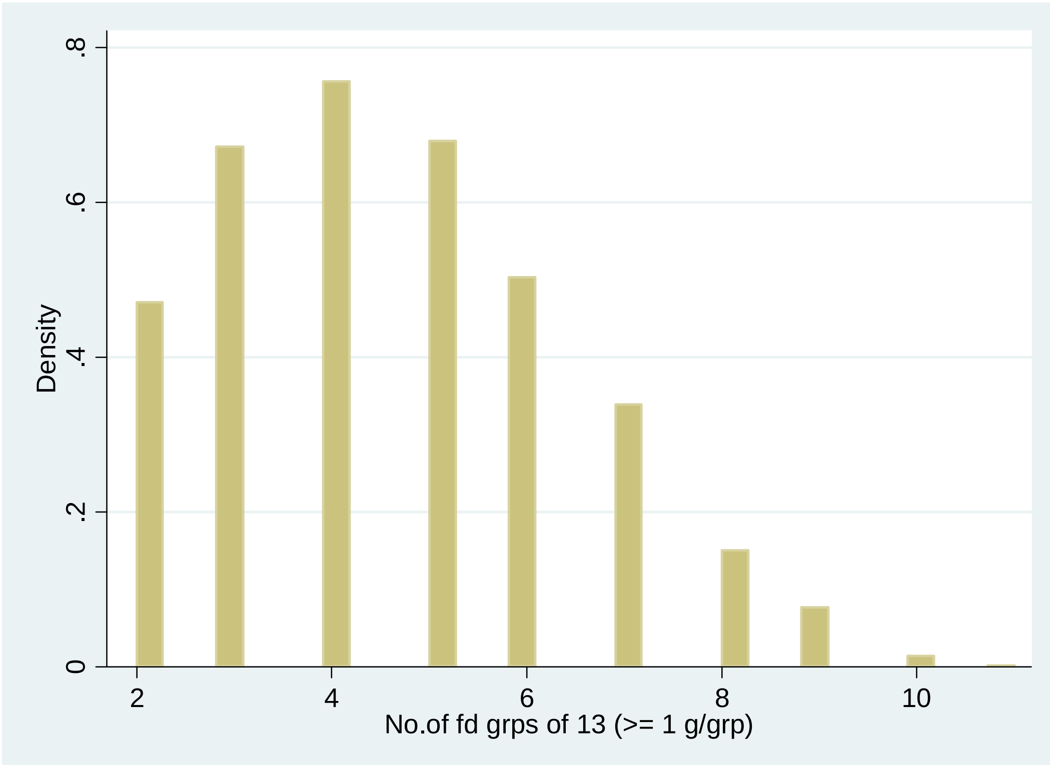


Figure 28. Distribution of Scores for FGI-13R, All Women

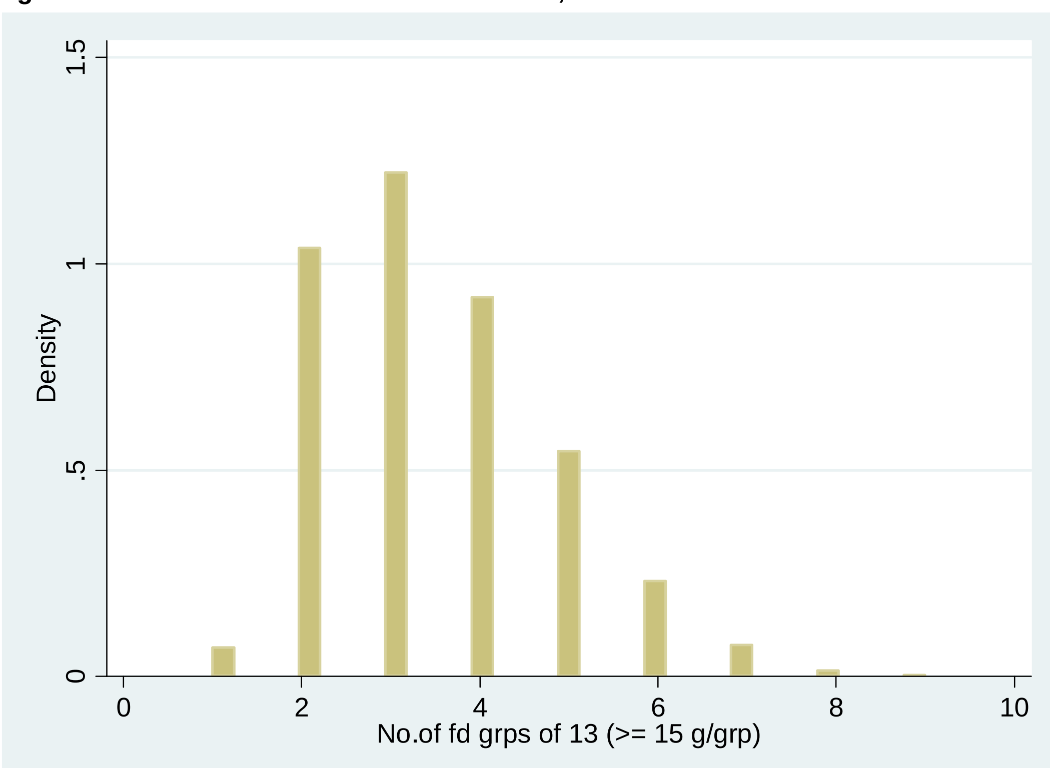


Figure 29. Distribution of Scores for FGI-21, All Women

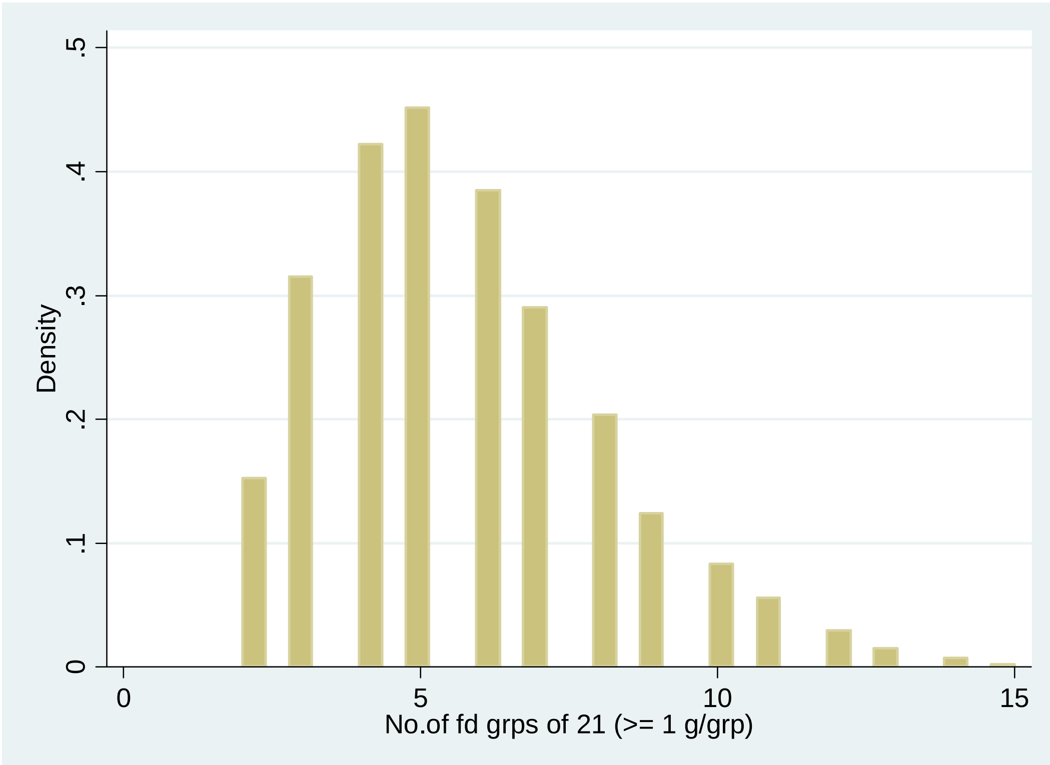


Figure 30. Distribution of Scores for FGI-21R, All Women

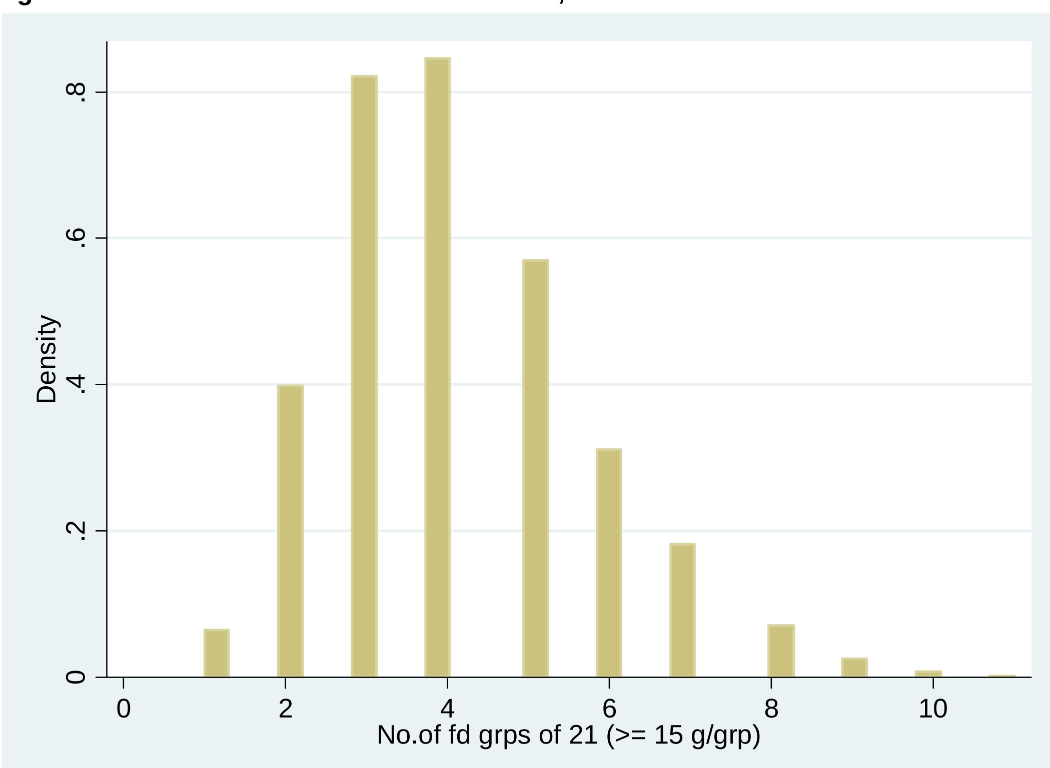


Table 6. Percent of Observation Days at Each Food Group Diversity Score, All Women, R1

Number of food groups eaten	Diversity indicators							
	FGI-6	FGI-6R	FGI-9	FGI-9R	FGI-13	FGI-13R	FGI-21	FGI-21R
1	0	2	0	2	0	2	0	2
2	17	32	14	26	13	25	6	12
3	25	33	21	32	18	30	12	25
4	30	25	27	25	21	22	17	26
5	20	8	20	11	19	13	18	17
6	8	1	11	3	14	6	15	9
7			6	1	9	2	11	6
8			2	0	4	0	8	2
9			0	0	2	0	5	1
10					0	0	3	0
11					0	0	2	0
12					0	0	1	0
13					0	0	1	0
14							0	0
15							0	0
16							0	0
17							0	0
18							0	0
19							0	0
20							0	0
21							0	0

Figure 31. Distribution of PA for Thiamin, All Women

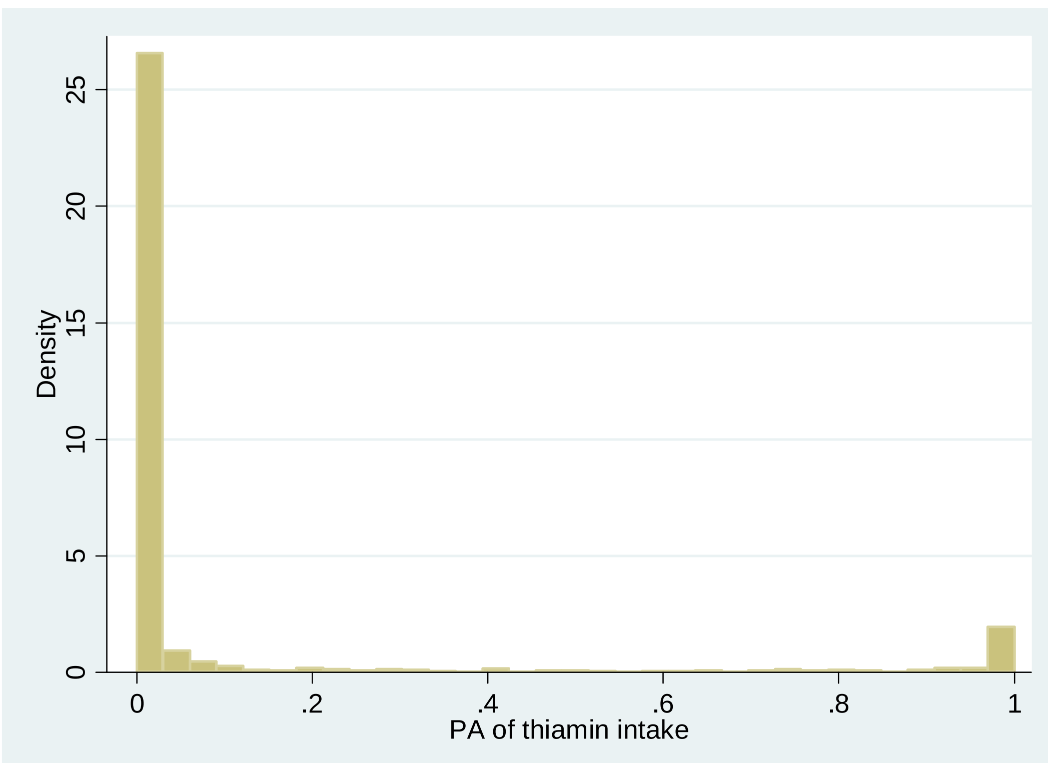


Figure 32. Distribution of PA for Riboflavin, All Women

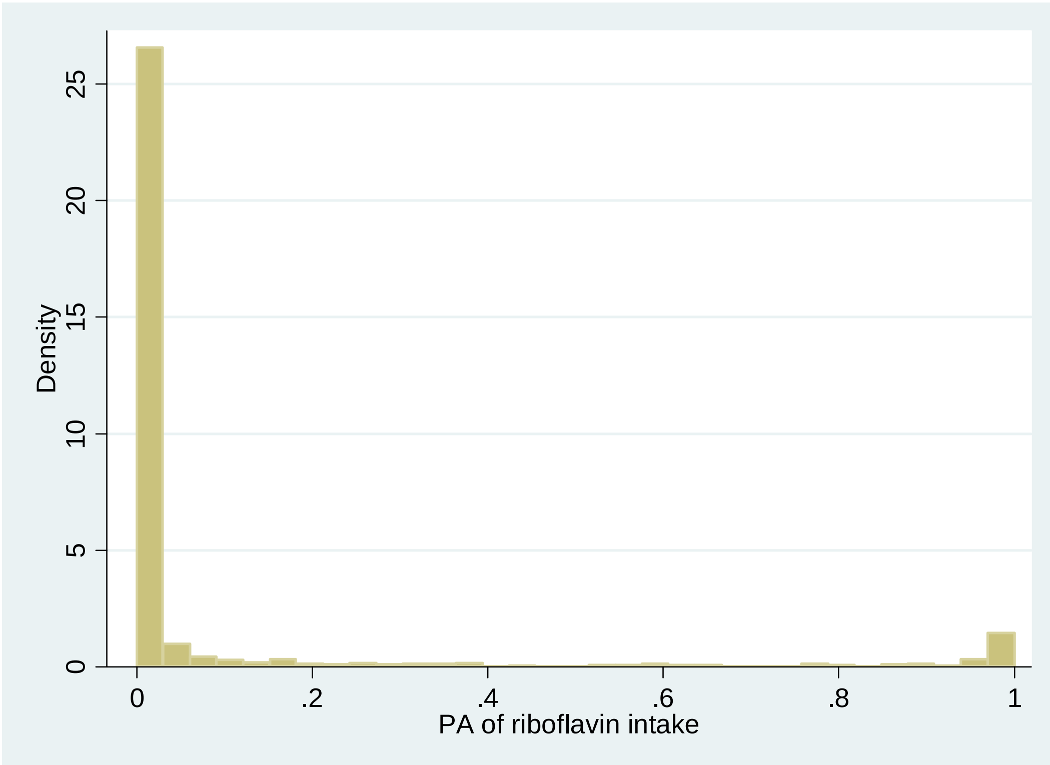


Figure 33. Distribution of PA for Niacin, All Women

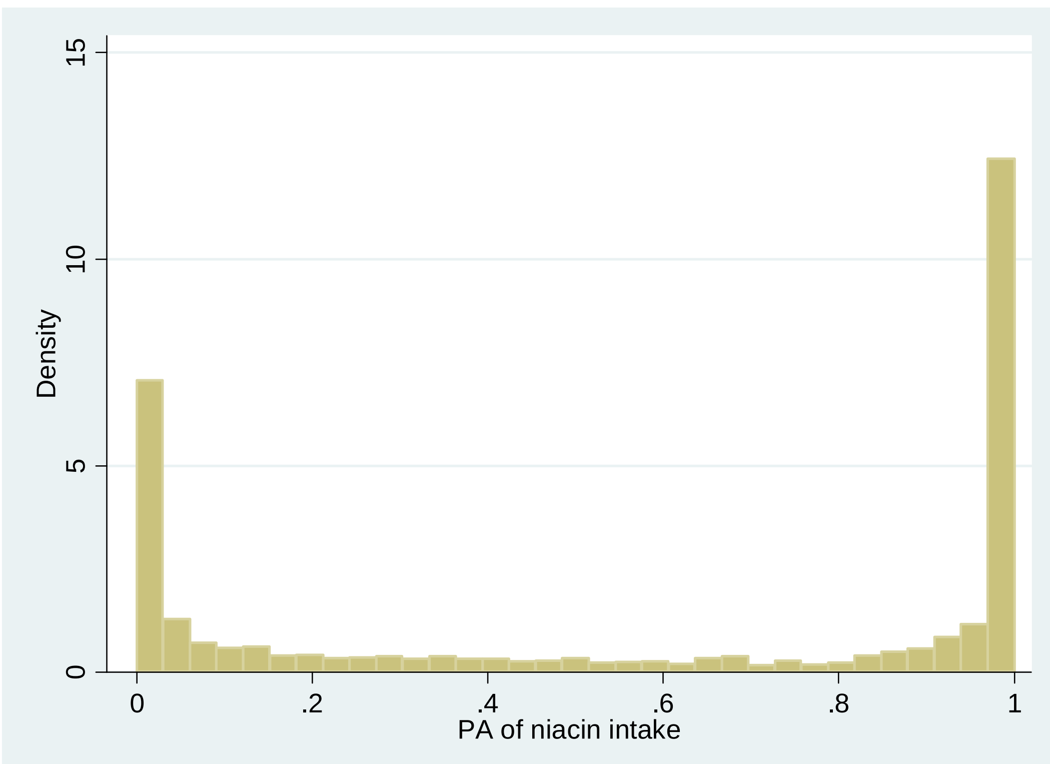


Figure 34. Distribution of PA for Vitamin B6, All Women

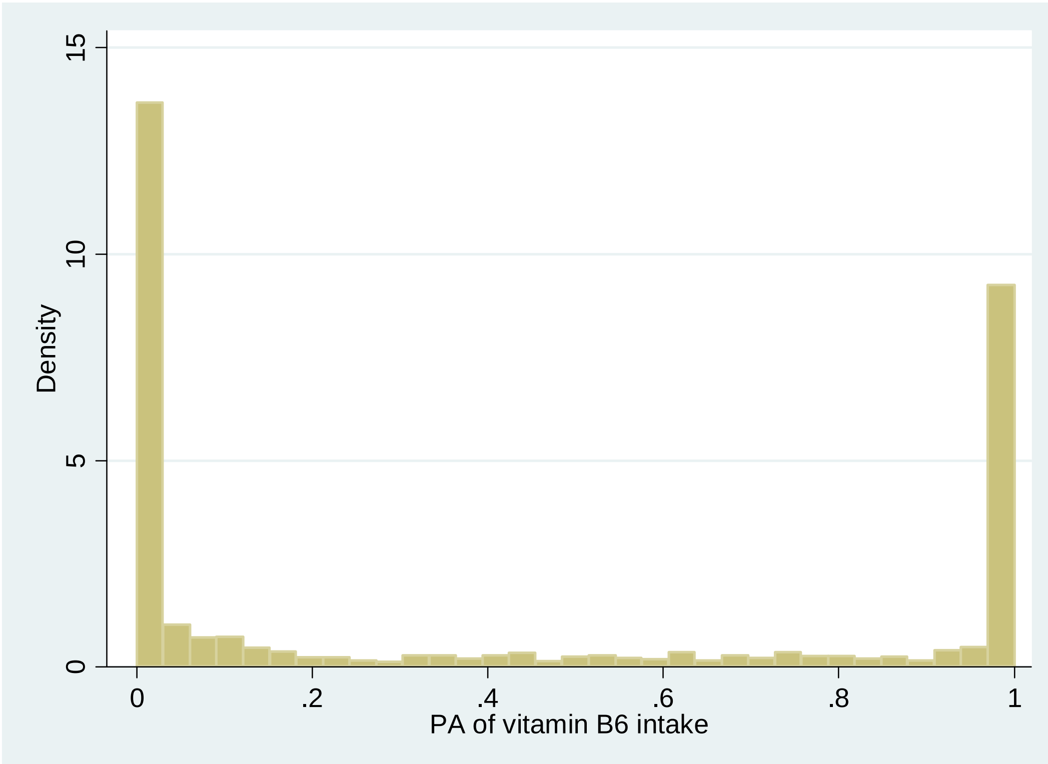


Figure 35. Distribution of PA for Folate, All Women

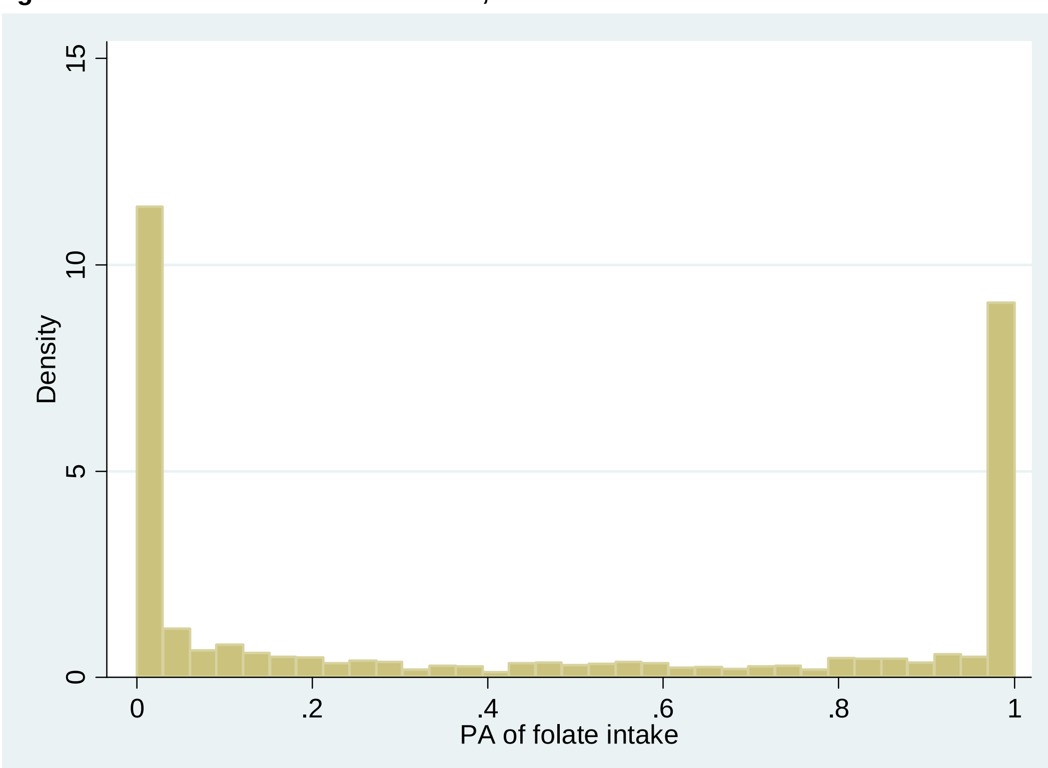


Figure 36. Distribution of PA for Vitamin B12, All Women

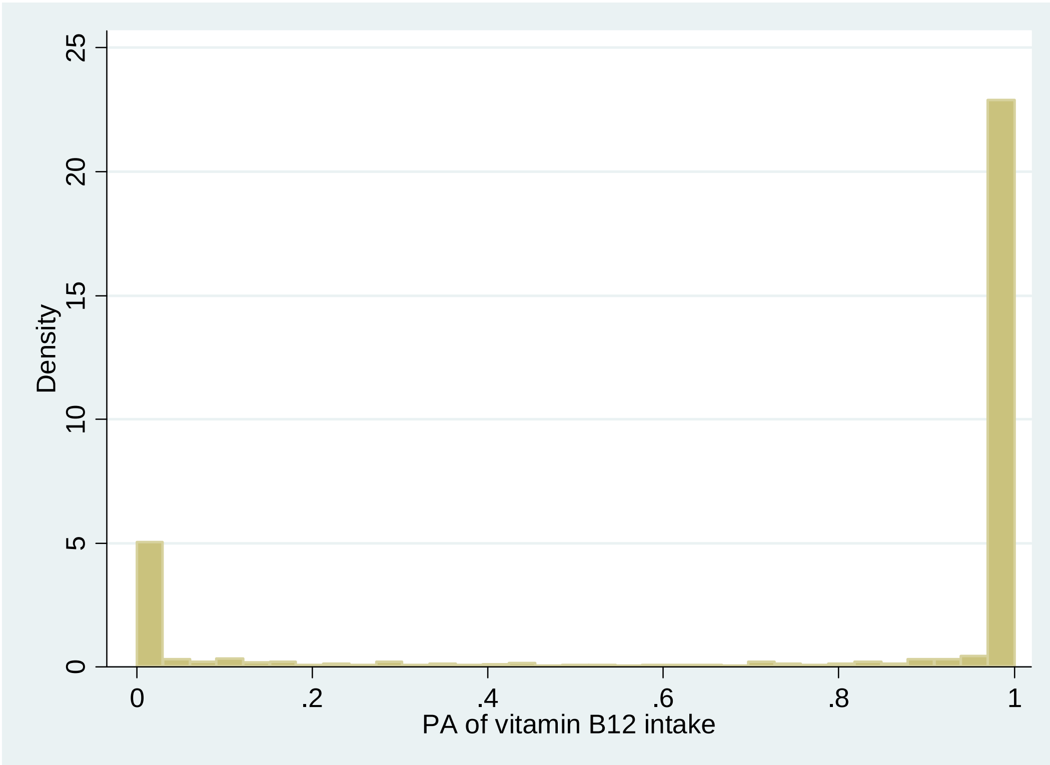


Figure 37. Distribution of PA for Vitamin C, All Women

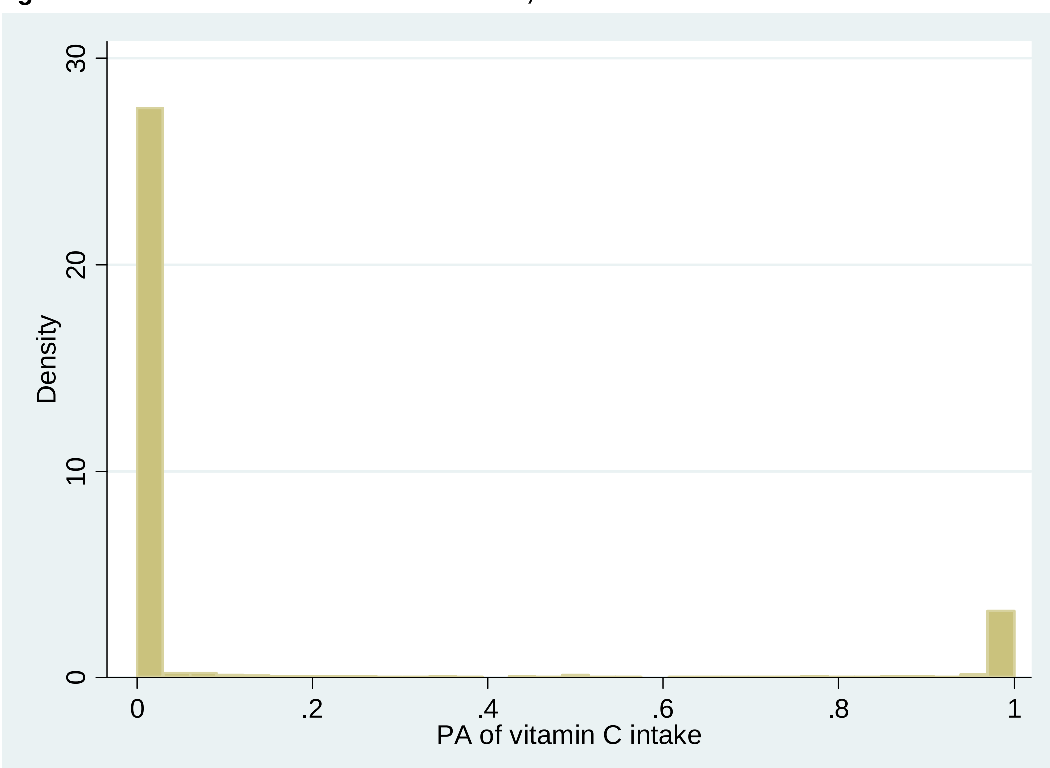


Figure 38. Distribution of PA for Vitamin A, All Women

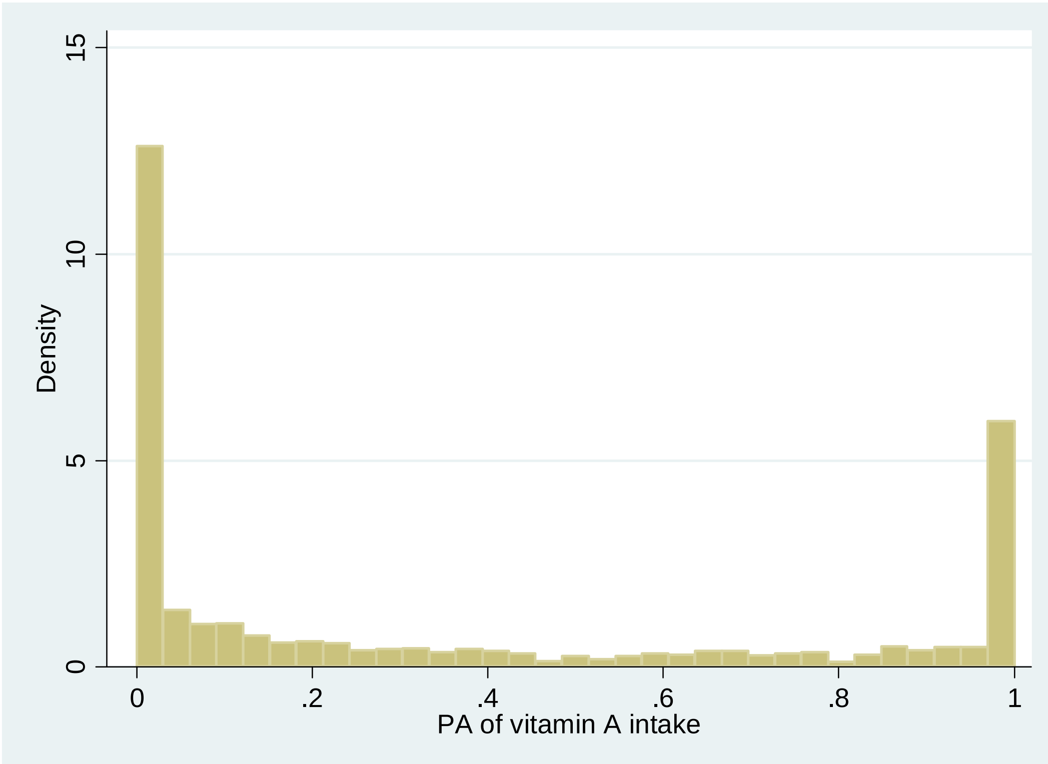


Figure 39. Distribution of PA for Calcium, All Women

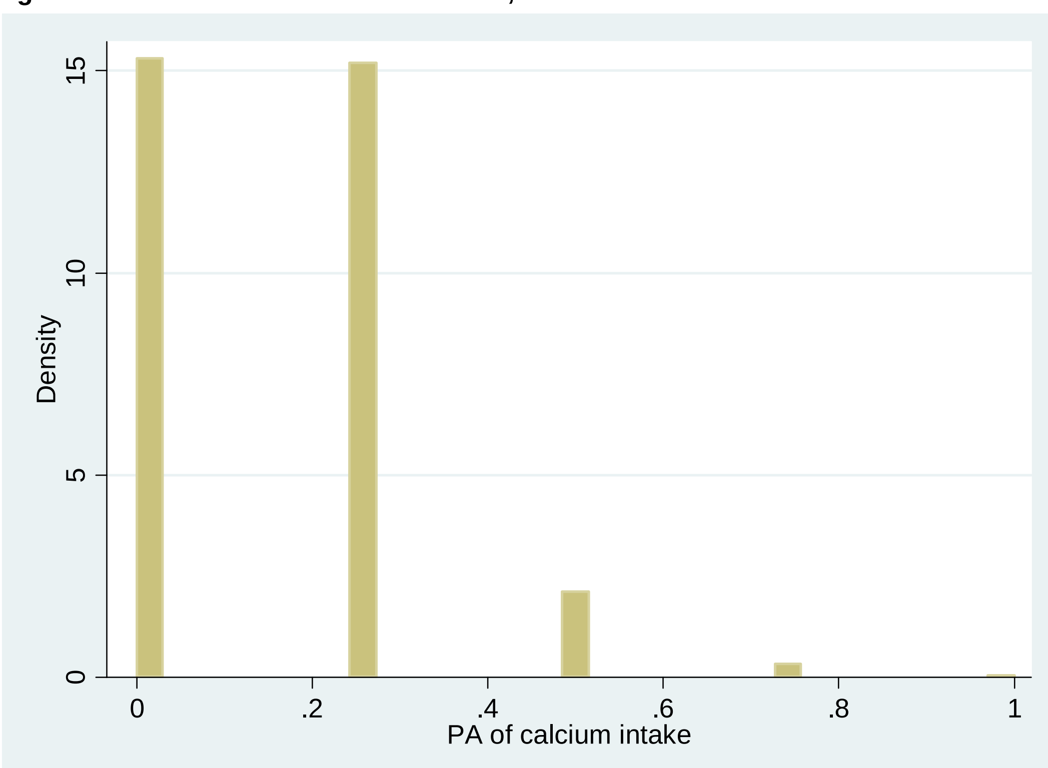


Figure 40. Distribution of PA for Iron, All Women

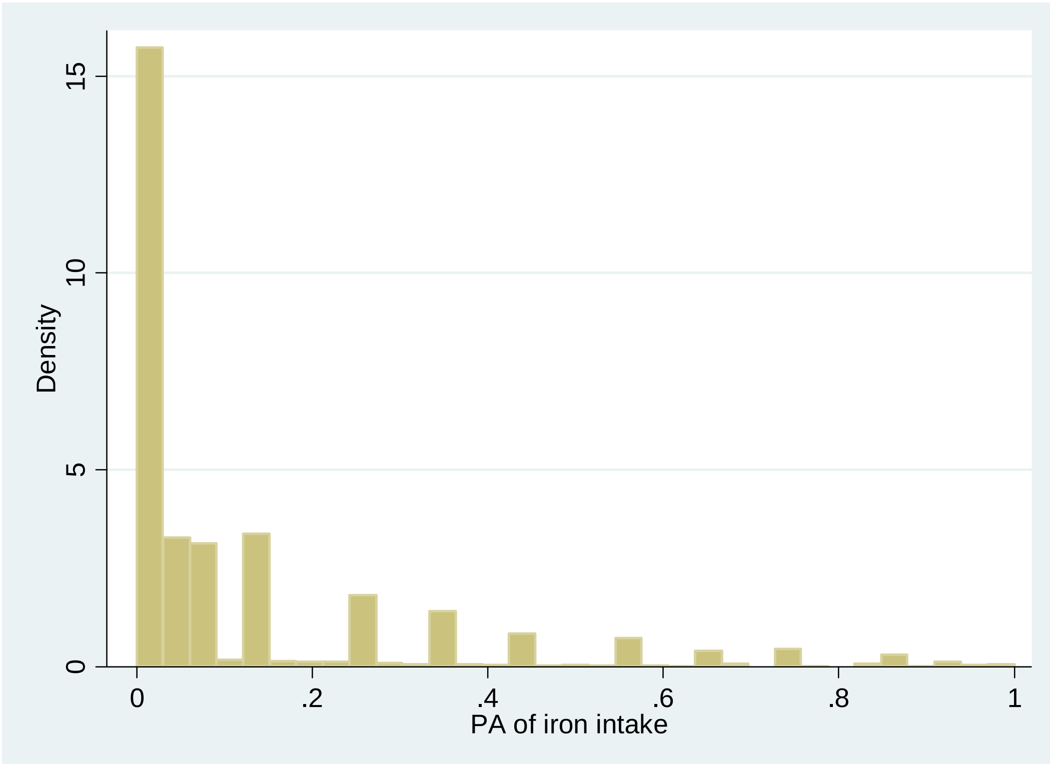


Figure 41. Distribution of PA for Zinc, All Women

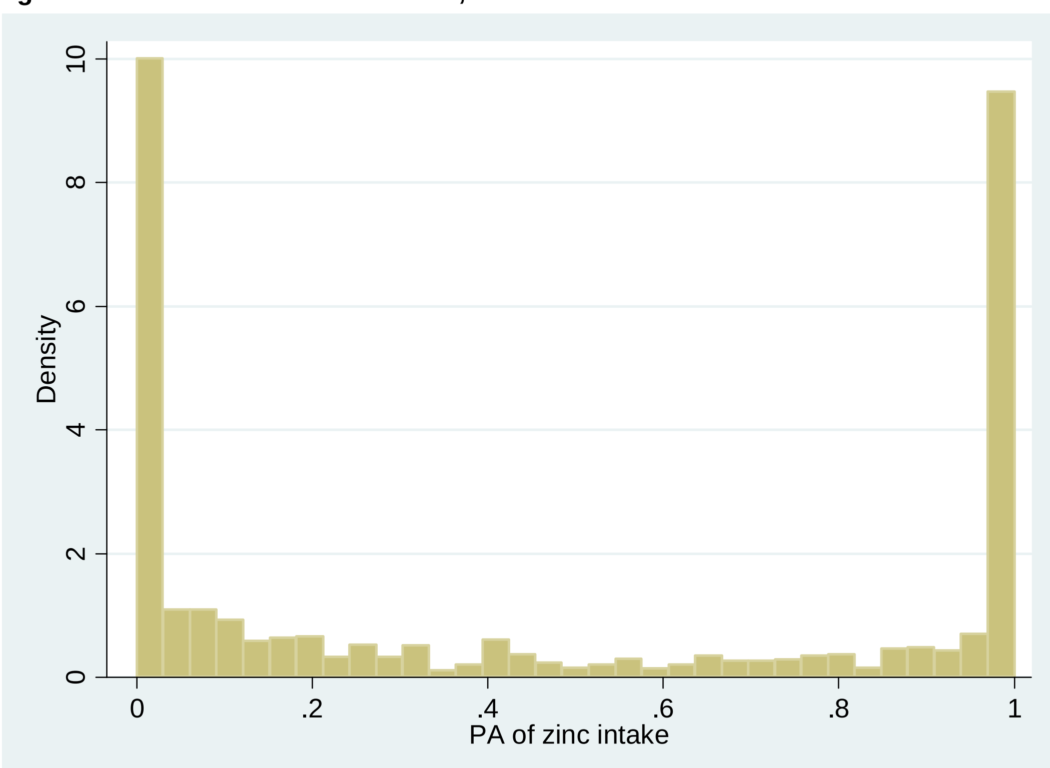
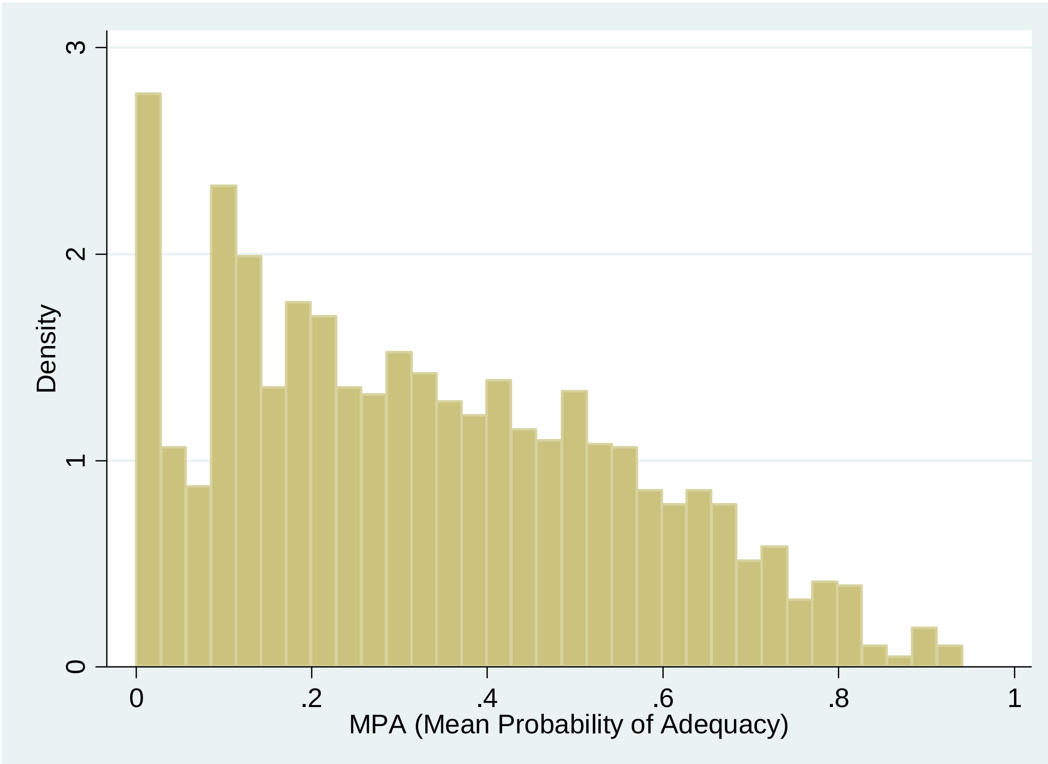


Figure 42. Distribution of MPA across 11 Micronutrients, All Women



Appendix 2. Tables and Figures, Lactating Women

Table L1. Description of Sample, Lactating Women, R1

	n	Mean	SD	Median	Range
Age (year)	167	28.3	10.0	21.0	20.0-48.0
Height (cm)	167	150.2	5.3	149.9	138.6-163.0
Weight (kg)	167	49.4	8.3	49.0	31.6-75.7
BMI	167	21.9	3.4	21.4	14.7-32.3
Education[a]	167	8.20	3.1	9.0	0-15
% Literate[b]	167	95.8			
% Lactating	167	100.0			
% Pregnant	167	0.0			
	n	**Percent**			
BMI < 16	2	1.2			
BMI 16-16.9	4	2.4			
BMI 17-18.49	20	12.0			
BMI 18.5-24.9	114	68.3			
BMI 25-29.9	24	14.4			
BMI ≥ 30	3	1.8			

[a] Years of schooling completed.
[b] Percent completing 3rd grade.

Table L2. Energy and Macronutrient Intakes, Lactating Women, R1

	Mean	SD	Median	Range	Percent of kcal
Energy (kcal)	1,367.4	630.2	1,263.7	389.4-3,237.7	
Protein (g)	49.7	30.2	42.5	8.9-153.1	14
Animal source (g)	29.9	26.8	21.5	0.0-119.0	8
Plant source (g)	20.0	10.1	19.0	3.9-59.7	6
Total carbohydrate (g)	233.6	102.7	213.0	71.3-554.9	70
Total fat (g)	25.8	27.2	15.6	1.2-135.6	15

Table L3a. Percent of Women Who Consumed 6 Major Food Groups, Lactating Women, R1

	≥ 1 g	≥ 15 g
All starchy staples	100	100
All legumes and nuts	37	26
All dairy	17	9
Other animal source foods	99	94
Vitamin A-rich fruits and vegetables [a]	45	33
Other fruits and vegetables	54	37

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table L3b. Percent of Women Who Consumed 9 Sub-Food Groups, Lactating Women, R1

	≥ 1 g	≥ 15 g
All starchy staples	100	100
All legumes and nuts	37	26
All dairy	17	9
Organ meat	11	7
Eggs	25	16
Flesh foods and other miscellaneous small animal protein	99	91
Vitamin A-rich dark green leafy vegetables [a]	33	28
Other vitamin A-rich vegetables and fruits [a]	17	8
Other fruits and vegetables	54	37

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table L3c. Percent of Women Who Consumed 13 Sub-Food Groups, Lactating Women, R1

	≥ 1 g	≥ 15 g
All starchy staples	100	100
All legumes and nuts	37	26
All dairy	17	9
Organ meat	11	7
Eggs	25	16
Small fish eaten whole with bones	18	11
All other flesh foods and miscellaneous small animal protein	96	87
Vitamin A-rich dark green leafy vegetables [a]	33	28
Vitamin A-rich deep yellow/orange/red vegetables [a]	14	5
Vitamin C-rich vegetables [b]	29	16
Vitamin A-rich fruits [a]	3	3
Vitamin C-rich fruits [b]	4	3
All other fruits and vegetables	43	25

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.
[b] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table L3d. Percent of Women Who Consumed 21 Sub-Food Groups, Lactating Women, R1

	≥ 1 g	≥ 15 g
Grains and grain products	100	100
All other starchy staples	25	19
Cooked dry beans and peas	32	25
Soybeans and soy products	9	0
Nuts and seeds	2	2
Milk/yogurt	14	8
Cheese	4	1
Beef, pork, veal, lamb, goat, game meat	50	41
Organ meat	11	7
Chicken, duck, turkey, pigeon, guinea hen, game birds	10	9
Large whole fish/dried fish/shellfish and other seafood	81	67
Small fish eaten whole with bones	18	11
Insects, grubs, snakes, rodents and other small animal	0	0
Eggs	25	16
Vitamin A-rich dark green leafy vegetables [a]	33	28
Vitamin A-rich deep yellow/orange/red vegetables [a]	14	5
Vitamin C-rich vegetables [b]	29	16
All other vegetables	40	24
Vitamin A-rich fruits [a]	3	3
Vitamin C-rich fruits [b]	4	3
All other fruits	5	2

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.
[b] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table L4a. Summary of Food Group Intake (FGI-6) for Lactating Women, for All R1 Observation Days and for Days When the Food Was Consumed

Food group	All (n = 167)					Among those who consume			
	Mean amount (g)	Mean energy (kcal)	Median amount (g)	Median energy (kcal)	Percent consuming	Mean amount (g)	Mean energy (kcal)	Median amount (g)	Median energy (kcal)
All starchy staples	646.2	877.6	555.0	834.2	100	646.2	877.6	555.0	834.2
All legumes and nuts	19.5	27.1	0.0	0.0	37	53.7	74.2	36.3	34.8
All dairy	4.8	19.5	0.0	0.0	17	28.3	116.3	17.3	54.6
Other animal source foods	102.6	289.3	78.6	178.3	99	103.2	291.1	78.9	178.5
Vitamin A-rich fruits and vegetables [a]	21.0	11.8	0.0	0.0	45	46.7	26.2	29.7	14.2
Other fruits and vegetables	25.3	11.2	3.3	1.9	54	46.9	20.7	26.0	10.8

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table L4b. Summary of Food Group Intake (FGI-9) for Lactating Women, for All R1 Observation Days and for Days When the Food Was Consumed

Food group	All (n = 167)					Among those who consume			
	Mean amount (g)	Mean energy (kcal)	Median amount (g)	Median energy (kcal)	Percent consuming	Mean amount (g)	Mean energy (kcal)	Median amount (g)	Median energy (kcal)
All starchy staples	646.2	877.6	555.0	834.2	100	646.2	877.6	555.0	834.2
All legumes and nuts	19.5	27.1	0.0	0.0	37	53.7	74.2	36.3	34.8
All dairy	4.8	19.5	0.0	0.0	17	28.3	116.3	17.3	54.6
Organ meat	3.5	4.9	0.0	0.0	11	30.5	43.0	20.0	33.0
Eggs	8.8	13.5	0.0	0.0	25	35.8	54.8	26.2	44.5
Flesh foods and other miscellaneous small animal protein	90.3	271.0	65.0	150.7	99	90.9	272.6	65.8	151.0
Vitamin A-rich dark green leafy vegetables [a]	13.5	7.4	0.0	0.0	33	41.0	22.6	30.0	15.6
Other vitamin A-rich vegetables and fruits [a]	7.5	4.4	0.0	0.0	17	44.6	25.9	12.5	6.8
Other fruits and vegetables	25.3	11.2	3.3	1.9	54	46.9	20.7	26.0	10.8

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table L4c. Summary of Food Group Intake (FGI-13) for Lactating Women, for All R1 Observation Days and for Days When the Food Was Consumed

Food group	All (n = 167)					Among those who consume			
	Mean amount (g)	Mean energy (kcal)	Median amount (g)	Median energy (kcal)	Percent consuming	Mean amount (g)	Mean energy (kcal)	Median amount (g)	Median energy (kcal)
All starchy staples	646.2	877.6	555.0	834.2	100	646.2	877.6	555.0	834.2
All legumes and nuts	19.5	27.1	0.0	0.0	37	53.7	74.2	36.3	34.8
All dairy	4.8	19.5	0.0	0.0	17	28.3	116.3	17.3	54.6
Organ meat	3.5	4.9	0.0	0.0	11	30.5	43.0	20.0	33.0
Eggs	8.8	13.5	0.0	0.0	25	35.8	54.8	26.2	44.5
Small fish eaten whole with bones	6.2	8.3	0.0	0.0	18	34.3	46.4	30.0	38.2
All other flesh foods and miscellaneous small animal protein	84.1	262.6	60.0	143.9	96	87.3	272.4	60.0	150.7
Vitamin A-rich dark green leafy vegetables [a]	13.5	7.4	0.0	0.0	33	41.0	22.6	30.0	15.6
Vitamin A-rich deep yellow/orange/red vegetables [a]	1.9	0.9	0.0	0.0	14	14.0	6.9	10.0	5.1
Vitamin C-rich vegetables [b]	9.8	3.4	0.0	0.0	29	33.5	11.5	19.3	5.1
Vitamin A-rich fruits [a]	5.5	3.4	0.0	0.0	3	185.2	113.7	250.0	140.8
Vitamin C-rich fruits [b]	4.5	2.6	0.0	0.0	4	124.3	73.1	97.5	53.8
All other fruits and vegetables	11.0	5.1	0.0	0.0	43	25.4	11.9	20.0	7.1

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.
[b] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table L4d. Summary of Food Group Intake (FGI-21) for Lactating Women, for All R1 Observation Days and for Days When the Food Was Consumed

	All (n = 167)					Among those who consume			
Food group	Mean amount (g)	Mean energy (kcal)	Median amount (g)	Median energy (kcal)	Percent consuming	Mean amount (g)	Mean energy (kcal)	Median amount (g)	Median energy (kcal)
Grains and grain products	632.3	854.2	555.0	799.2	100	632.3	854.2	555.0	799.2
All other starchy staples	13.9	23.5	0.0	0.0	25	56.5	95.6	30.0	41.2
Cooked dry beans and peas	18.4	23.6	0.0	0.0	32	56.9	73.1	36.3	36.8
Soybeans and soy products	0.5	0.5	0.0	0.0	9	5.3	5.7	3.8	2.9
Nuts and seeds	0.7	2.9	0.0	0.0	2	49.0	164.0	50.0	200.5
Milk/yogurt	4.3	18.1	0.0	0.0	14	29.9	125.8	17.5	63.5
Cheese	0.5	1.4	0.0	0.0	4	12.8	39.8	10.9	33.9
Beef, pork, veal, lamb, goat, game meat	31.5	157.4	1.7	9.3	50	62.6	312.8	51.3	252.7
Organ meat	3.5	4.9	0.0	0.0	11	30.5	43.0	20.0	33.0
Chicken, duck, turkey, pigeon, guinea hen, game birds	11.5	37.3	0.0	0.0	10	120.2	389.0	93.3	240.6
Large whole fish/dried fish/shellfish and other seafood	41.2	68.0	24.6	42.9	81	50.5	83.5	40.0	59.0
Small fish eaten whole with bones	6.2	8.3	0.0	0.0	18	34.3	46.4	30.0	38.2
Insects, grubs, snakes, rodents and other small animal	0.0	0.0	0.0	0.0	0				
Eggs	8.8	13.5	0.0	0.0	25	35.8	54.8	26.2	44.5
Vitamin A-rich dark green leafy vegetables [a]	13.5	7.4	0.0	0.0	33	41.0	22.6	30.0	15.6
Vitamin A-rich deep yellow/orange/red vegetables [a]	1.9	0.9	0.0	0.0	14	14.0	6.9	10.0	5.1
Vitamin C-rich vegetables [b]	9.8	3.4	0.0	0.0	29	33.5	11.5	19.3	5.1
All other vegetables	9.9	3.8	0.0	0.0	40	24.6	9.5	20.0	6.8
Vitamin A-rich fruits [a]	5.5	3.4	0.0	0.0	3	185.2	113.7	250.0	140.8
Vitamin C-rich fruits [b]	4.5	2.6	0.0	0.0	4	124.3	73.1	97.5	53.8
All other fruits	1.1	1.3	0.0	0.0	5	20.0	23.7	5.7	6.4

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.
[b] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table L5. Diversity Scores for Various Diversity Indicators, Lactating Women, R1

Indicator	Number of food groups and level	Mean	SD	Median	Range
FGI-6	6 major food groups	3.5	1.1	3.0	2-6
FGI-6R [a]	6 major food groups	3.0	1.0	3.0	1-6
FGI-9	9 food subgroups	3.9	1.4	4.0	2-8
FGI-9R [a]	9 food subgroups	3.2	1.2	3.0	1-7
FGI-13	13 food subgroups	4.3	1.7	4.0	2-9
FGI-13R [a]	13 food subgroups	3.4	1.3	3.0	1-9
FGI-21	21 food subgroups	5.1	2.1	5.0	2-11
FGI-21R [a]	21 food subgroups	3.9	1.5	4.0	1-10

[a] "R" indicates that at least 15 g must be consumed in order for the food group/subgroup to ―count" in the score.

Table L6. Percent of Observation Days at Each Food Group Diversity Score, Lactating Women, R1

Number of food groups eaten	Diversity indicators							
	FGI-6	FGI-6R	FGI-9	FGI-9R	FGI-13	FGI-13R	FGI-21	FGI-21R
1	0	3	0	4	0	4	0	4
2	22	34	17	25	16	23	8	12
3	31	33	25	34	21	32	16	28
4	28	23	26	25	21	25	21	29
5	14	7	18	8	19	10	16	14
6	5	1	8	2	13	5	16	7
7			5	1	8	1	11	4
8			1	0	2	0	6	1
9			0	0	1	1	1	1
10					0	0	4	1
11					0	0	1	0
12					0	0	0	0
13					0	0	0	0
14							0	0
15							0	0
16							0	0
17							0	0
18							0	0
19							0	0
20							0	0
21							0	0

Table L7a. Percent of Observation Days on Which Different Food Groups Were Consumed, By Food Group Diversity Score, Lactating Women, R1 (FGI-6 - 1 g Minimum)

	Number of food groups eaten					
	1	2	3	4	5	6
Percent (number) of observation days at each diversity score	0 (0)	22 (36)	31 (51)	28 (47)	14 (24)	5 (9)
Food groups	**Percent of observation days on which each food group was consumed**					
All starchy staples	–	100	100	100	100	100
All legumes and nuts	–	0	35	32	79	100
All dairy	–	0	12	17	21	100
Other animal source foods	–	100	98	100	100	100
Vitamin A-rich fruits and vegetables [a]	–	0	20	68	100	100
Other fruits and vegetables	–	0	35	83	100	100

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table L7b. Percent of Observation Days on Which Different Food Groups Were Consumed, By Food Group Diversity Score, Lactating Women, R1 (FGI-6R - 15 g Minimum)

	Number of food groups eaten					
	1	2	3	4	5	6
Percent (number) of observation days at each diversity score	3 (5)	34 (56)	33 (55)	23 (39)	7 (11)	1 (1)
Food groups	**Percent of observation days on which each food group was consumed**					
All starchy staples	100	100	100	100	100	100
All legumes and nuts	0	0	36	33	82	100
All dairy	0	0	11	13	27	100
Other animal source foods	0	93	98	100	100	100
Vitamin A-rich fruits and vegetables [a]	0	2	24	77	91	100
Other fruits and vegetables	0	5	31	77	100	100

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table L7c. Percent of Observation Days on Which Different Food Groups Were Consumed, By Food Group Diversity Score, Lactating Women, R1 (FGI-9 - 1 g Minimum)

	Number of food groups eaten								
	1	2	3	4	5	6	7	8	9
Percent (number) of observation days at each diversity score	0 (0)	17 (29)	25 (42)	26 (43)	18 (30)	8 (13)	5 (9)	1 (1)	0 (0)
Food groups	**Percent of observation days on which each food group was consumed**								
All starchy staples	–	100	100	100	100	100	100	100	–
All legumes and nuts	–	0	33	23	60	69	100	100	–
All dairy	–	0	10	12	20	46	67	100	–
Organ meat	–	0	2	9	13	15	78	100	–
Eggs	–	0	14	21	43	69	33	100	–
Flesh foods and other miscellaneous small animal protein	–	100	98	100	100	100	100	100	–
Vitamin A-rich dark green leafy vegetables [a]	–	0	14	51	57	62	22	0	–
Other vitamin A-rich vegetables and fruits [a]	–	0	0	16	20	39	100	100	–
Other fruits and vegetables	–	0	29	67	87	100	100	100	–

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table L7d. Percent of Observation Days on Which Different Food Groups Were Consumed, By Food Group Diversity Score, Lactating Women, R1 (FGI-9R - 15 g Minimum)

	Number of food groups eaten								
	1	2	3	4	5	6	7	8	9
Percent (number) of observation days at each diversity score	4 (6)	25 (42)	34 (57)	25 (42)	8 (14)	2 (4)	1 (2)	0 (0)	0 (0)
Food groups	**Percent of observation days on which each food group was consumed**								
All starchy staples	100	100	100	100	100	100	100	–	–
All legumes and nuts	0	0	32	29	64	50	100	–	–
All dairy	0	0	4	17	21	75	0	–	–
Organ meat	0	0	9	7	14	25	50	–	–
Eggs	0	0	16	21	29	75	50	–	–
Flesh foods and other miscellaneous small animal protein	0	88	97	95	100	100	100	–	–
Vitamin A-rich dark green leafy vegetables [a]	0	5	12	57	64	50	100	–	–
Other vitamin A-rich vegetables and fruits [a]	0	0	5	7	36	25	100	–	–
Other fruits and vegetables	0	7	26	67	71	100	100	–	–

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table L7e. Percent of Observation Days on Which Different Food Groups Were Consumed, By Food Group Diversity Score, Lactating Women, R1 (FGI-13 - 1 g Minimum)

	Number of food groups eaten												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Percent (number) of observation days at each diversity score	0 (0)	16 (26)	21 (35)	21 (35)	19 (31)	13 (21)	8 (14)	2 (4)	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)
Food groups	**Percent of observation days on which each food group was consumed**												
All starchy staples	–	100	100	100	100	100	100	100	100	–	–	–	–
All legumes and nuts	–	0	34	11	48	71	71	100	100	–	–	–	–
All dairy	–	0	9	11	19	14	64	75	0	–	–	–	–
Organ meat	–	0	6	6	10	10	50	75	0	–	–	–	–
Eggs	–	0	11	23	26	52	50	50	100	–	–	–	–
Small fish eaten whole with bones	–	4	9	20	29	38	7	0	100	–	–	–	–
All other flesh foods and miscellaneous small animal protein	–	96	97	100	90	100	93	100	100	–	–	–	–
Vitamin A-rich dark green leafy vegetables [a]	–	0	17	43	45	62	36	25	100	–	–	–	–
Vitamin A-rich deep yellow/orange/red vegetables [a]	–	0	0	6	16	14	64	75	100	–	–	–	–
Vitamin C-rich vegetables [b]	–	0	3	26	48	52	64	75	100	–	–	–	–
Vitamin A-rich fruits [a]	–	0	0	6	7	0	0	25	0	–	–	–	–
Vitamin C-rich fruits [b]	–	0	6	3	3	10	0	0	0	–	–	–	–
All other fruits and vegetables	–	0	9	46	58	76	100	100	100	–	–	–	–

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.
[b] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table L7f. Percent of Observation Days on Which Different Food Groups Were Consumed, By Food Group Diversity Score, Lactating Women, R1 (FGI-13R - 15 g Minimum)

	Number of food groups eaten												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Percent (number) of observation days at each diversity score	4 (6)	23 (39)	32 (53)	25 (42)	10 (17)	5 (8)	1 (1)	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)
Food groups	**Percent of observation days on which each food group was consumed**												
All starchy staples	100	100	100	100	100	100	100	–	100	–	–	–	–
All legumes and nuts	0	0	32	29	53	38	100	–	100	–	–	–	–
All dairy	0	0	4	14	18	50	0	–	0	–	–	–	–
Organ meat	0	0	8	10	12	13	100	–	0	–	–	–	–
Eggs	0	0	15	21	24	50	0	–	100	–	–	–	–
Small fish eaten whole with bones	0	0	8	21	24	13	0	–	100	–	–	–	–
All other flesh foods and miscellaneous small animal protein	0	87	93	86	94	100	100	–	100	–	–	–	–
Vitamin A-rich dark green leafy vegetables [a]	0	5	13	45	65	63	100	–	100	–	–	–	–
Vitamin A-rich deep yellow/orange/red vegetables [a]	0	0	2	5	12	38	0	–	100	–	–	–	–
Vitamin C-rich vegetables [b]	0	3	6	24	35	50	100	–	100	–	–	–	–
Vitamin A-rich fruits [a]	0	0	4	2	6	0	100	–	0	–	–	–	–
Vitamin C-rich fruits [b]	0	0	6	2	0	13	0	–	0	–	–	–	–
All other fruits and vegetables	0	5	11	41	59	75	0	–	100	–	–	–	–

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.
[b] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table L7g. Percent of Observation Days on Which Different Food Groups Were Consumed, By Food Group Diversity Score, Lactating Women, R1 (FGI-21 - 1 g Minimum)

	Number of food groups eaten																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Percent (number) of observation days at each diversity score	0 (0)	8 (13)	16 (27)	21 (35)	16 (27)	16 (27)	11 (18)	6 (10)	1 (2)	4 (6)	1 (2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Food groups	**Percent of observation days on which each food group was consumed**																				
Grains and grain products	–	100	100	100	100	100	100	100	100	100	100	–	–	–	–	–	–	–	–	–	–
All other starchy staples	–	0	11	14	19	33	39	40	50	83	100	–	–	–	–	–	–	–	–	–	–
Cooked dry beans and peas	–	0	22	17	22	41	56	50	100	100	100	–	–	–	–	–	–	–	–	–	–
Soybeans and soy products	–	0	0	0	11	7	11	20	0	67	100	–	–	–	–	–	–	–	–	–	–
Nuts and seeds	–	0	0	3	0	0	6	10	0	0	0	–	–	–	–	–	–	–	–	–	–
Milk/yogurt	–	0	4	9	11	11	17	60	0	50	100	–	–	–	–	–	–	–	–	–	–
Cheese	–	0	4	0	4	0	6	10	50	17	0	–	–	–	–	–	–	–	–	–	–
Beef, pork, veal, lamb, goat, game meat	–	15	19	46	59	56	72	80	50	100	100	–	–	–	–	–	–	–	–	–	–
Organ meat	–	0	0	9	4	11	11	40	0	67	100	–	–	–	–	–	–	–	–	–	–
Chicken, duck, turkey, pigeon, guinea hen, game birds	–	0	15	14	4	4	0	20	50	33	0	–	–	–	–	–	–	–	–	–	–
Large whole fish/dried fish/shellfish and other seafood	–	77	93	77	89	74	83	70	100	67	100	–	–	–	–	–	–	–	–	–	–
Small fish eaten whole with bones	–	8	4	20	26	26	28	10	0	17	0	–	–	–	–	–	–	–	–	–	–
Insects, grubs, snakes, rodents and other small animal	–	0	0	0	0	0	0	0	0	0	0	–	–	–	–	–	–	–	–	–	–
Eggs	–	0	4	20	19	41	56	30	100	33	0	–	–	–	–	–	–	–	–	–	–
Vitamin A-rich dark green leafy vegetables [a]	–	0	15	29	37	44	56	50	50	50	0	–	–	–	–	–	–	–	–	–	–
Vitamin A-rich deep yellow/orange/red vegetables [a]	–	0	0	0	4	30	17	40	50	67	100	–	–	–	–	–	–	–	–	–	–
Vitamin C-rich vegetables [b]	–	0	4	11	37	52	50	70	100	33	0	–	–	–	–	–	–	–	–	–	–
All other vegetables	–	0	4	29	33	59	67	90	100	100	100	–	–	–	–	–	–	–	–	–	–
Vitamin A-rich fruits [a]	–	0	0	0	11	4	0	0	0	17	0	–	–	–	–	–	–	–	–	–	–
Vitamin C-rich fruits [b]	–	0	4	0	7	0	11	10	0	0	0	–	–	–	–	–	–	–	–	–	–
All other fruits	–	0	0	3	4	7	17	0	0	0	100	–	–	–	–	–	–	–	–	–	–

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.
[b] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table L7h. Percent of Observation Days on Which Different Food Groups Were Consumed, By Food Group Diversity Score, Lactating Women, R1 (FGI-21R - 15 g Minimum)

	Number of food groups eaten																				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
Percent (number) of observation days at each diversity score	4 (7)	12 (20)	28 (46)	29 (48)	14 (24)	7 (12)	4 (7)	1 (1)	1 (1)	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Food groups	**Percent of observation days on which each food group was consumed**																				
Grains and grain products	100	100	100	100	100	100	100	100	100	100	–	–	–	–	–	–	–	–	–	–	–
All other starchy staples	0	0	7	19	38	42	57	100	100	0	–	–	–	–	–	–	–	–	–	–	–
Cooked dry beans and peas	0	0	26	25	25	50	43	100	100	100	–	–	–	–	–	–	–	–	–	–	–
Soybeans and soy products	0	0	0	0	0	0	0	0	0	0	–	–	–	–	–	–	–	–	–	–	–
Nuts and seeds	0	0	0	2	0	0	29	0	0	0	–	–	–	–	–	–	–	–	–	–	–
Milk/yogurt	0	0	4	8	4	17	57	0	0	0	–	–	–	–	–	–	–	–	–	–	–
Cheese	0	0	0	0	0	8	0	100	0	0	–	–	–	–	–	–	–	–	–	–	–
Beef, pork, veal, lamb, goat, game meat	0	15	33	48	63	58	29	100	100	100	–	–	–	–	–	–	–	–	–	–	–
Organ meat	0	0	4	8	17	0	14	0	100	0	–	–	–	–	–	–	–	–	–	–	–
Chicken, duck, turkey, pigeon, guinea hen, game birds	0	0	13	10	0	8	29	100	0	0	–	–	–	–	–	–	–	–	–	–	–
Large whole fish/dried fish/shellfish and other seafood	0	60	67	69	75	83	71	100	100	100	–	–	–	–	–	–	–	–	–	–	–
Small fish eaten whole with bones	0	0	4	17	21	8	29	0	0	100	–	–	–	–	–	–	–	–	–	–	–
Insects, grubs, snakes, rodents and other small animal	0	0	0	0	0	0	0	0	0	0	–	–	–	–	–	–	–	–	–	–	–
Eggs	0	0	9	21	17	33	43	0	0	100	–	–	–	–	–	–	–	–	–	–	–
Vitamin A-rich dark green leafy vegetables [a]	0	10	13	27	46	58	71	0	100	100	–	–	–	–	–	–	–	–	–	–	–
Vitamin A-rich deep yellow/orange/red vegetables [a]	0	0	0	0	17	33	0	0	0	100	–	–	–	–	–	–	–	–	–	–	–
Vitamin C-rich vegetables [b]	0	5	7	8	33	50	29	0	100	100	–	–	–	–	–	–	–	–	–	–	–
All other vegetables	0	10	9	29	33	42	71	100	0	100	–	–	–	–	–	–	–	–	–	–	–
Vitamin A-rich fruits [a]	0	0	2	4	0	8	0	0	100	0	–	–	–	–	–	–	–	–	–	–	–
Vitamin C-rich fruits [b]	0	0	2	2	8	0	14	0	0	0	–	–	–	–	–	–	–	–	–	–	–
All other fruits	0	0	0	2	4	0	14	0	0	0	–	–	–	–	–	–	–	–	–	–	–

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.
[b] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table L8. Mean and Median Nutrient Intake and PA, Lactating Women [a]

Nutrient	Mean	SD	Median	EAR [b]	SD [b]	PA (Mean)	PA (Median)	Lambda (Box-Cox transformation) [c]
Energy	1,367	630	1,264					
Protein (All Sources) (% of kcal)	14	5	14					
Protein from animal sources (% of kcal)	8	6	7					
Total carbohydrate (% of kcal)	70	13	73					
Total fat (% of kcal)	15	12	11					
Thiamin (mg/d)	0.57	0.41	0.47	1.2	0.12	0.03	0.00	0.021
Riboflavin (mg/d)	0.61	0.65	0.48	1.3	0.13	0.03	0.00	-0.133
Niacin (mg/d)	14.08	10.29	11.40	13	2.0	0.39	0.16	0.069
Vitamin B6 (mg/d)	1.18	0.65	1.04	1.7	0.17	0.13	0.00	0.076
Folate (µg/d)	398.65	236.86	377.08	450	45.0	0.29	0.02	0.438
Vitamin B12 (µg/d)	5.97	8.53	3.58	2.4	0.24	0.71	1.00	0.197
Vitamin C (mg/d)	36.27	73.99	12.65	58	5.8	0.07	0.00	0.224
Vitamin A (RE/d)	405.15	1,113.57	244.34	450	90	0.12	0.00	0.028
Calcium (mg/d)	366.42	282.71	279.83	1,000 [d]	– [d]	0.17	0.25	-0.080
Iron (mg/d)	10.53	6.86	8.80	11.7	3.51	0.28	0.19	-0.160
Zinc (mg/d)	5.75	3.38	5.14	7	0.88	0.38	0.10	0.131
MPA across 11 micronutrients	0.24	0.19	0.20					

[a] Mean and median nutrient intakes are for the first observation day; PA are based on estimated usual intake calculated from both rounds of dietary data for the full sample. Pregnant women were excluded from this study sample.
[b] See Table A6-1 for sources for each EAR and SD. Requirements for lactating women are presented here.
[c] This documents the transformation parameters selected for each nutrient. The power transformations result in approximately normal distributions.
[d] There is no EAR and no SD for calcium; 1,000 mg is the Adequate Intake (AI) for lactating women.

Table L10. Correlations between Food Group Diversity Scores and Estimated Usual Intakes of Individual Nutrients, Lactating Women [a, b]

	FGI-6		FGI-6R		FGI-9		FGI-9R		FGI-13		FGI-13R		FGI-21		FGI-21R	
Nutrients	Not controlling for energy	Controlling for energy	Not controlling for energy	Controlling for energy	Not controlling for energy	Controlling for energy	Not controlling for energy	Controlling for energy	Not controlling for energy	Controlling for energy	Not controlling for energy	Controlling for energy	Not controlling for energy	Controlling for energy	Not controlling for energy	Controlling for energy
Total energy	0.154 *		0.126		0.171 *		0.199 **		0.160 *		0.183 *		0.273 ***		0.308 ***	
Thiamin	0.074	-0.091	0.087	-0.026	0.120	-0.034	0.163 *	0.002	0.100	-0.052	0.140	-0.016	0.199 **	-0.042	0.252 **	0.001
Riboflavin	0.184 *	0.103	0.188 *	0.150	0.264 ***	0.221 **	0.311 ***	0.266 ***	0.251 **	0.215 **	0.298 ***	0.266 ***	0.323 ***	0.179 *	0.381 ***	0.236 **
Niacin	0.089	-0.046	0.099	0.004	0.122	-0.013	0.176 *	0.038	0.105	-0.027	0.178 *	0.059	0.189 *	-0.032	0.284 ***	0.079
Vitamin B6	0.202 **	0.133	0.217 **	0.192 *	0.188 *	0.088	0.264 ***	0.177 *	0.158 *	0.054	0.232 **	0.145	0.238 **	0.041	0.319 ***	0.131
Folate	0.100	-0.027	0.133	0.059	0.089	-0.064	0.146	-0.008	0.092	-0.045	0.125	-0.023	0.154 *	-0.086	0.185 *	-0.080
Vitamin B12	0.124	0.074	0.165 *	0.129	0.160 *	0.106	0.221 **	0.162 *	0.161 *	0.112	0.230 **	0.178 *	0.193 *	0.103	0.287 ***	0.196 *
Vitamin C	0.263 ***	0.237 **	0.331 ***	0.313 ***	0.235 **	0.205 **	0.317 ***	0.285 ***	0.199 *	0.169 *	0.254 ***	0.222 **	0.218 **	0.167 *	0.267 ***	0.213 **
Vitamin A	0.308 ***	0.270 ***	0.351 ***	0.334 ***	0.368 ***	0.331 ***	0.472 ***	0.438 ***	0.355 ***	0.322 ***	0.447 ***	0.416 ***	0.373 ***	0.287 ***	0.475 ***	0.393 ***
Calcium	0.206 **	0.141	0.327 ***	0.325 ***	0.208 **	0.130	0.371 ***	0.324 ***	0.216 **	0.150	0.361 ***	0.325 ***	0.249 **	0.097	0.404 ***	0.281 ***
Iron	0.253 ***	0.214 **	0.178 *	0.129	0.299 ***	0.268 ***	0.298 ***	0.232 **	0.265 ***	0.227 **	0.246 **	0.168 *	0.320 ***	0.178 *	0.343 ***	0.173 *
Zinc	0.230 **	0.200 **	0.191 *	0.170 *	0.272 ***	0.259 ***	0.275 ***	0.214 **	0.254 ***	0.240 **	0.245 **	0.178 *	0.351 ***	0.242 **	0.352 ***	0.178 *

[a] Usual intake of energy and individual nutrients are estimated by the BLUP following the method described in section 11 of the protocol (Arimond et al. 2008).
[b] A "*" indicates a coefficient that is statistically significant at $p < 0.05$; ** indicates $p < 0.01$, and *** indicates $p < 0.001$.

Table L11a. Correlation between Energy from 6 Major Food Groups and MPA, With and Without Controlling for Total Energy Intake, Lactating Women [a, b, c]

Major food groups	Correlation between MPA and energy from each food group:	Partial correlation coefficients for energy from each food group (controlling for total energy)
All starchy staples	0.584 ***	-0.003
All legumes and nuts	0.170 *	-0.068
All dairy	0.345 ***	0.196 *
Other animal source foods	0.452 ***	-0.080
Vitamin A-rich fruits and vegetables [d]	0.115	0.089
Other fruits and vegetables	0.076	0.073

[a] Numbers in bold indicate coefficients that changed direction when total energy was controlled for, with both coefficients being significant. A "*" indicates a coefficient that is statistically significant at $p < 0.05$; ** indicates $p < 0.01$, and *** indicates $p < 0.001$.
[b] Energy from food groups is from first observation day; MPA is based on estimated usual intake, calculated using repeat observations for the entire sample.
[c] MPA was normalized using the Box Cox transformation method.
[d] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table L11b. Correlation between Energy from 9 Sub-Food Groups and MPA, With and Without Controlling for Total Energy Intake, Lactating Women [a, b, c]

Major food groups	Correlation between MPA and energy from each food group:	Partial correlation coefficients for energy from each food group (controlling for total energy)
All starchy staples	0.584 ***	-0.003
All legumes and nuts	0.170 *	-0.068
All dairy	0.345 ***	0.196 *
Organ meat	0.175 *	0.172 *
Eggs	0.193 *	0.179 *
Flesh foods and other miscellaneous small animal protein	0.425 ***	-0.124
Vitamin A-rich dark green leafy vegetables [d]	0.080	0.132
Other vitamin A-rich vegetables and fruits [d]	0.109	0.022
Other fruits and vegetables	0.076	0.073

[a] Numbers in bold indicate coefficients that changed direction when total energy was controlled for, with both coefficients being significant. A "*" indicates a coefficient that is statistically significant at $p < 0.05$; ** indicates $p < 0.01$, and *** indicates $p < 0.001$.
[b] Energy from food groups is from first observation day; MPA is based on estimated usual intake, calculated using repeat observations for the entire sample.
[c] MPA was normalized using the Box Cox transformation method.
[d] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table L11c. Correlation between Energy from 13 Sub-Food Groups and MPA, With and Without Controlling for Total Energy Intake, Lactating Women [a, b, c]

Major food groups	Correlation between MPA and energy from each food group:	Partial correlation coefficients for energy from each food group (controlling for total energy)
All starchy staples	0.584 ***	-0.003
All legumes and nuts	0.170 *	-0.068
All dairy	0.345 ***	0.196 *
Organ meat	0.175 *	0.172 *
Eggs	0.193 *	0.179 *
Small fish eaten whole with bones	0.087	0.036
All other flesh foods and miscellaneous small animal protein	0.418 ***	-0.127
Vitamin A-rich dark green leafy vegetables [d]	0.080	0.132
Vitamin A-rich deep yellow/orange/red vegetables [d]	0.065	0.092
Vitamin C-rich vegetables [e]	0.131	0.119
Vitamin A-rich fruits [d]	0.100	0.007
Vitamin C-rich fruits [e]	-0.004	-0.027
All other fruits and vegetables	-0.021	0.025

[a] Numbers in bold indicate coefficients that changed direction when total energy was controlled for, with both coefficients being significant. A "*" indicates a coefficient that is statistically significant at $p < 0.05$; ** indicates $p < 0.01$, and *** indicates $p < 0.001$.
[b] Energy from food groups is from first observation day; MPA is based on estimated usual intake, calculated using repeat observations for the entire sample.
[c] MPA was normalized using the Box Cox transformation method.
[d] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.
[e] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table L11d. Correlation between Energy from 21 Sub-Food Groups and MPA, With and Without Controlling for Total Energy Intake, Lactating Women [a, b, c]

Major food groups	Correlation between MPA and energy from each food group:	Partial correlation coefficients for energy from each food group (controlling for total energy)
Grains and grain products	0.558 ***	-0.025
All other starchy staples	0.166 *	0.064
Cooked dry beans and peas	0.117	-0.038
Soybeans and soy products	0.135	0.016
Nuts and seeds	0.147	-0.085
Milk/yogurt	0.336 ***	0.186 *
Cheese	0.122	0.101
Beef, pork, veal, lamb, goat, game meat	0.309 ***	-0.140
Organ meat	0.175 *	0.172 *
Chicken, duck, turkey, pigeon, guinea hen, game birds	0.115	-0.196 *
Large whole fish/dried fish/shellfish and other seafood	0.391 ***	0.380 ***
Small fish eaten whole with bones	0.087	0.036
Insects, grubs, snakes, rodents and other small animal	–	–
Eggs	0.193 *	0.179 *
Vitamin A-rich dark green leafy vegetables [d]	0.080	0.132
Vitamin A-rich deep yellow/orange/red vegetables [d]	0.065	0.092
Vitamin C-rich vegetables [e]	0.131	0.119
All other vegetables	-0.060	0.017
Vitamin A-rich fruits [d]	0.100	0.007
Vitamin C-rich fruits [e]	-0.004	-0.027
All other fruits	0.018	0.021

[a] Numbers in bold indicate coefficients that changed direction when total energy was controlled for, with both coefficients being significant. A "*" indicates a coefficient that is statistically significant at $p < 0.05$; ** indicates $p < 0.01$, and *** indicates $p < 0.001$.

[b] Energy from food groups is from first observation day; MPA is based on estimated usual intake, calculated using repeat observations for the entire sample.

[c] MPA was normalized using the Box Cox transformation method.

[d] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

[e] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table L12. Total Energy Intake (kcal), by Food Group Diversity Scores, Lactating Women, R1 [a]

Number of food groups eaten	Diversity indicators															
	FGI-6		FGI-6R		FGI-9		FGI-9R		FGI-13		FGI-13R		FGI-21		FGI-21R	
	Median total energy intake (range)															
1	–	–	644	(447-932)	–	–	620	(447-932)	–	–	620	(447-932)	–	–	644	(447-1222)
2	1185	(447-2400)	1234	(498-3238)	1075	(447-2400)	1204	(498-3238)	1078	(447-2400)	1222	(498-3238)	902	(447-1434)	1042	(498-1719)
3	1263	(389-3168)	1365	(389-3211)	1354	(508-3168)	1346	(389-3211)	1148	(508-3168)	1343	(543-3211)	999	(508-2400)	1304	(543-3238)
4	1186	(434-2986)	1164	(434-2986)	1069	(389-2834)	1076	(434-2986)	1186	(434-2676)	1139	(389-2986)	1272	(434-3168)	1311	(389-3211)
5	1369	(694-2683)	1606	(747-2340)	1705	(435-2986)	1612	(896-2492)	1412	(389-2986)	1252	(660-2834)	1412	(389-2676)	1338	(435-2986)
6	2076	(898-3238)	–	–	1471	(694-2349)	–	–	1481	(584-2683)	1615	(896-2349)	1165	(435-2986)	1828	(847-2701)
7					1279	(992-3238)	–	–	1375	(747-3238)	–	–	1473	(660-2834)	1624	(660-2834)
8					–	–	–	–	–	–	–	–	1842	(896-2349)	–	–
9					–	–	–	–	–	–	–	–	–	–	–	–
10									–	–	–	–	1478	(898-3238)	–	–
11									–	–	–	–	–	–	–	–
12									–	–	–	–	–	–	–	–
13									–	–	–	–	–	–	–	–
14													–	–	–	–
15													–	–	–	–
16													–	–	–	–
17													–	–	–	–
18													–	–	–	–
19													–	–	–	–
20													–	–	–	–
21													–	–	–	–

[a] Light shading indicates impossible values (beyond range of possible scores). A — indicates that a cell has fewer than 5 observations. Cells with fewer than 10 observations have dark shading.

Table L13. Relationship between Food Group Diversity Scores and Total Energy Intake, Lactating Women [a]

	Food group diversity score		Total energy intake		Correlation Coefficient [b]	
	(mean)	(median)	(mean)	(median)		
FGI-6	3.5	3.0	1367	1264	0.154	*
FGI-6R [c]	3.0	3.0	1367	1264	0.126	
FGI-9	3.9	4.0	1367	1264	0.171	*
FGI-9R [c]	3.2	3.0	1367	1264	0.199	**
FGI-13	4.3	4.0	1367	1264	0.160	*
FGI-13R [c]	3.4	3.0	1367	1264	0.183	*
FGI-21	5.1	5.0	1367	1264	0.273	***
FGI-21R [c]	3.9	4.0	1367	1264	0.308	***

[a] Food group diversity scores and mean and median energy intakes are from first observation day; BLUP for energy intake (calculated using repeat observations for the entire sample) is used for correlation analysis.
[b] A "*" indicates a coefficient that is statistically significant at $p < 0.05$; ** indicates $p < 0.01$, and *** indicates $p < 0.001$.
[c] Refers to minimum intake of 15 g for each of the food groups/sub food groups.

Table L14. MPA by Food Group Diversity Scores, Lactating Women [a, b]

Number of food groups eaten	Diversity indicators															
	FGI-6		FGI-6R		FGI-9		FGI-9R		FGI-13		FGI-13R		FGI-21		FGI-21R	
	Median MPA (range)															
1	–	–	0.00	(0.00-0.13)	–	–	0.01	(0.00-0.13)	–	–	0.01	(0.00-0.13)	–	–	0.00	(0.00-0.13)
2	0.13	(0.00-0.58)	0.14	(0.00-0.58)	0.12	(0.00-0.58)	0.13	(0.00-0.58)	0.13	(0.00-0.58)	0.13	(0.00-0.58)	0.11	(0.00-0.30)	0.11	(0.00-0.30)
3	0.21	(0.00-0.64)	0.24	(0.00-0.71)	0.23	(0.00-0.64)	0.25	(0.00-0.71)	0.28	(0.00-0.64)	0.24	(0.00-0.71)	0.18	(0.00-0.58)	0.19	(0.00-0.71)
4	0.15	(0.00-0.80)	0.19	(0.00-0.80)	0.14	(0.00-0.77)	0.20	(0.00-0.77)	0.13	(0.00-0.56)	0.20	(0.00-0.66)	0.14	(0.00-0.64)	0.22	(0.00-0.66)
5	0.25	(0.01-0.66)	0.34	(0.05-0.59)	0.33	(0.01-0.80)	0.28	(0.06-0.80)	0.25	(0.00-0.80)	0.26	(0.04-0.80)	0.19	(0.00-0.71)	0.25	(0.00-0.56)
6	0.36	(0.22-0.64)	–	–	0.24	(0.01-0.64)	–	–	0.24	(0.01-0.59)	0.34	(0.13-0.64)	0.24	(0.00-0.80)	0.42	(0.04-0.80)
7					0.41	(0.10-0.64)	–	–	0.26	(0.02-0.64)	–	–	0.25	(0.01-0.77)	0.30	(0.12-0.77)
8					–	–	–	–	–	–	–	–	0.37	(0.02-0.64)	–	–
9					–	–	–	–	–	–	–	–	–	–	–	–
10									–	–	–	–	0.29	(0.10-0.44)	–	–
11									–	–	–	–	–	–	–	–
12									–	–	–	–	–	–	–	–
13									–	–	–	–	–	–	–	–
14													–	–	–	–
15													–	–	–	–
16													–	–	–	–
17													–	–	–	–
18													–	–	–	–
19													–	–	–	–
20													–	–	–	–
21													–	–	–	–

[a] Food group diversity scores are from first observation day; MPA is is based on estimated usual intake, calculated using repeat observations for the entire sample.
[b] Light shading indicates impossible values (beyond range of possible scores). A — indicates that a cell has fewer than 5 observations. Cells with fewer than 10 observations have dark shading.

Table L15. Relationship between MPA and Food Group Diversity Scores, Lactating Women [a]

	Food group diversity score		MPA		Correlation coefficient [b]		Partial correlation controlling for total energy intake [b]	
	(mean)	(median)	(mean)	(median)				
FGI-6	3.5	3.0	0.24	0.20	0.192	*	0.117	
FGI-6R [c]	3.0	3.0	0.24	0.20	0.226	**	0.219	**
FGI-9	3.9	4.0	0.24	0.20	0.226	**	0.153	*
FGI-9R [c]	3.2	3.0	0.24	0.20	0.317	***	0.276	***
FGI-13	4.3	4.0	0.24	0.20	0.202	**	0.125	
FGI-13R [c]	3.4	3.0	0.24	0.20	0.297	***	0.263	***
FGI-21	5.1	5.0	0.24	0.20	0.276	***	0.093	
FGI-21R [c]	3.9	4.0	0.24	0.20	0.392	***	0.255	***

[a] Food group diversity scores are from first observation day, MPA is based on the first observation day and repeat observations for the entire sample. MPA was transformed to approximate normality, and transformed MPA and BLUP for total energy intake were used for correlation analysis.
[b] A "*" indicates a coefficient that is statistically significant at $p < 0.05$; ** indicates $p < 0.01$, and *** indicates $p < 0.001$.
[c] Refers to minimum intake of 15 g for each of the food groups/sub food groups.

Table L16. Results of Ordinary Least Squares Regression Analysis of the Determinants of MPA, Lactating Women [a, b]

	FGI-6		FGI-6R		FGI-9		FGI-9R		FGI-13		FGI-13R		FGI-21		FGI-21R	
	Not controlling for energy															
	B	Standard error	B	Standard error	B	Standard error	B	Standard error	B	Standard error	B	Standard error	B	Standard error	B	Standard error
Constant	-1.740 **	0.614	-1.739 **	0.608	-1.793 **	0.613	-1.795 **	0.595	-1.746 **	0.615	-1.818 **	0.600	-1.696 **	0.606	-1.702 **	0.583
Woman's height	0.006	0.004	0.006	0.004	0.006	0.004	0.006	0.004	0.006	0.004	0.006	0.004	0.005	0.004	0.005	0.004
Age	-0.009 ***	0.002	-0.009 ***	0.002	-0.009 ***	0.002	-0.009 ***	0.002	-0.009 ***	0.002	-0.009 ***	0.002	-0.008 ***	0.002	-0.008 ***	0.002
Dietary diversity score	0.049 *	0.019	0.066 **	0.021	0.042 **	0.015	0.076 ***	0.018	0.033 *	0.013	0.064 ***	0.016	0.035 **	0.011	0.068 ***	0.013
Adjusted R^2	0.126 ***		0.142 ***		0.132 ***		0.180 ***		0.124 ***		0.168 ***		0.149 ***		0.213 ***	
	Controlling for energy															
	B	Standard error	B	Standard error	B	Standard error	B	Standard error	B	Standard error	B	Standard error	B	Standard error	B	Standard error
Constant	-1.276 **	0.431	-1.286 **	0.424	-1.294 **	0.432	-1.329 **	0.418	-1.279 **	0.431	-1.340 **	0.420	-1.267 **	0.432	-1.285 **	0.421
Woman's height	0.000	0.003	-0.001	0.003	0.000	0.003	-0.001	0.003	0.000	0.003	0.000	0.003	0.000	0.003	-0.001	0.003
Age	-0.004 **	0.002	-0.004 **	0.002	-0.004 **	0.002	-0.004 **	0.002	-0.004 **	0.002	-0.004 **	0.002	-0.004 **	0.002	-0.004 **	0.002
Dietary diversity score	0.014	0.014	0.039 *	0.015	0.013	0.011	0.045 ***	0.013	0.011	0.009	0.038 **	0.012	0.007	0.008	0.031 **	0.010
Total energy intake [c]	0.334 ***	0.026	0.331 ***	0.025	0.333 ***	0.026	0.324 ***	0.025	0.334 ***	0.026	0.326 ***	0.025	0.333 ***	0.026	0.317 ***	0.026
Adjusted R^2	0.571 ***		0.585 ***		0.572 ***		0.598 ***		0.572 ***		0.596 ***		0.570 ***		0.593 ***	

[a] A "*" indicates a coefficient that is statistically significant at $p < 0.05$; ** indicates $p < 0.01$, and *** indicates $p < 0.001$. For the adjusted R^2, the stars indicate the significance level of the F statistic of the regression.
[b] MPA was transformed to an approximate normal distribution before use in these regressions.
[c] Energy was divided by 1000 before running the regressions to bring regression coefficients to a visible scale.

FIGURES

Histograms of intakes for 11 micronutrients (R1 data): Figures L1-L11

Histograms for intra-individual SDs of intake, based on data from two rounds: Figures L12- L22

Histograms for FGIs (R1 data): Figures L23-L30

Histograms of PA for 11 micronutrients, based on data from two rounds: Figures L31-L41

Histogram of MPA, based on data from two rounds: Figure L42

Figure L1. Distribution of Thiamin Intakes, Lactating Women

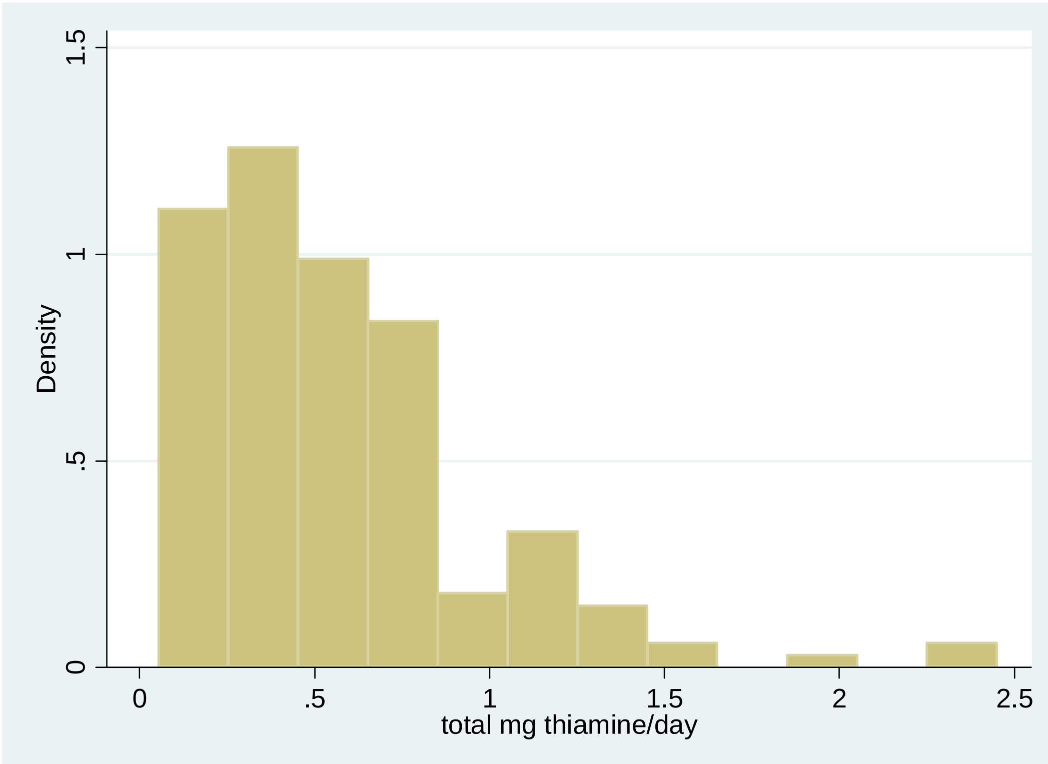


Figure L2. Distribution of Riboflavin Intakes, Lactating Women

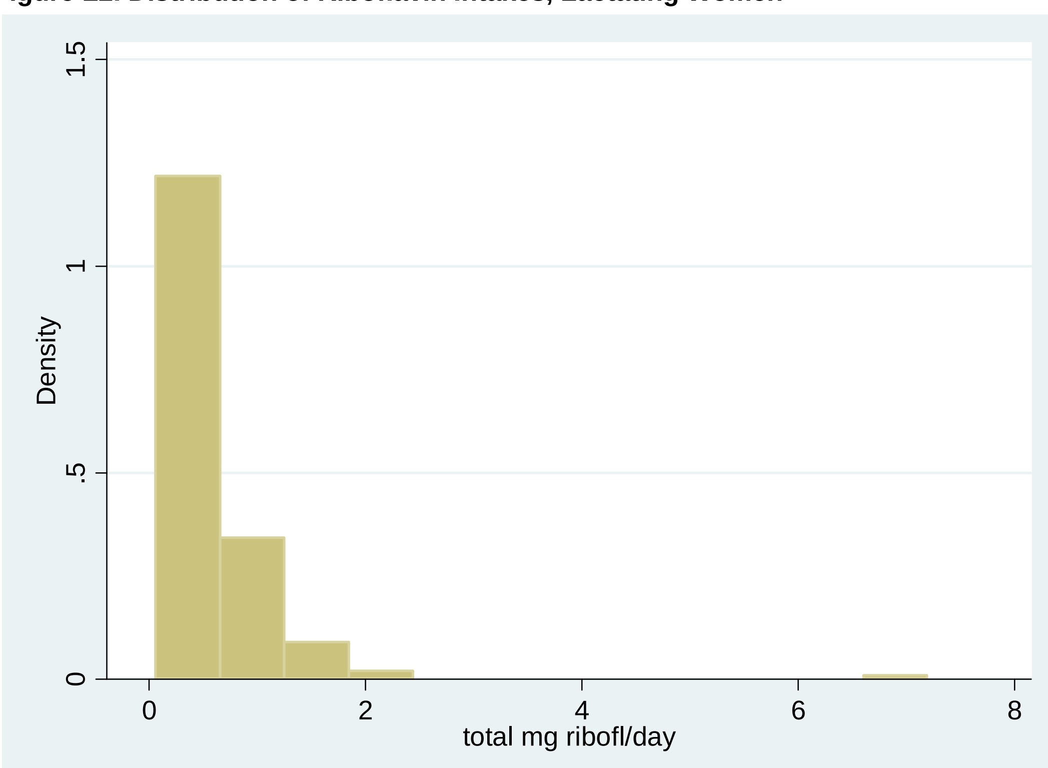


Figure L3. Distribution of Niacin Intakes, Lactating Women

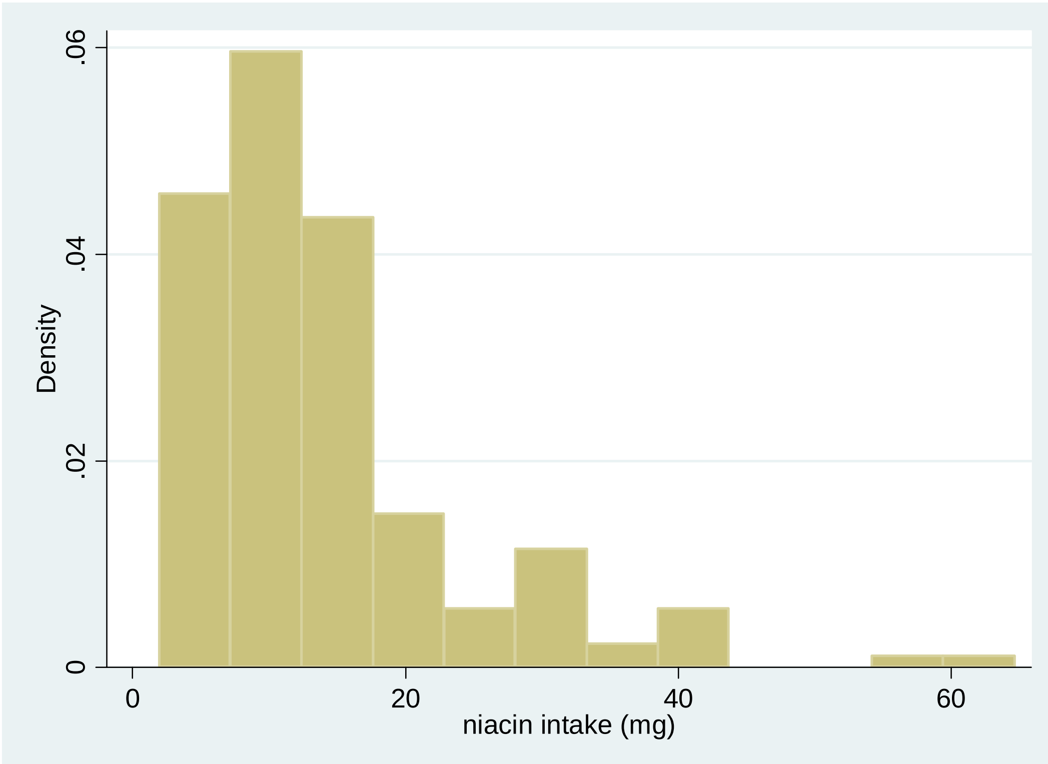


Figure L4. Distribution of Vitamin B6 Intakes, Lactating Women

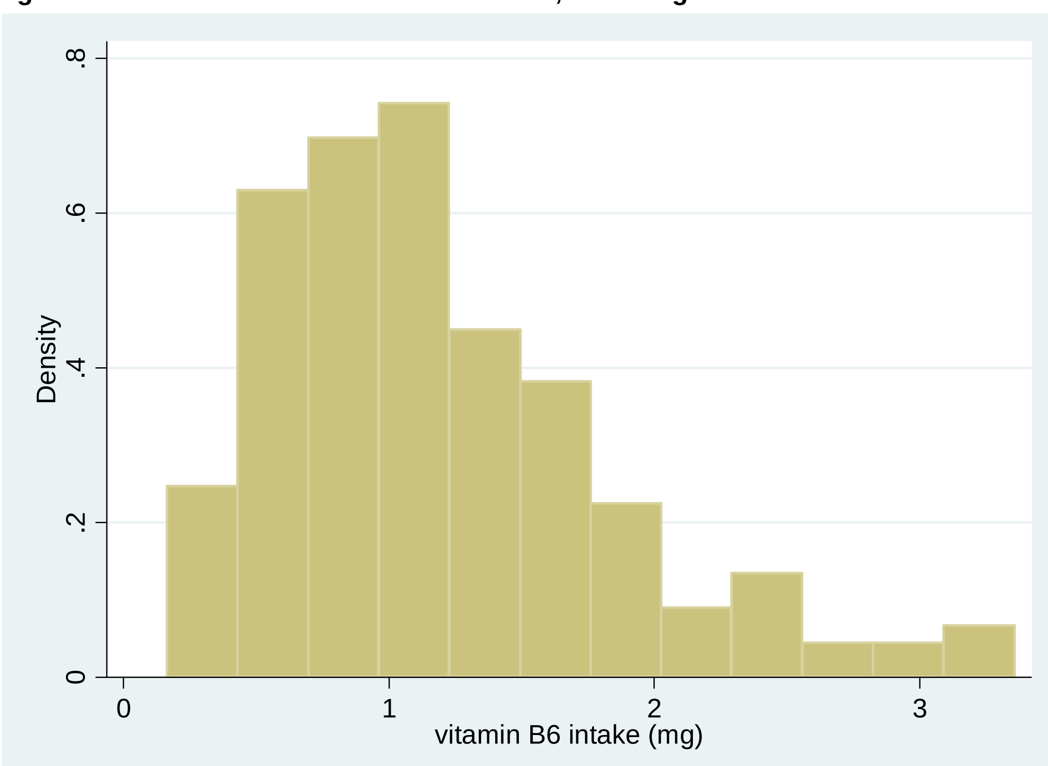


Figure L5. Distribution of Folate Intakes, Lactating Women

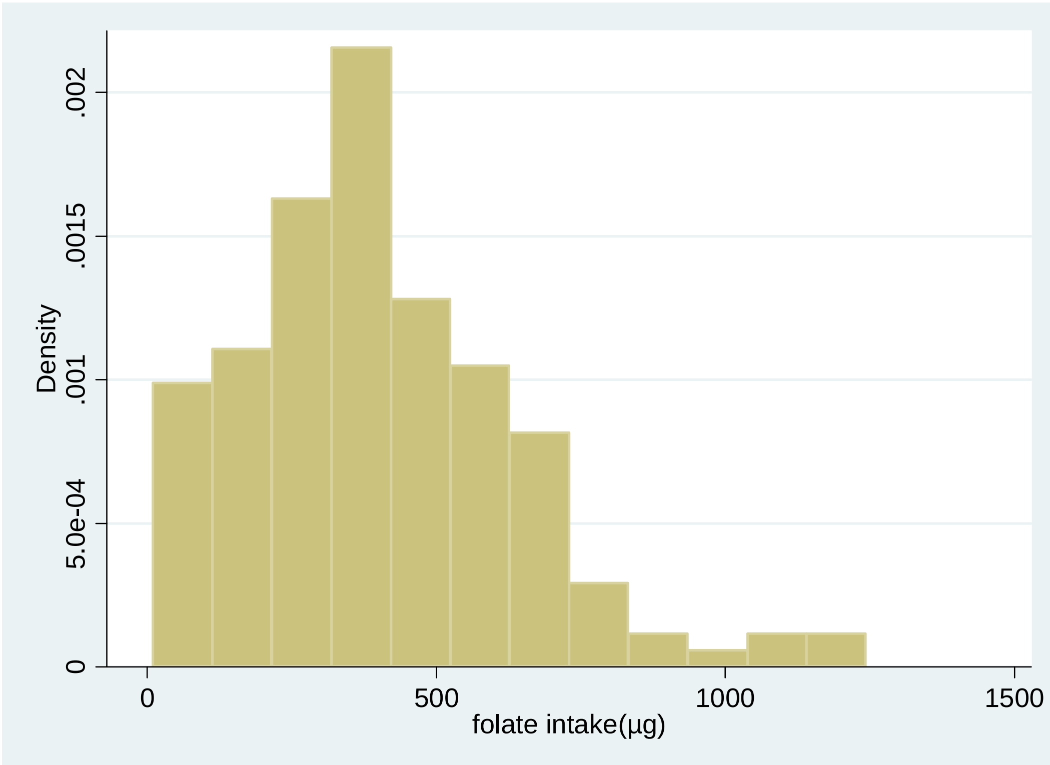


Figure L6. Distribution of Vitamin B12 Intakes, Lactating Women

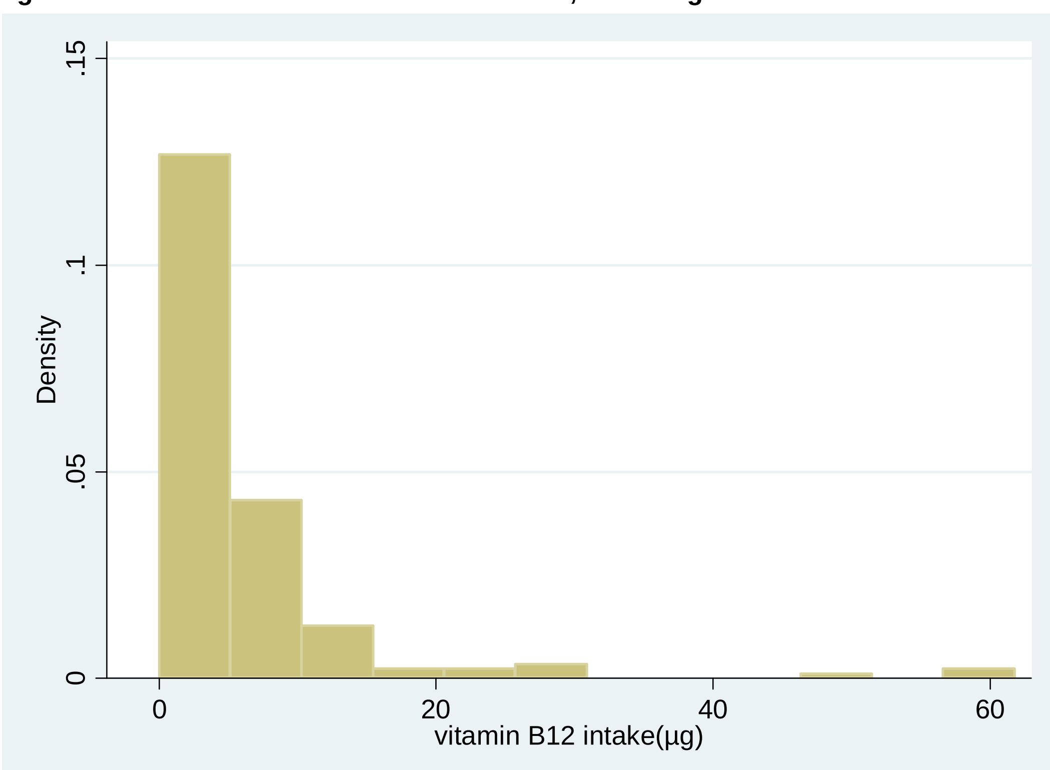


Figure L7. Distribution of Vitamin C Intakes, Lactating Women

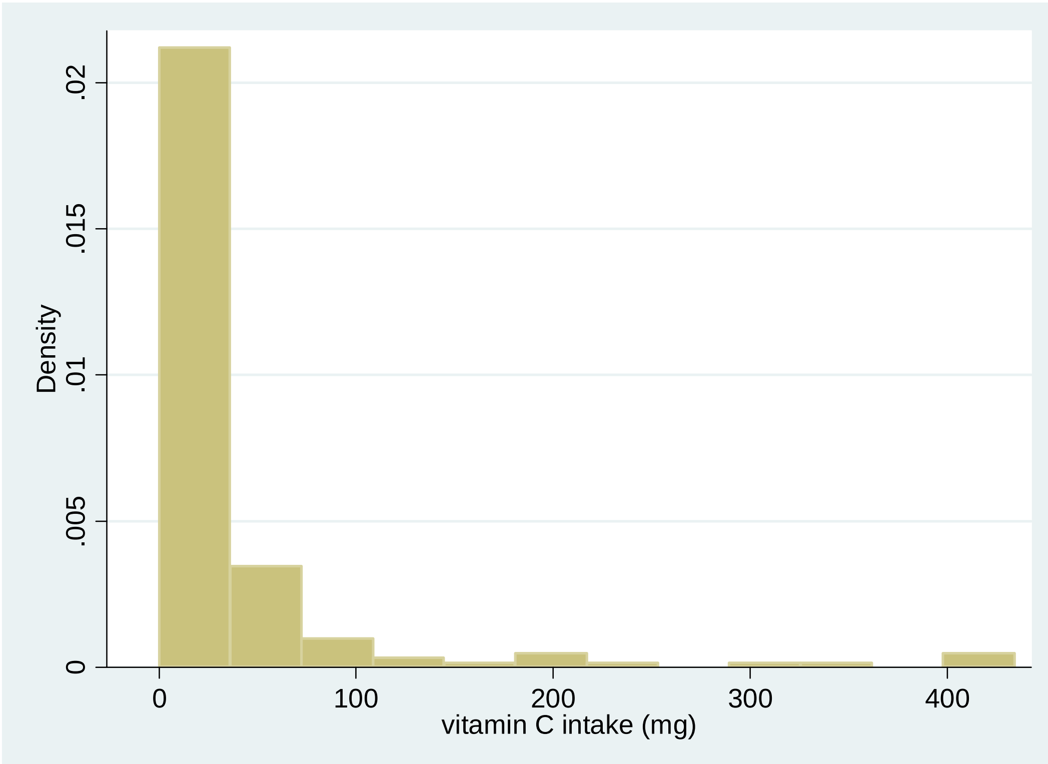


Figure L8. Distribution of Vitamin A Intakes, Lactating Women

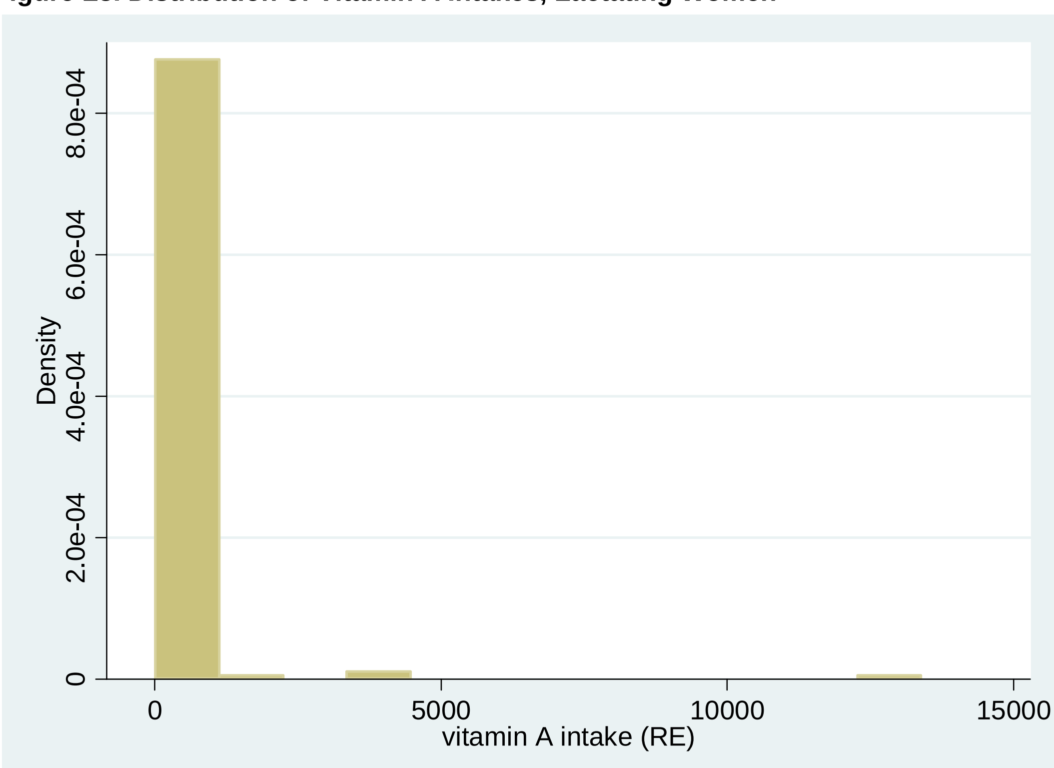


Figure L9. Distribution of Calcium Intakes, Lactating Women

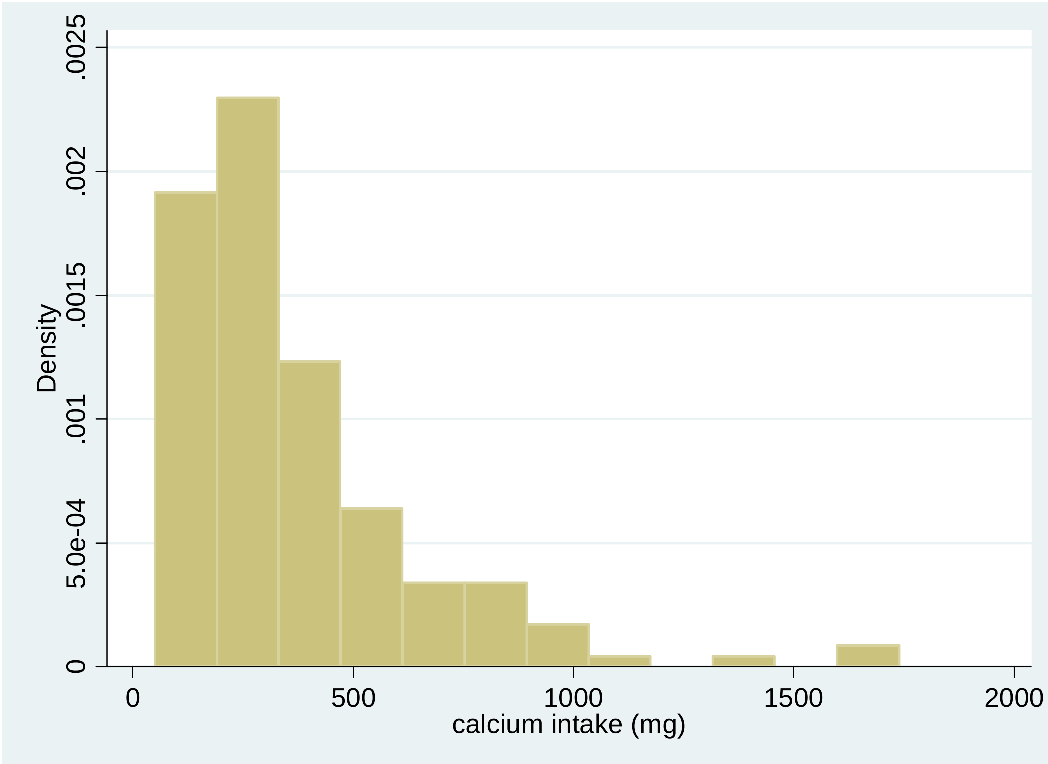


Figure L10. Distribution of Iron Intakes, Lactating Women

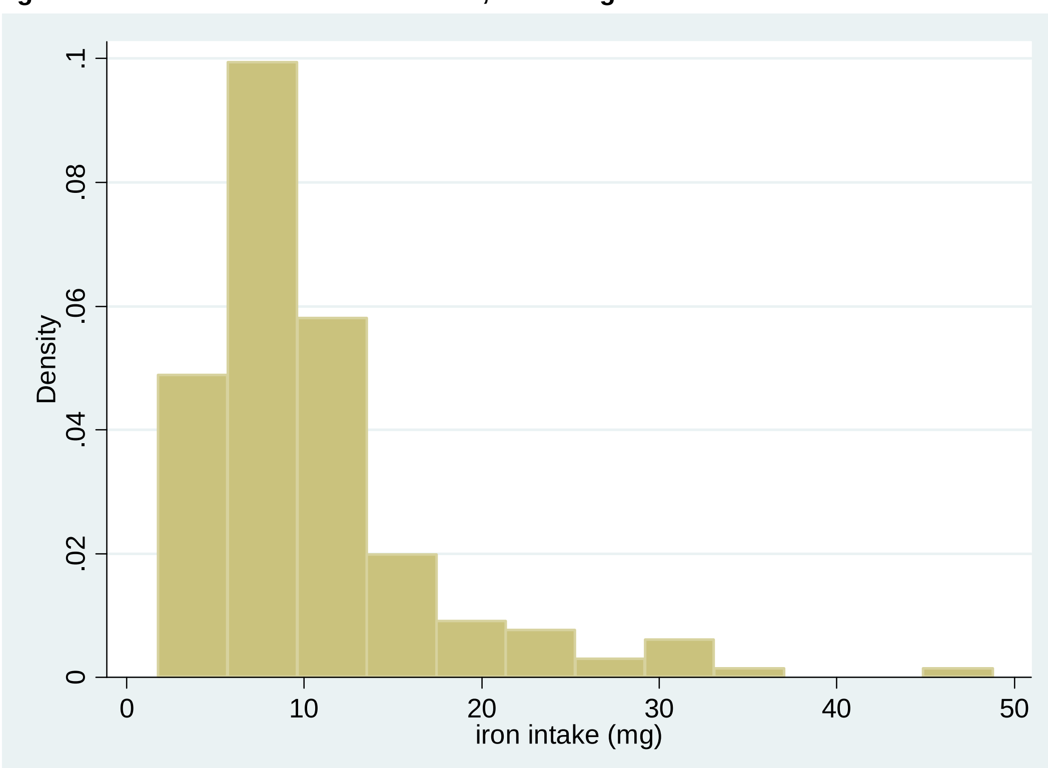


Figure L11. Distribution of Zinc Intakes, Lactating Women

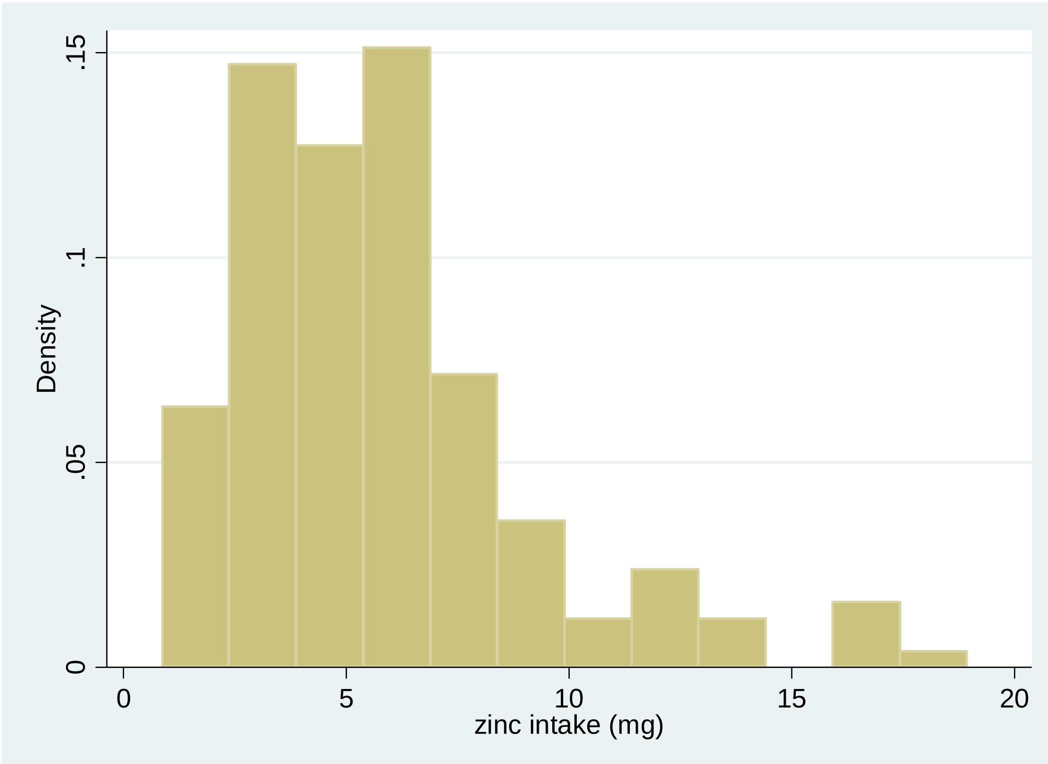


Figure L12. Intra-Individual SD of Thiamin Intakes, Lactating Women

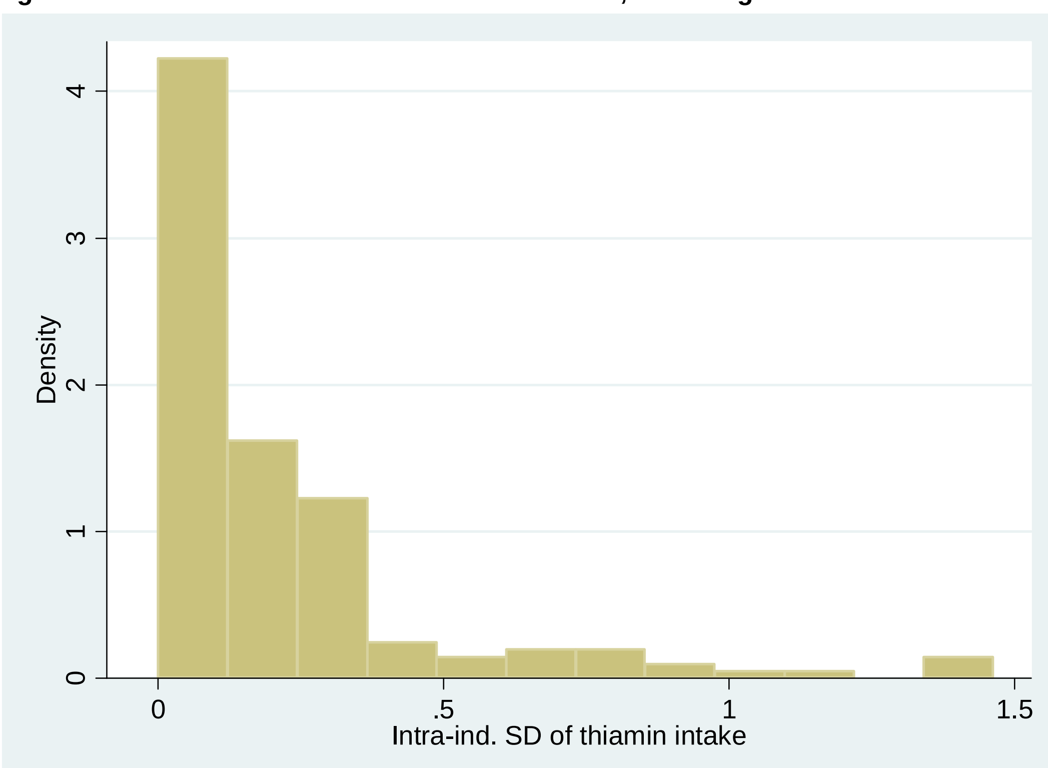


Figure L13. Intra-Individual SD of Riboflavin Intakes, Lactating Women

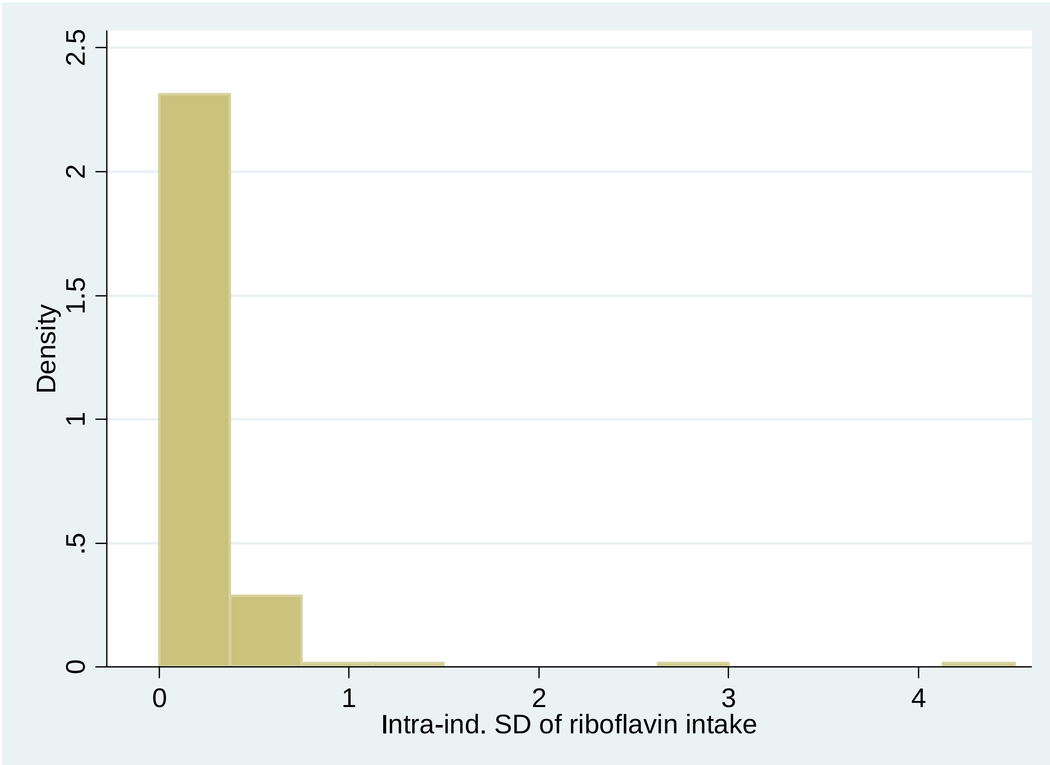


Figure L14. Intra-Individual SD of Niacin Intakes, Lactating Women

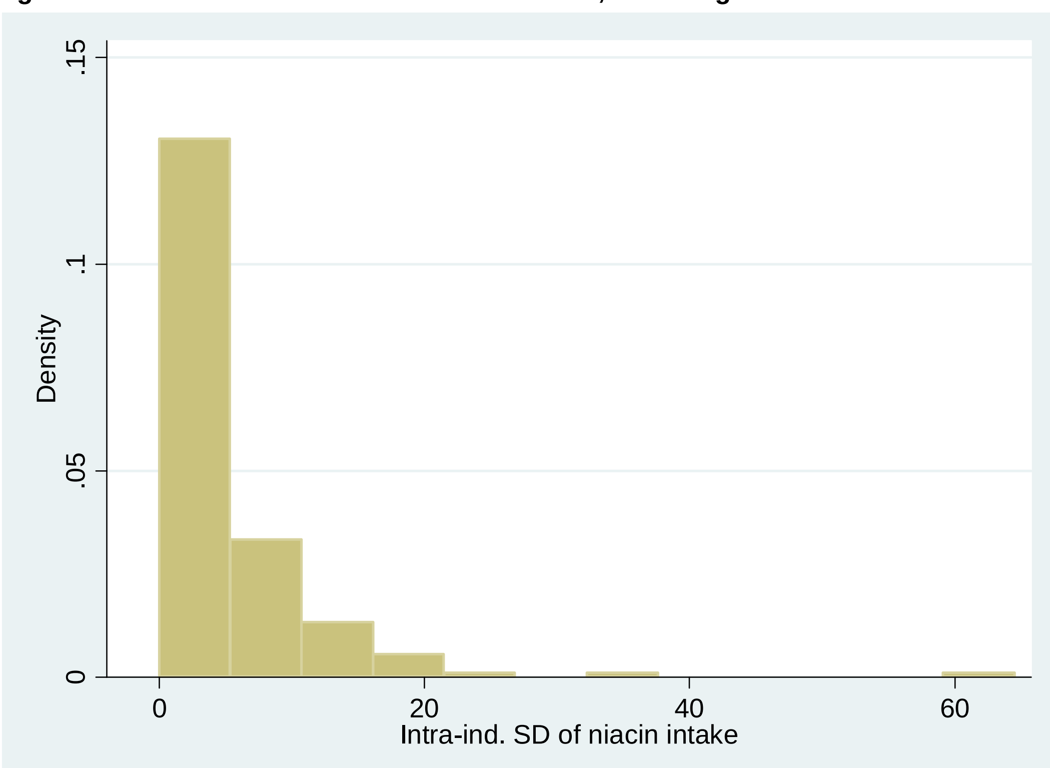


Figure L15. Intra-Individual SD of Vitamin B6 Intakes, Lactating Women

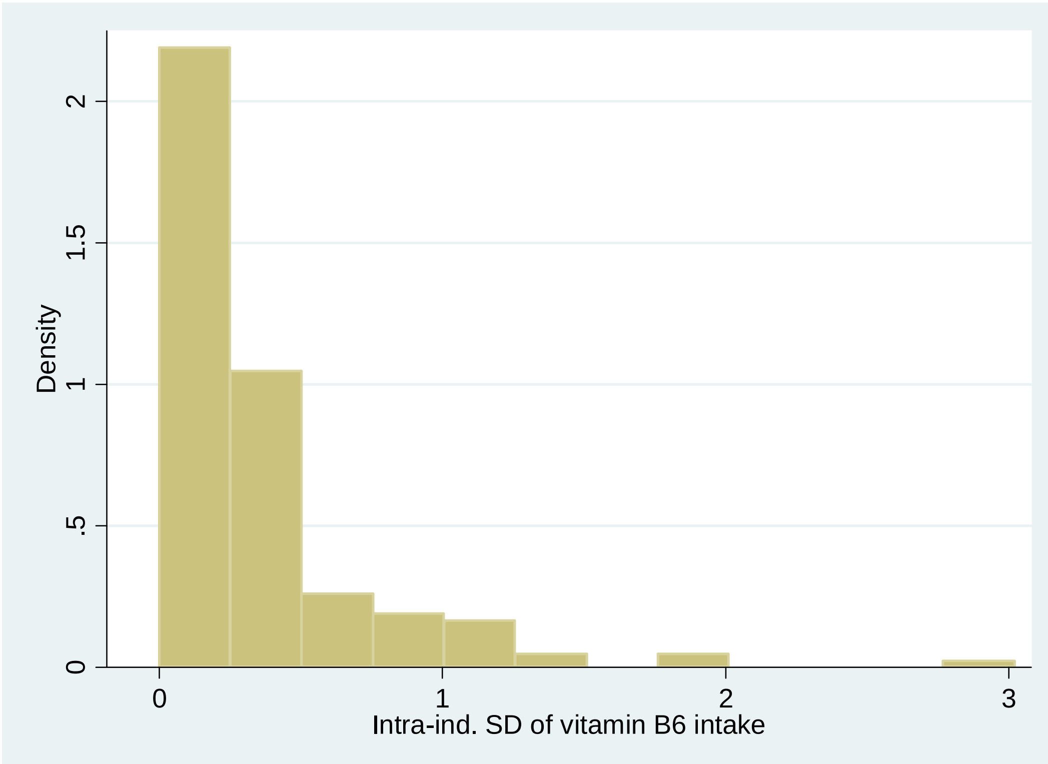


Figure L16. Intra-Individual SD of Folate Intakes, Lactating Women

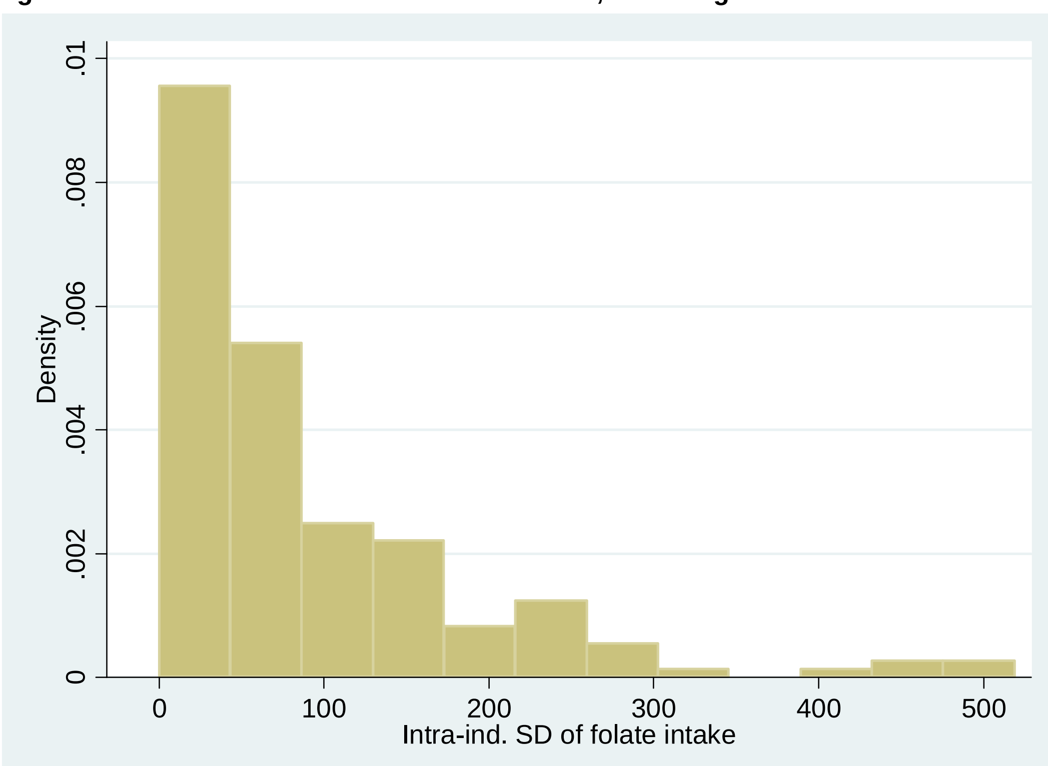


Figure L17. Intra-Individual SD of Vitamin B12 Intakes, Lactating Women

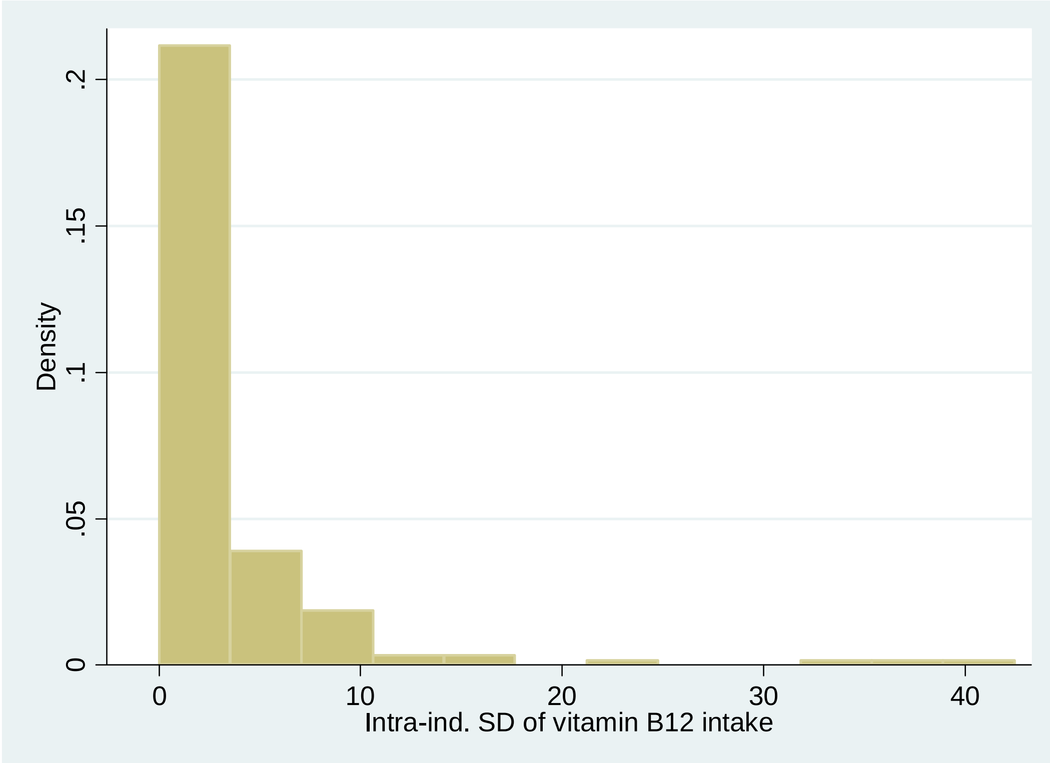


Figure L18. Intra-Individual SD of Vitamin C Intakes, Lactating Women

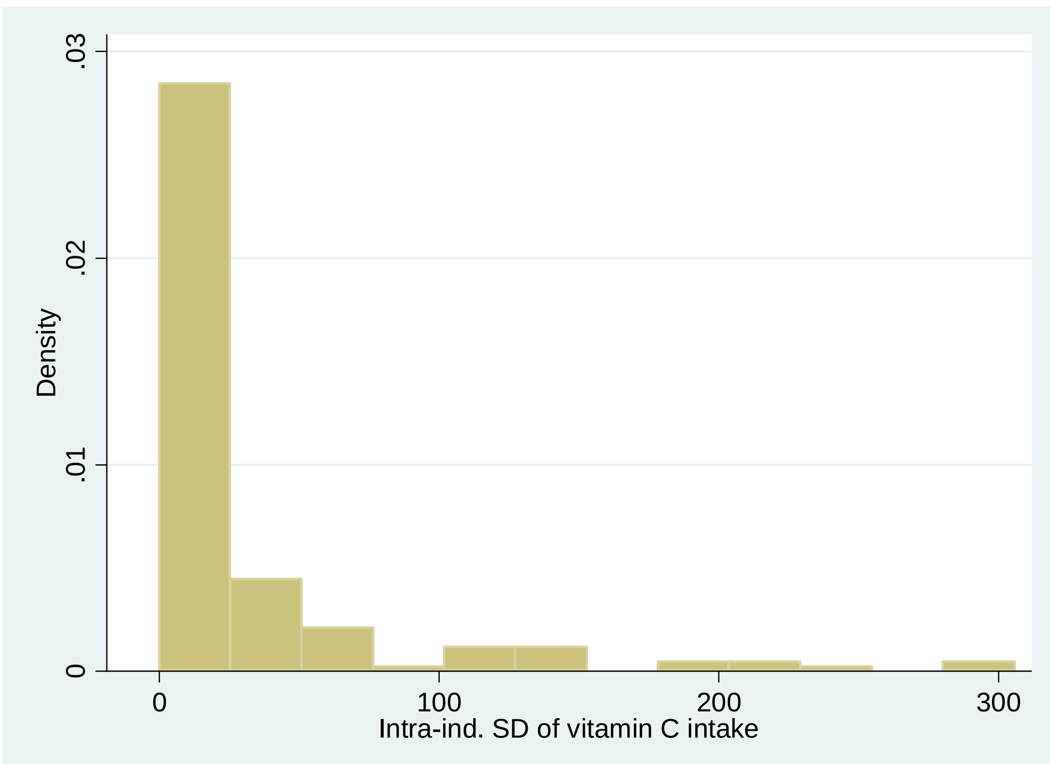


Figure L19. Intra-Individual SD of Vitamin A Intakes, Lactating Women

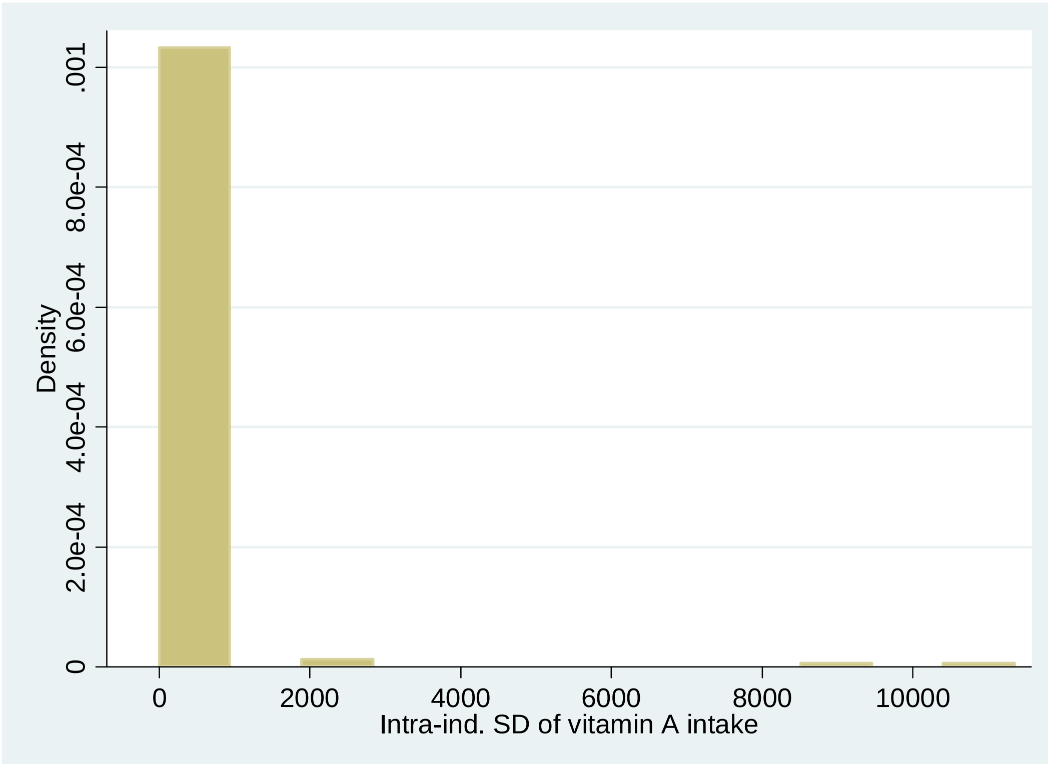


Figure L20. Intra-Individual SD of Calcium Intakes, Lactating Women

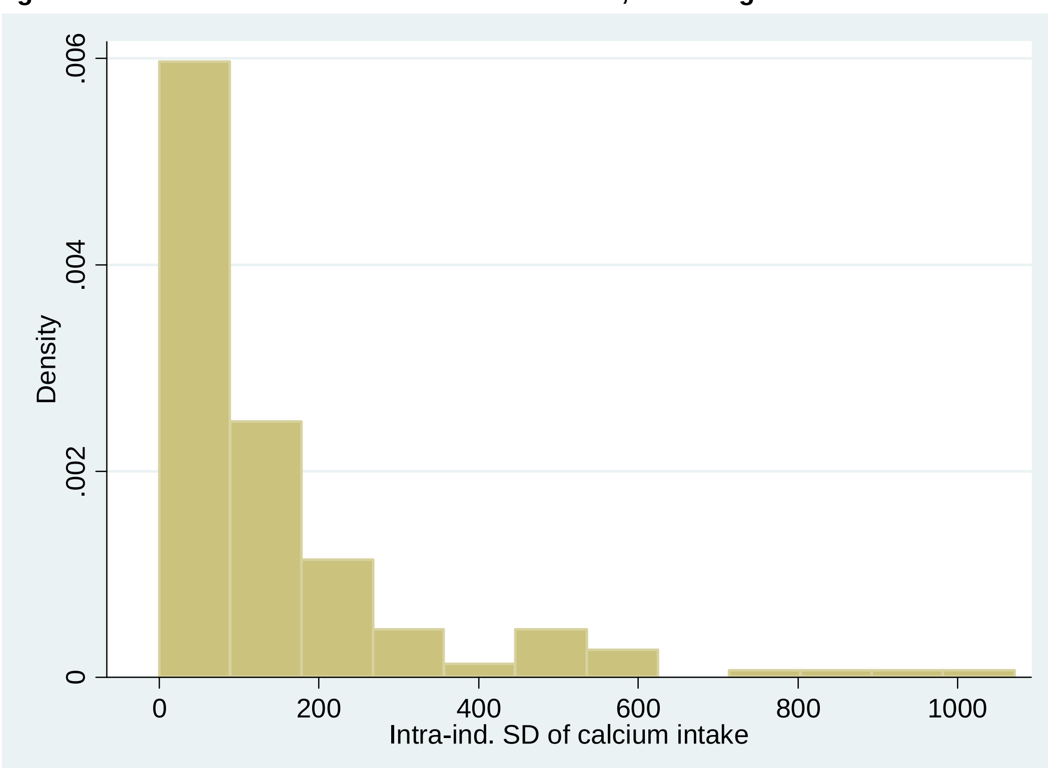


Figure L21. Intra-Individual SD of Iron Intakes, Lactating Women

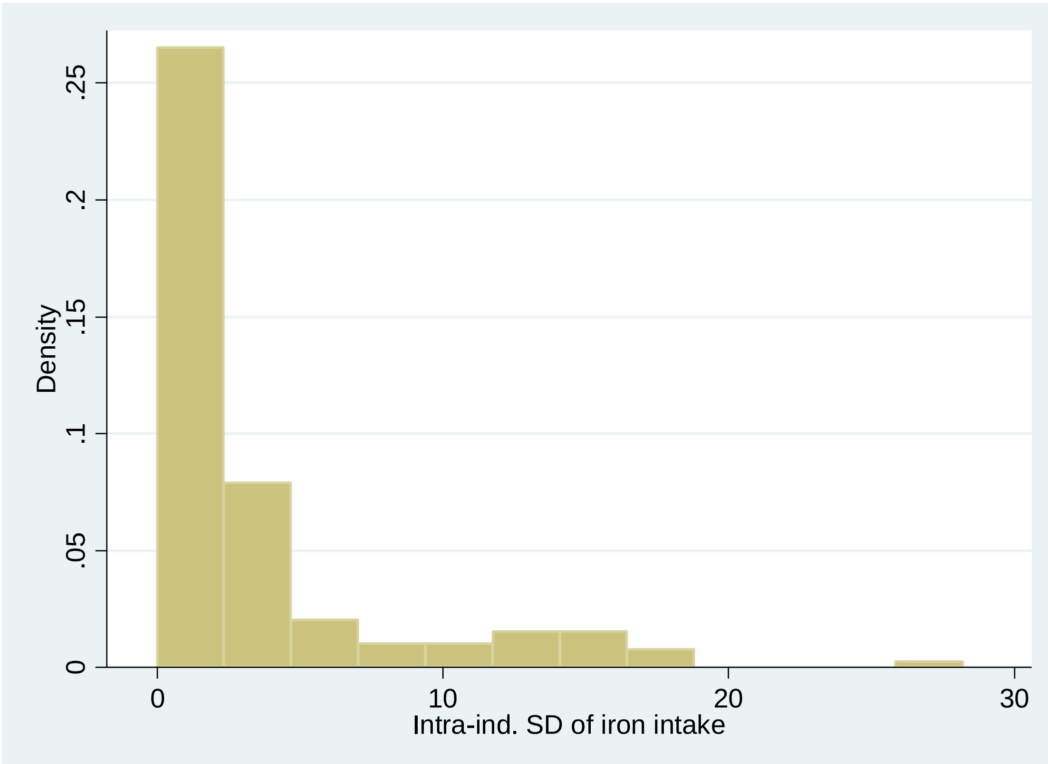


Figure L22. Intra-Individual SD of Zinc Intakes, Lactating Women

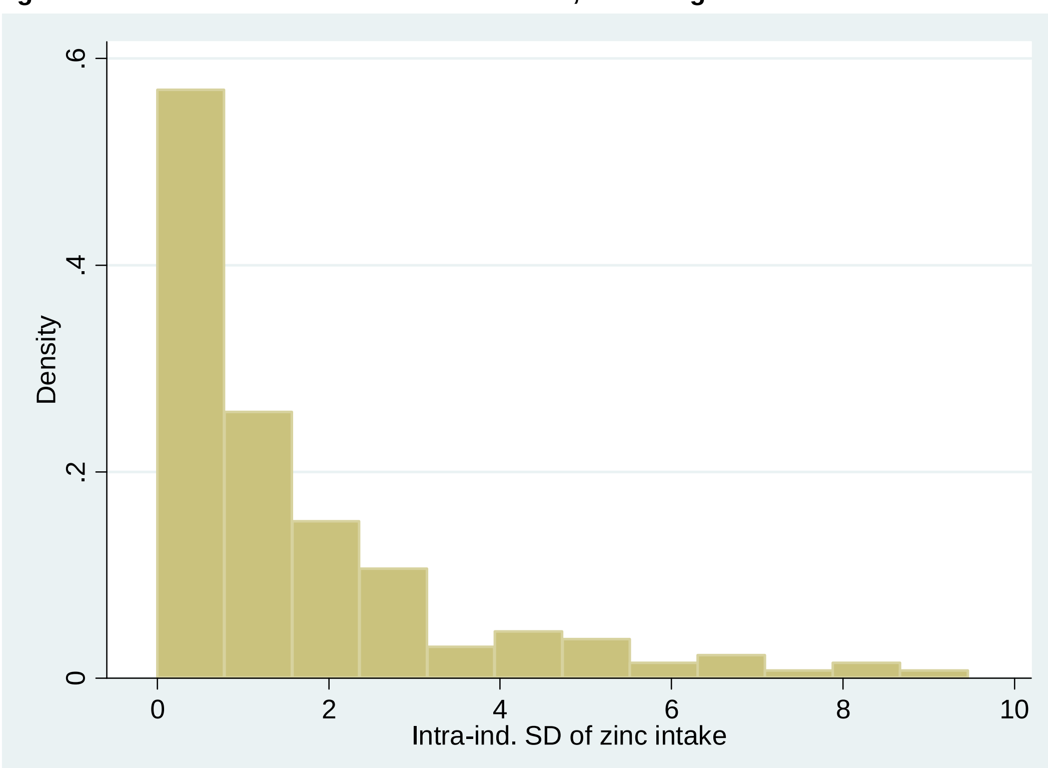


Figure L23. Distribution of Scores for FGI-6, Lactating Women

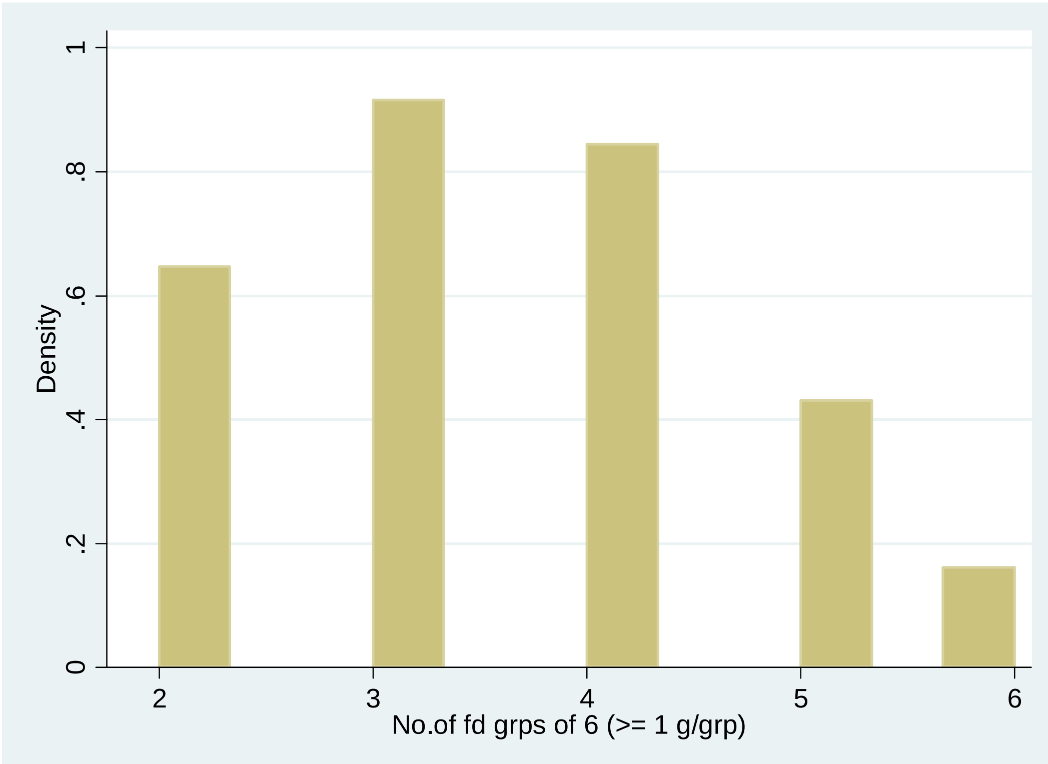


Figure L24. Distribution of Scores for FGI-6R, Lactating Women

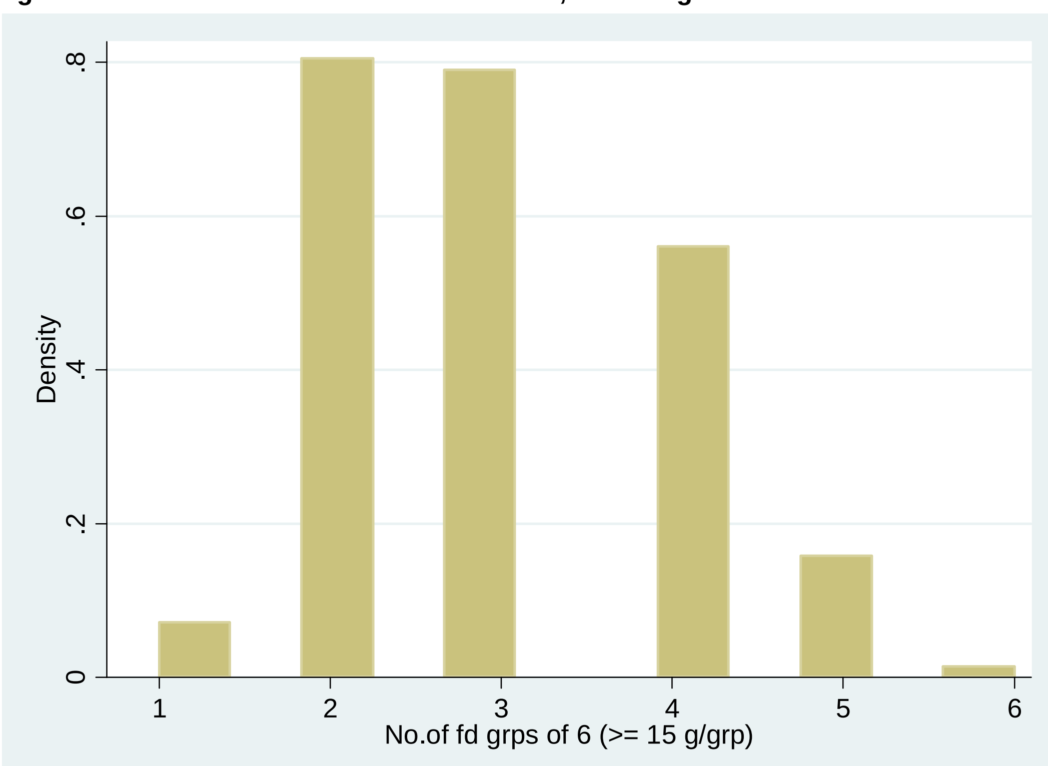


Figure L25. Distribution of Scores for FGI-9, Lactating Women

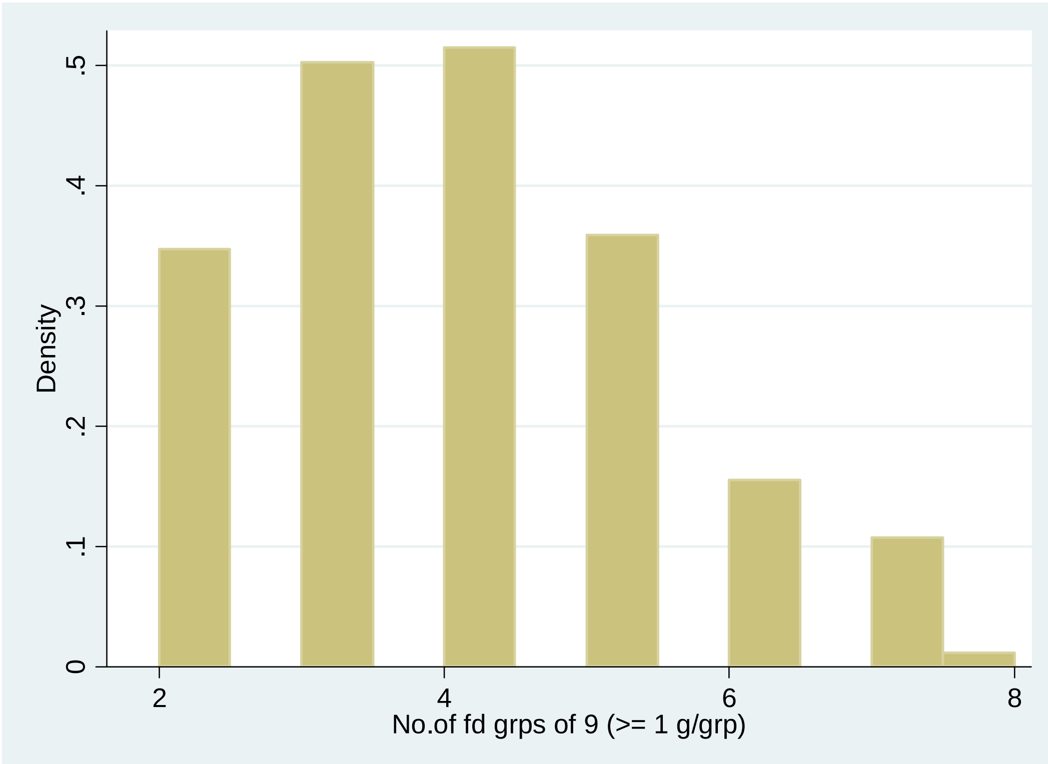


Figure L26. Distribution of Scores for FGI-9R, Lactating Women

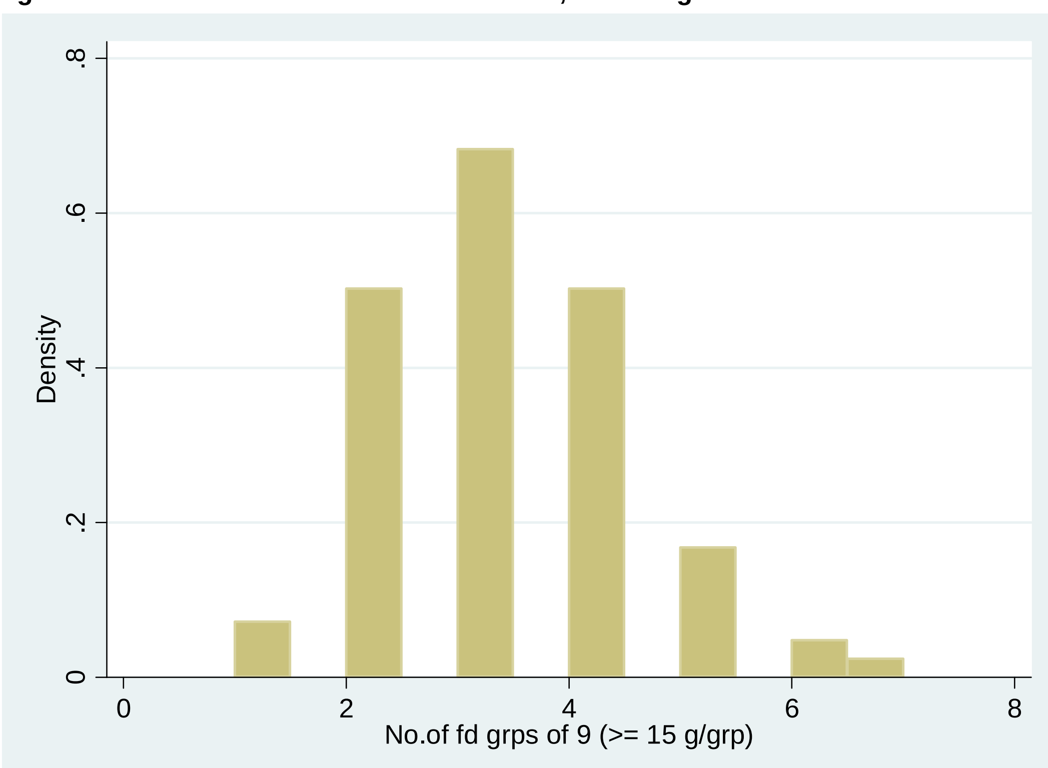


Figure L27. Distribution of Scores for FGI-13, Lactating Women

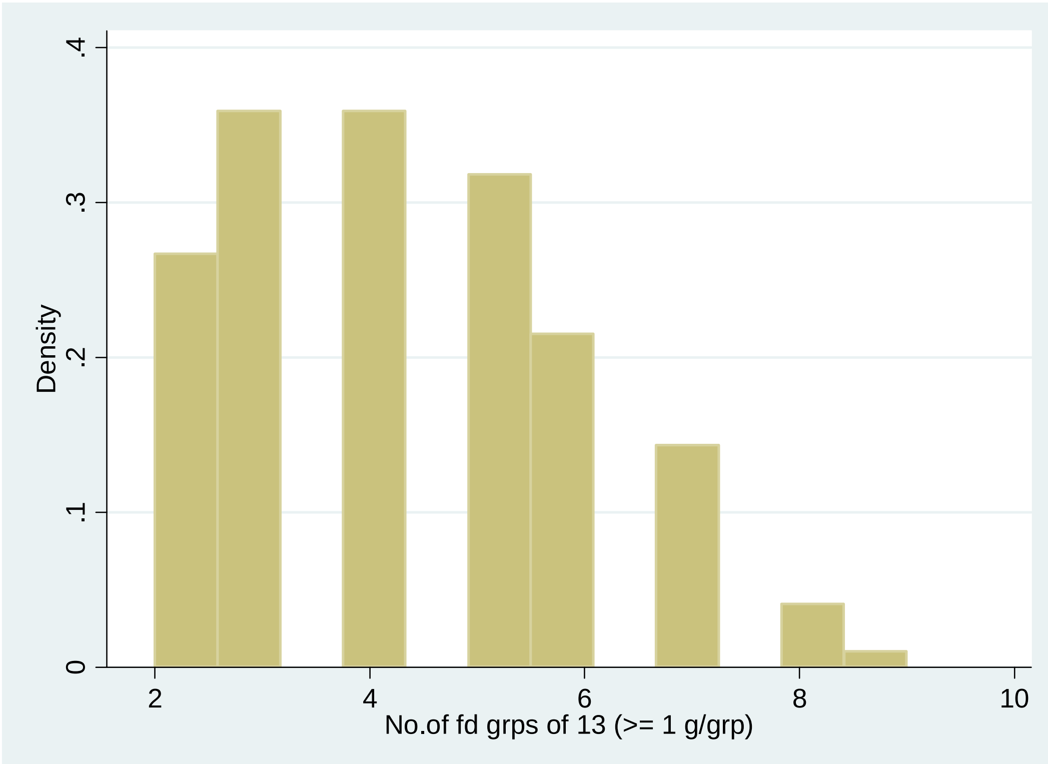


Figure L28. Distribution of Scores for FGI-13R, Lactating Women

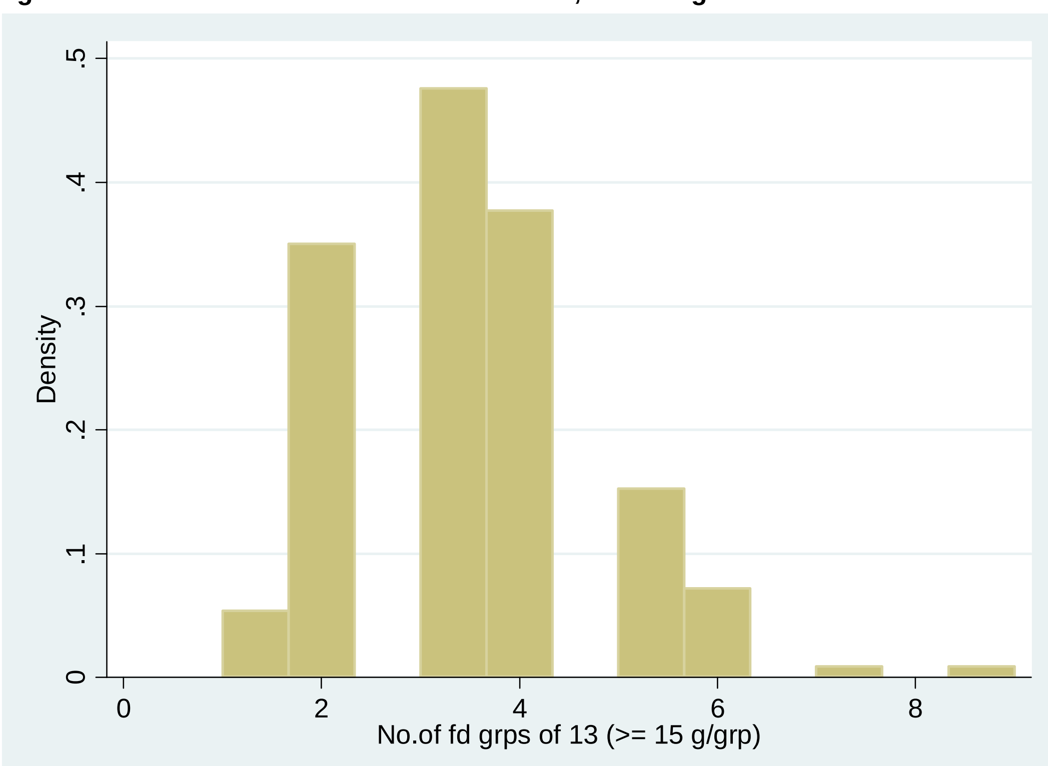


Figure L29. Distribution of Scores for FGI-21, Lactating Women

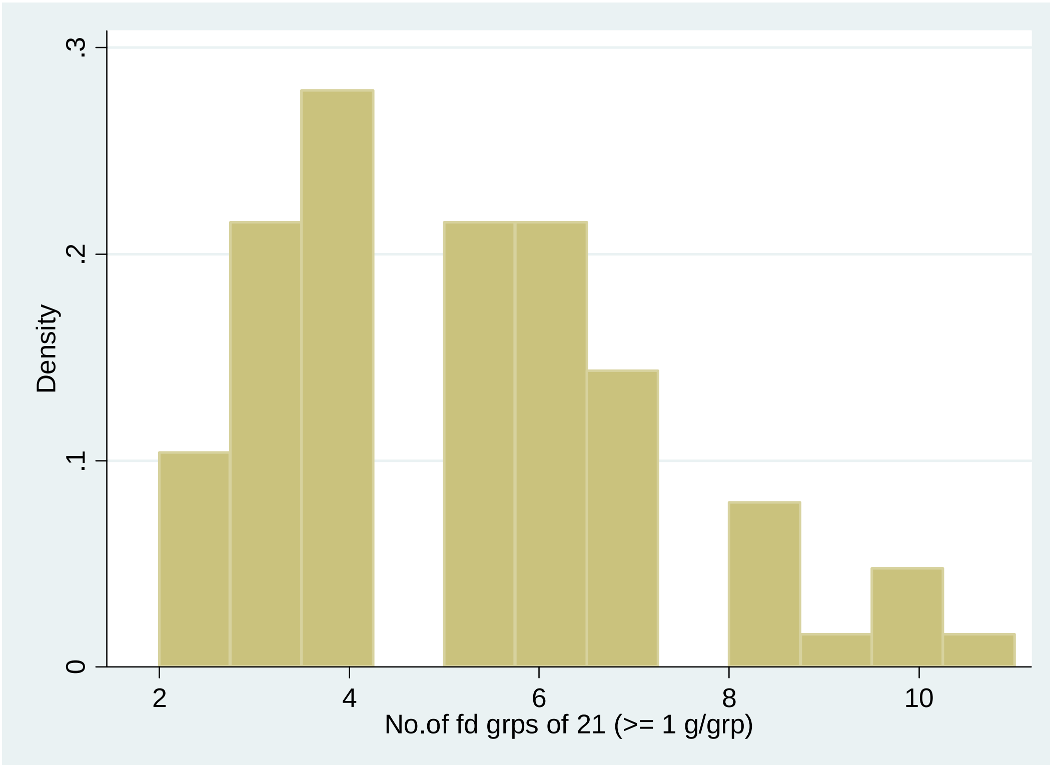


Figure L30. Distribution of Scores for FGI-21R, Lactating Women

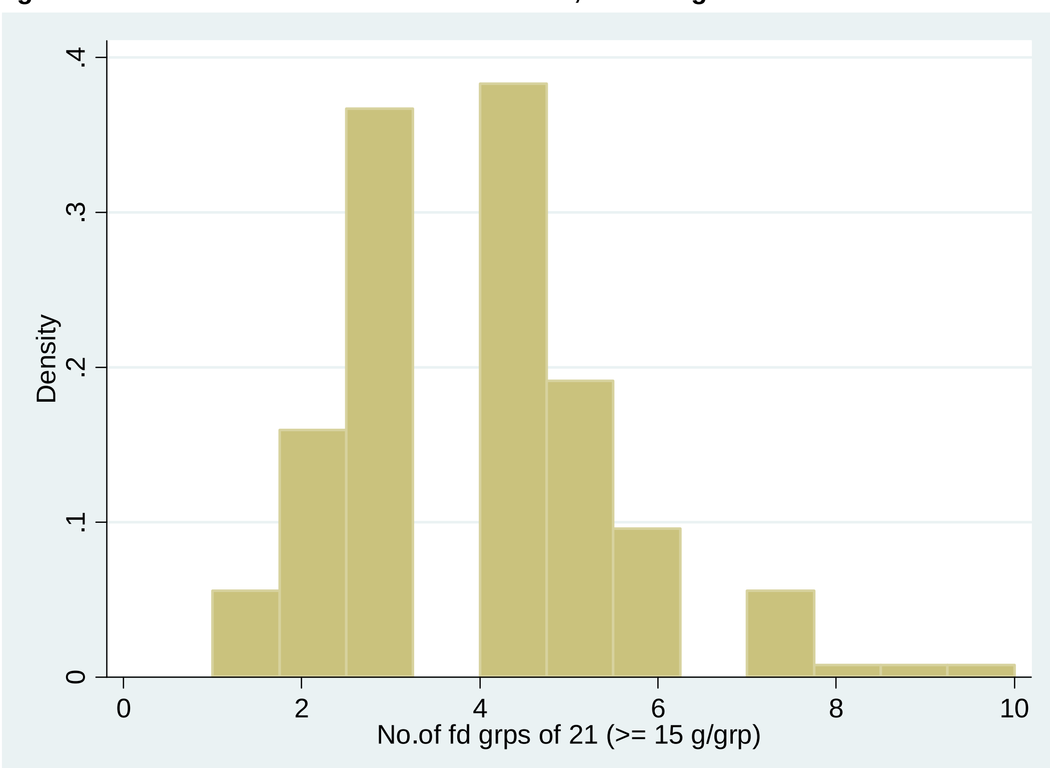


Table L6. Percent of Observation Days at Each Food Group Diversity Score, Lactating Women, R1

Number of food groups eaten	Diversity indicators							
	FGI-6	FGI-6R	FGI-9	FGI-9R	FGI-13	FGI-13R	FGI-21	FGI-21R
1	0	3	0	4	0	4	0	4
2	22	34	17	25	16	23	8	12
3	31	33	25	34	21	32	16	28
4	28	23	26	25	21	25	21	29
5	14	7	18	8	19	10	16	14
6	5	1	8	2	13	5	16	7
7			5	1	8	1	11	4
8			1	0	2	0	6	1
9			0	0	1	1	1	1
10					0	0	4	1
11					0	0	1	0
12					0	0	0	0
13					0	0	0	0
14							0	0
15							0	0
16							0	0
17							0	0
18							0	0
19							0	0
20							0	0
21							0	0

Figure L31. Distribution of PA for Thiamin, Lactating Women

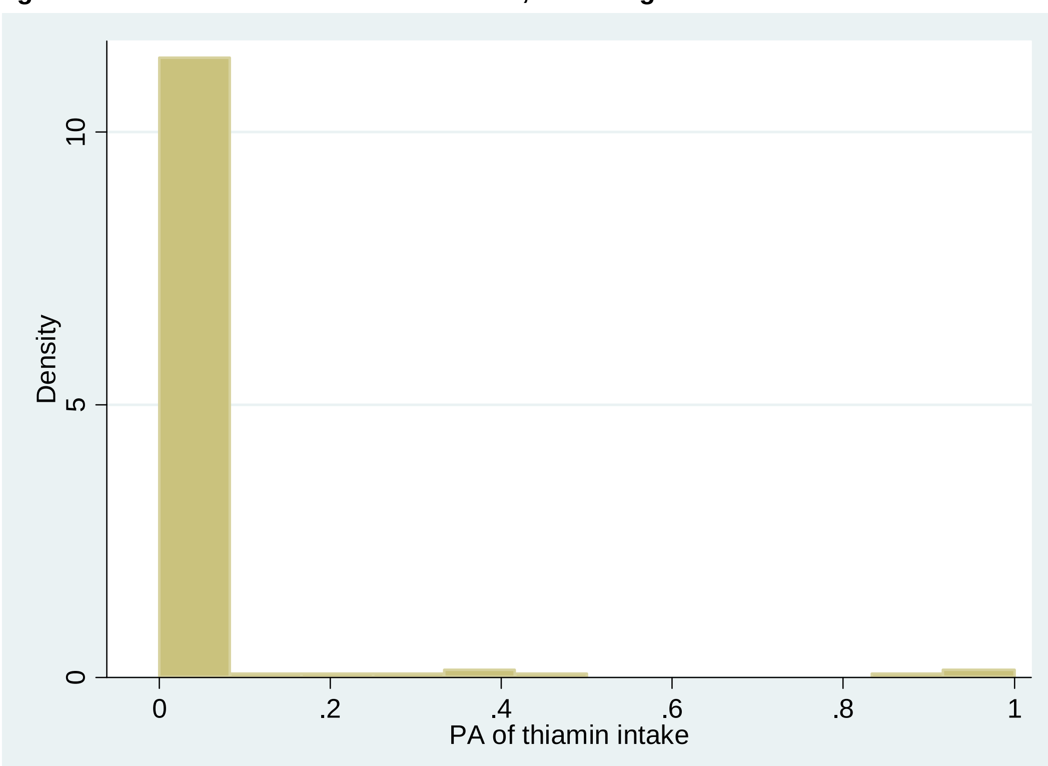


Figure L32. Distribution of PA for Riboflavin, Lactating Women

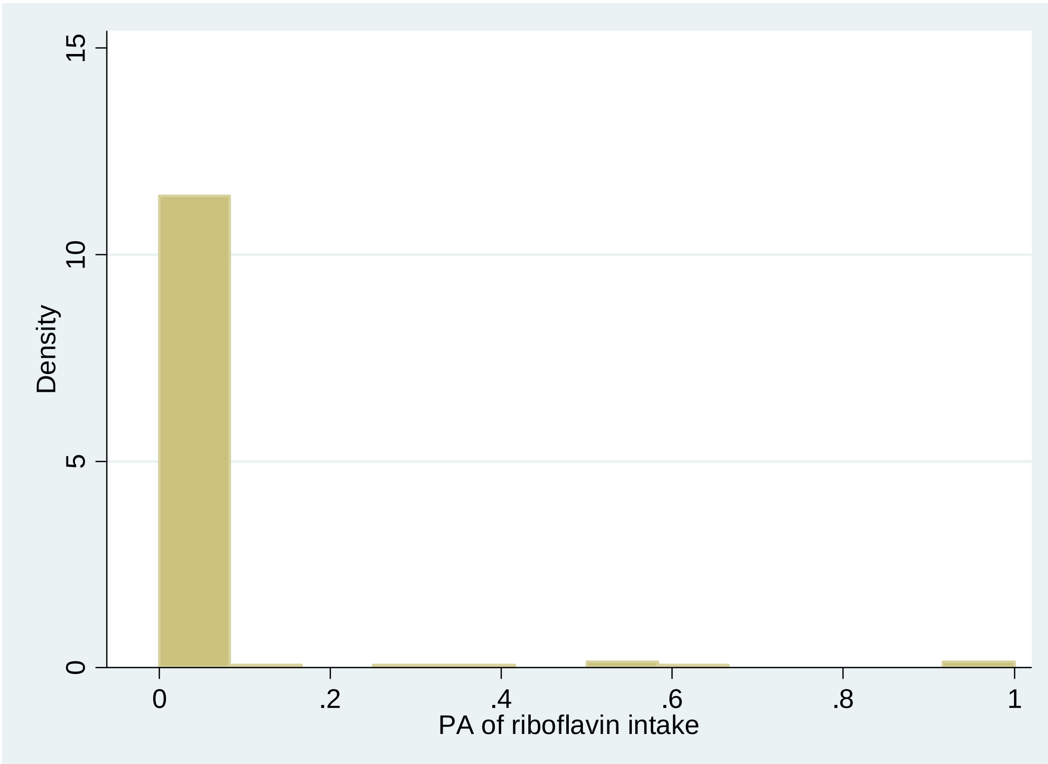


Figure L33. Distribution of PA for Niacin, Lactating Women

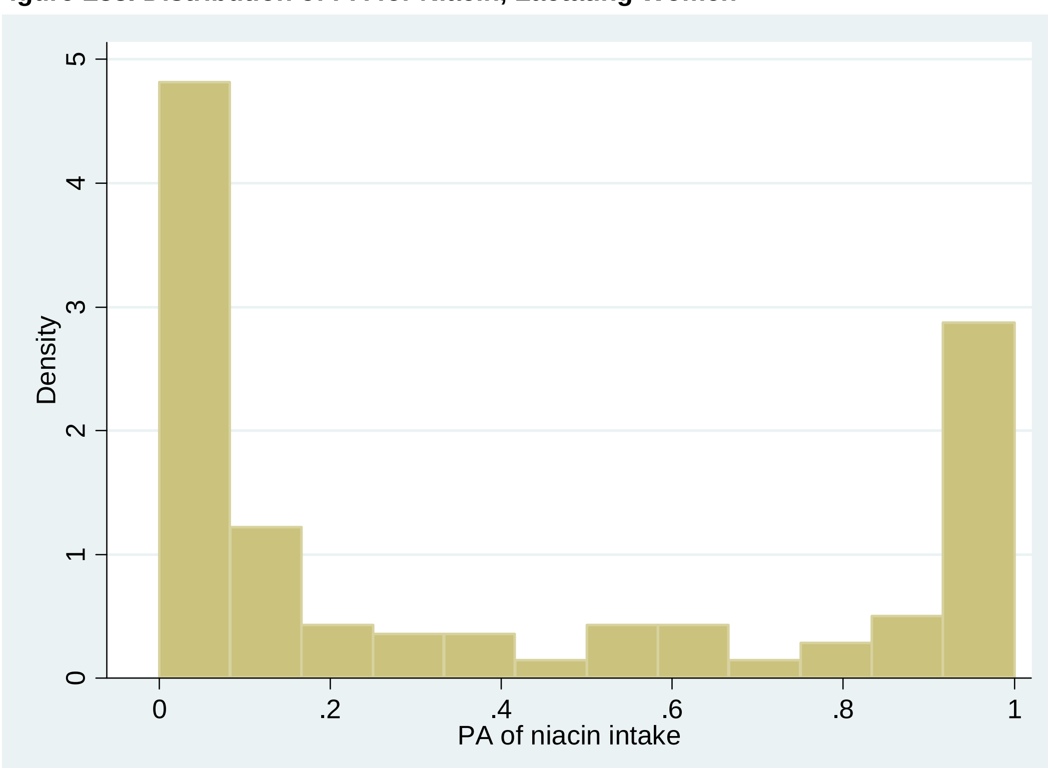


Figure L34. Distribution of PA for Vitamin B6, Lactating Women

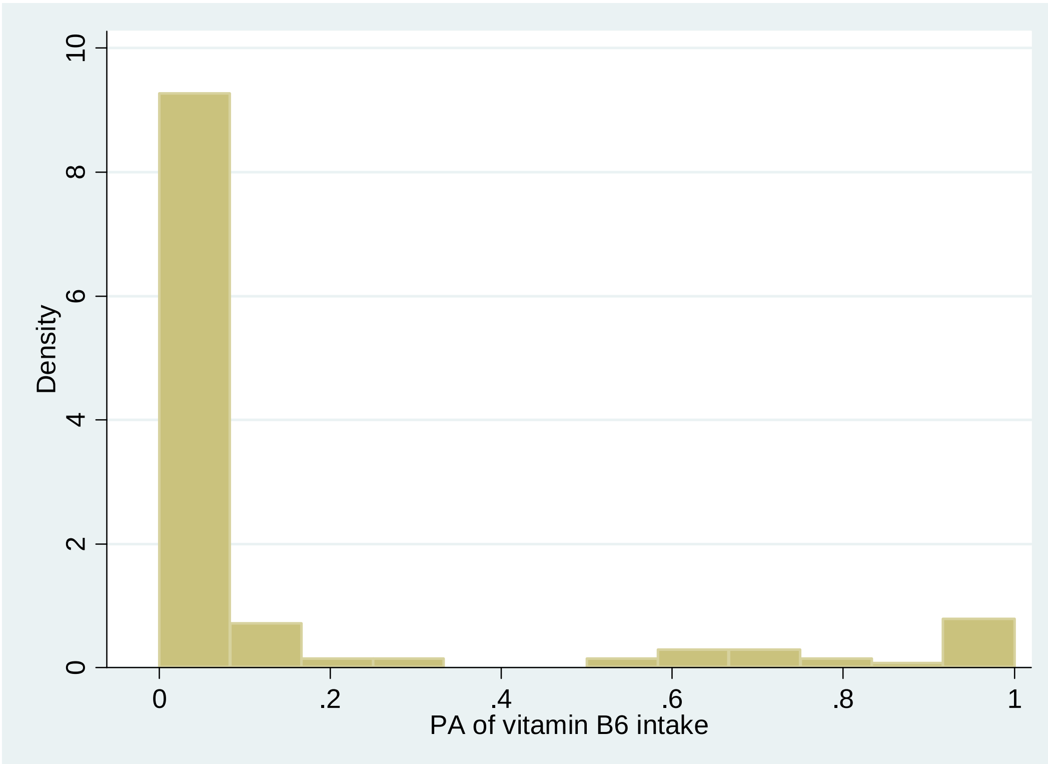


Figure L35. Distribution of PA for Folate, Lactating Women

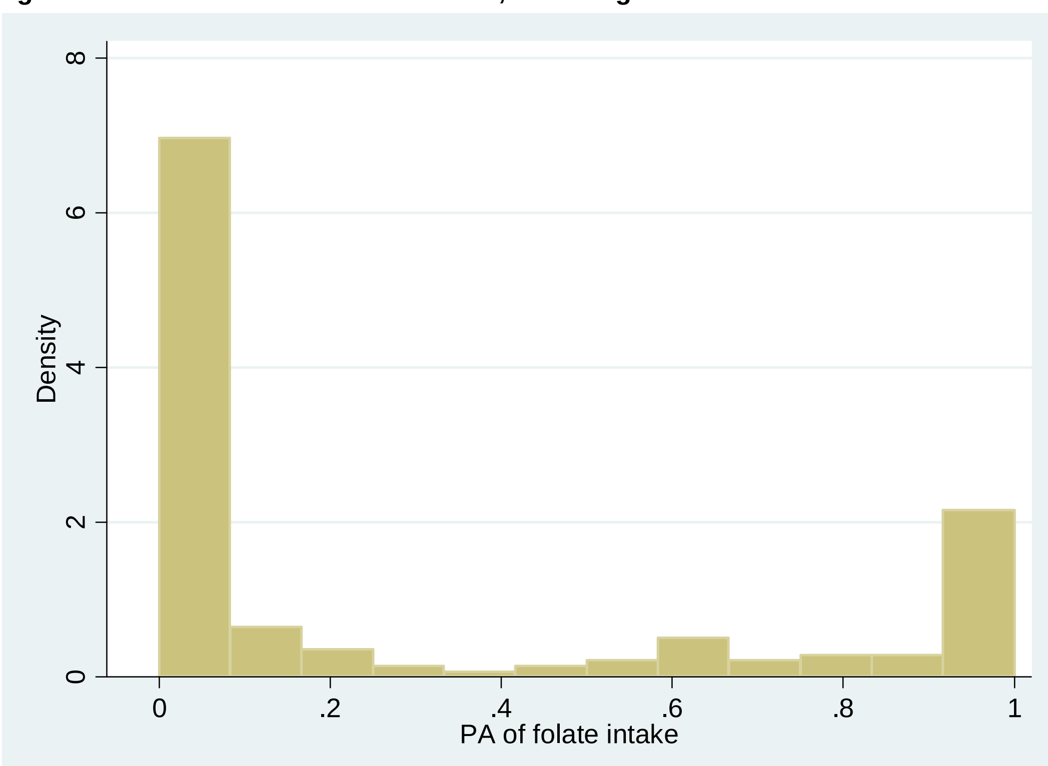


Figure L36. Distribution of PA for Vitamin B12, Lactating Women

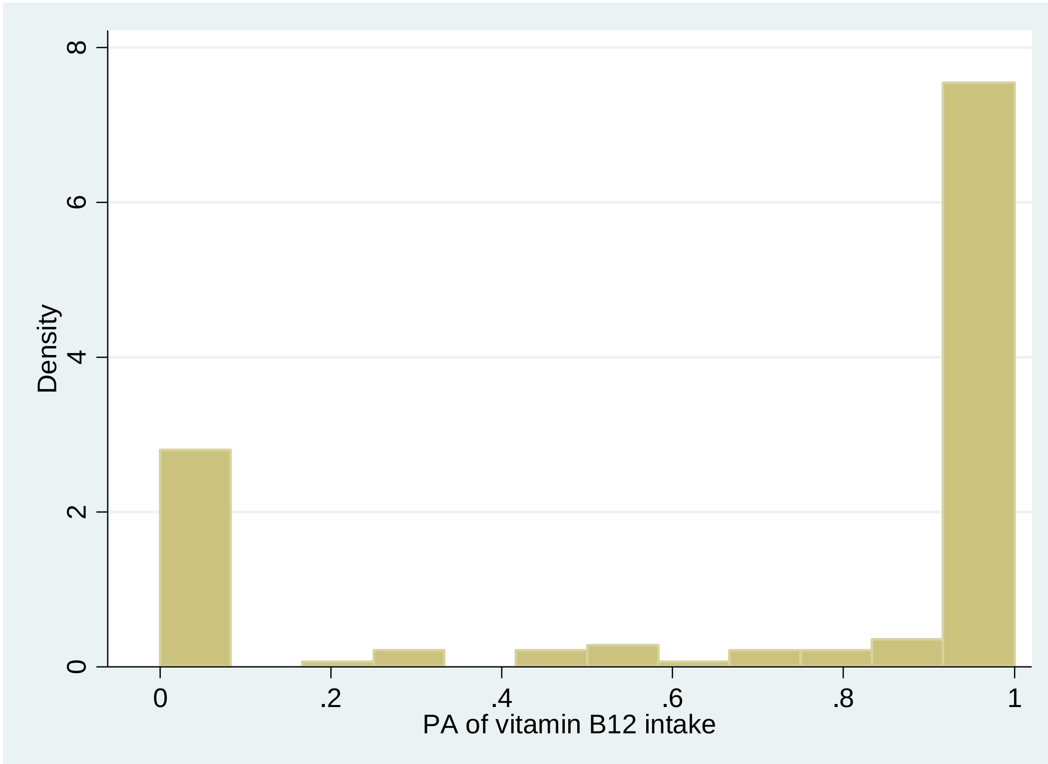


Figure L37. Distribution of PA for Vitamin C, Lactating Women

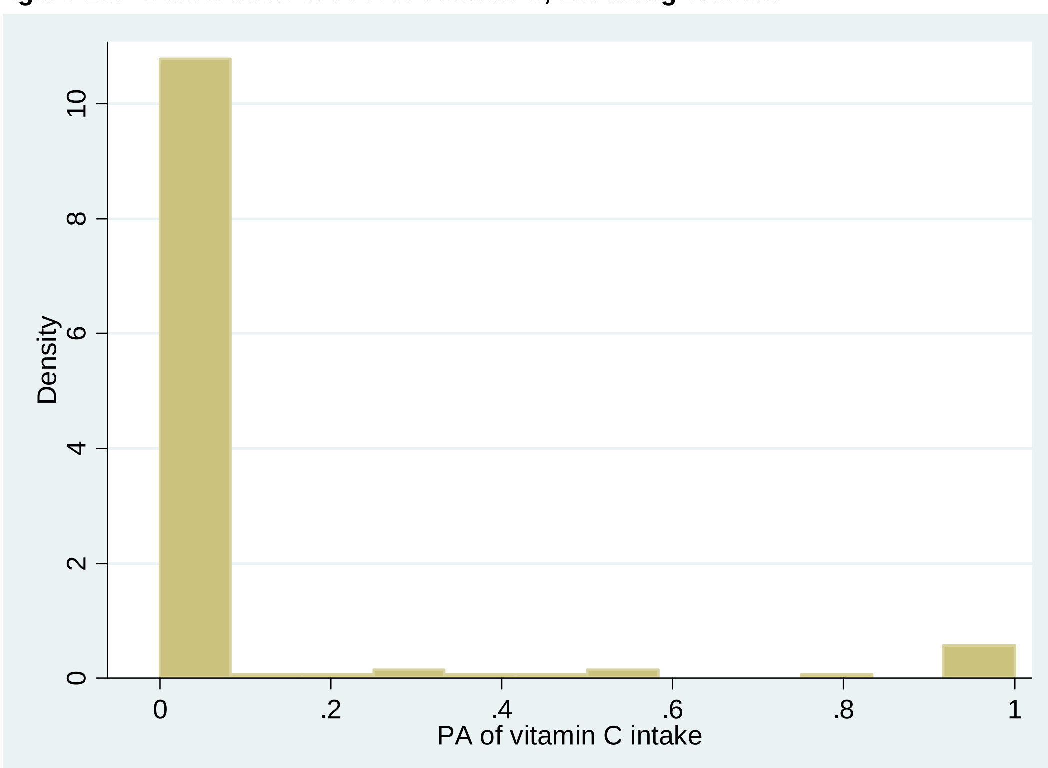


Figure L38. Distribution of PA for Vitamin A, Lactating Women

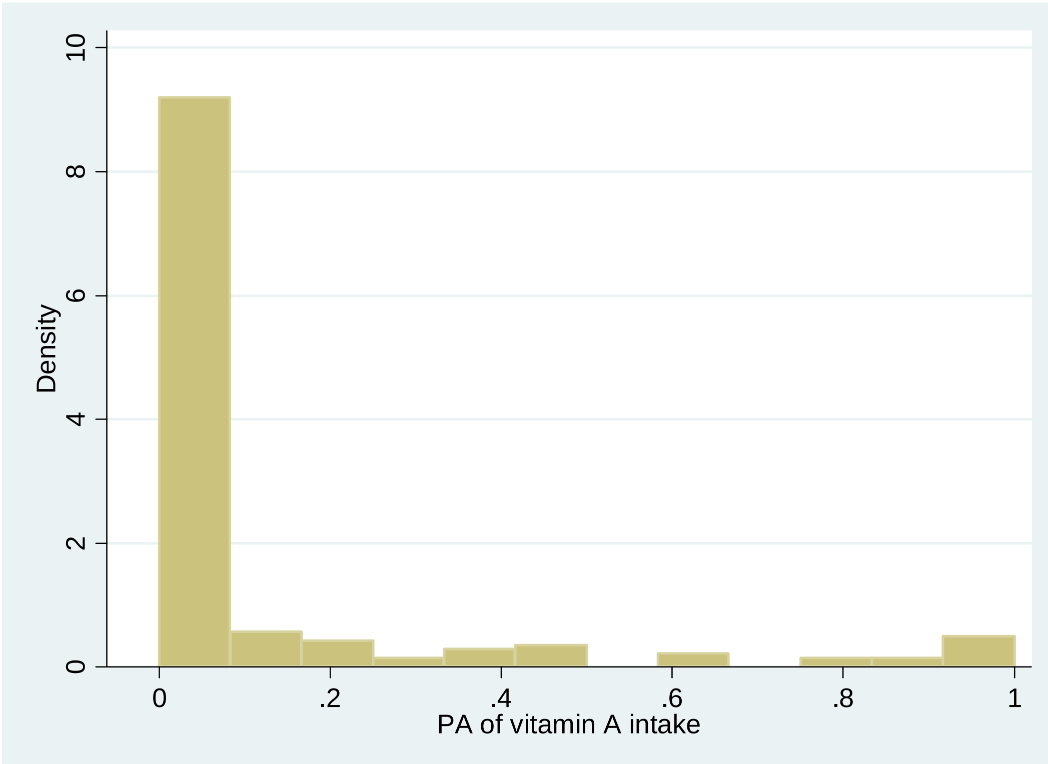


Figure L39. Distribution of PA for Calcium, Lactating Women

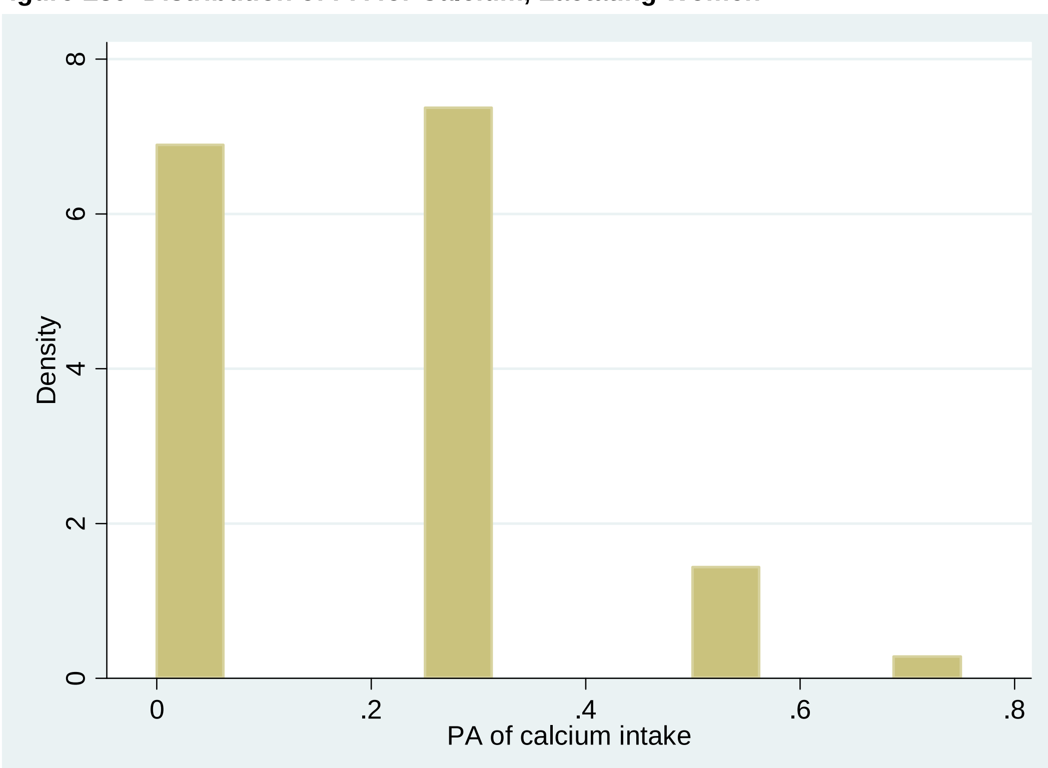


Figure L40. Distribution of PA for Iron, Lactating Women

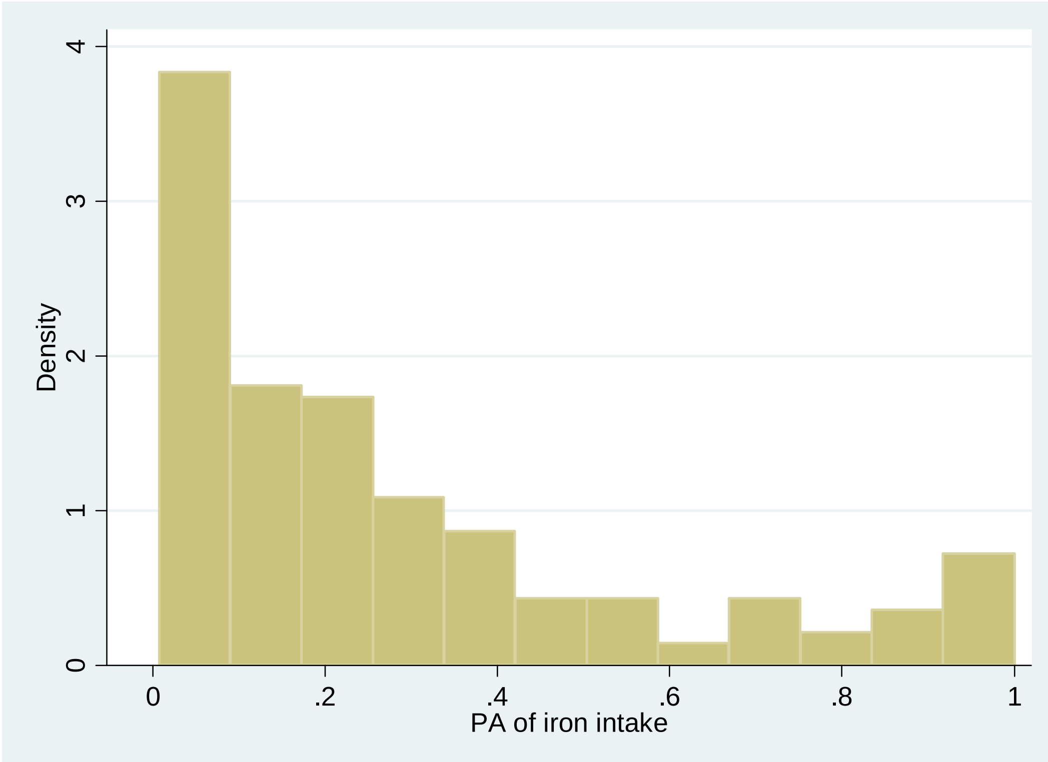


Figure L41. Distribution of PA for Zinc, Lactating Women

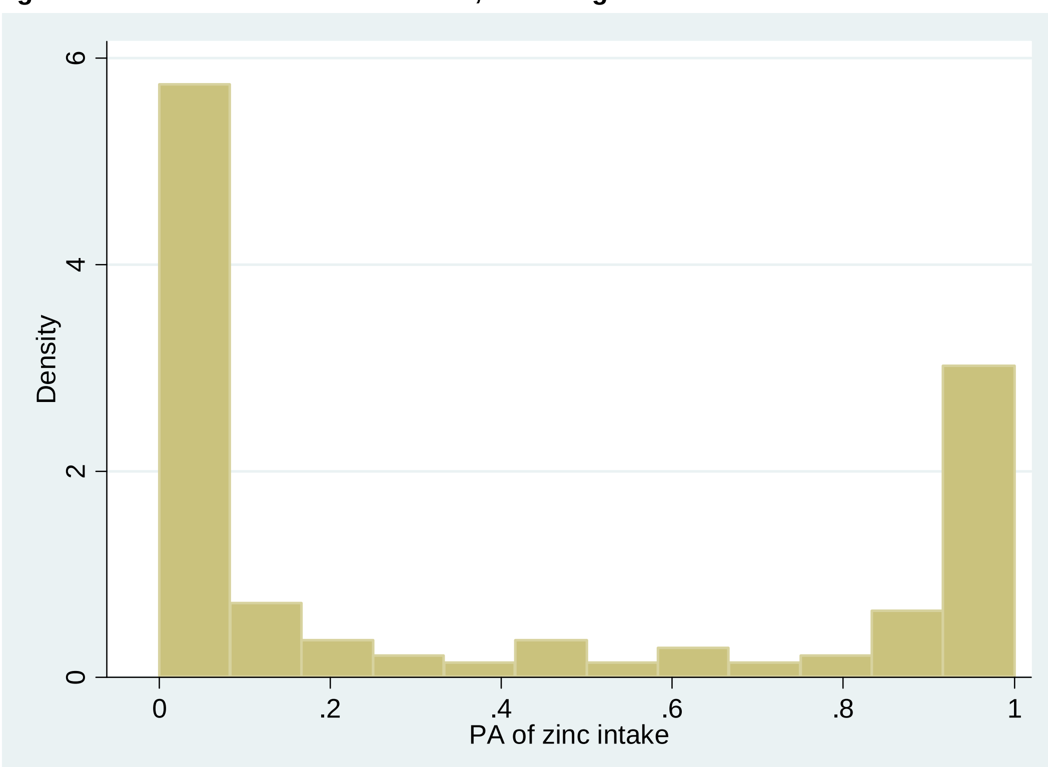
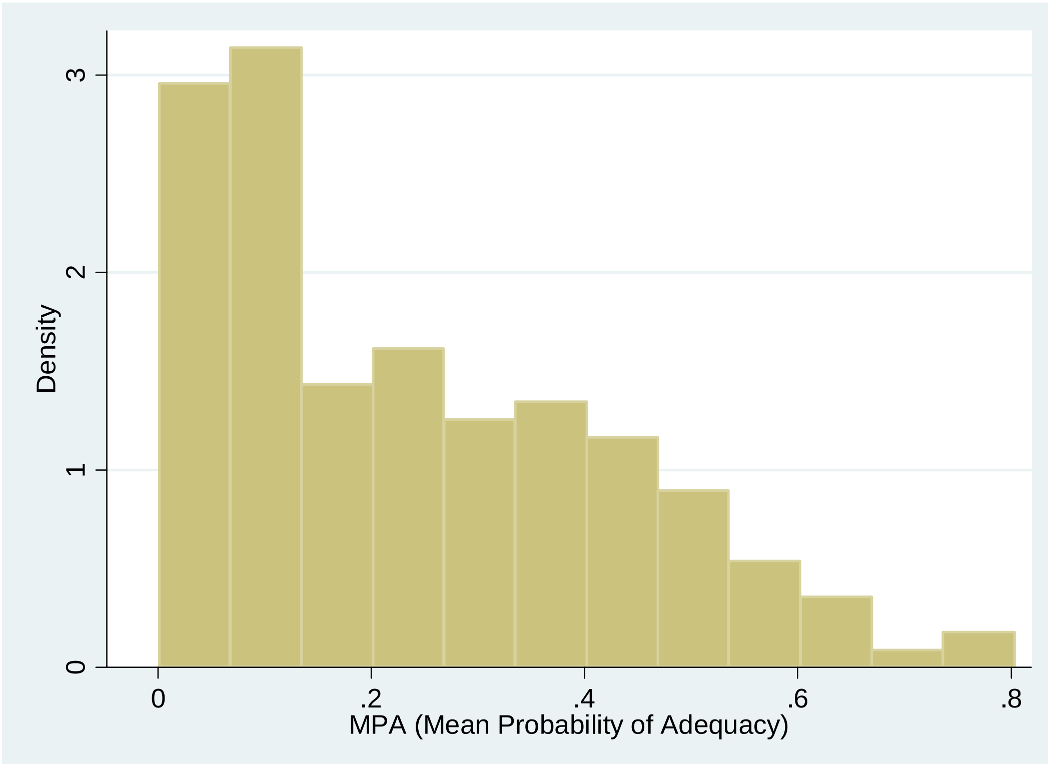


Figure L42. Distribution of MPA across 11 Micronutrients, Lactating Women



Appendix 3. Tables and Figures, Non-Pregnant Non-Lactating Women

Table N1. Description of Sample, NPNL Women, R1

	n	Mean	SD	Median	Range
Age (year)	1798	35.9	11.5	42.0	20.0-49.0
Height (cm)	1798	151.1	5.1	150.9	132.7-168.8
Weight (kg)	1798	52.8	11.0	51.3	29.7-105.0
BMI	1798	23.1	4.5	22.5	13.4-41.9
Education[a]	1798	9.1	3.7	10.0	0-18
% Literate[b]	1798	96.7			
% Lactating	1798	0.0			
% Pregnant	1798	0.0			
	n	**Percent**			
BMI < 16	42	2.3			
BMI 16-16.9	63	3.5			
BMI 17-18.49	175	9.7			
BMI 18.5-24.9	940	52.3			
BMI 25-29.9	438	24.4			
BMI ≥ 30	140	7.8			

[a] Years of schooling completed.
[b] Percent completing 3rd grade.

Table N2. Energy and Macronutrient Intakes, NPNL Women, R1

	Mean	SD	Median	Range	Percent of kcal
Energy (kcal)	1,341.4	628.7	1,211.4	334.0-4,155.0	
Protein (g)	52.1	31.4	44.6	7.3-299.6	16
Animal source (g)	35.0	30.0	27.6	0.0-280.5	10
Plant source (g)	17.2	8.4	15.8	1.6-56.6	6
Total carbohydrate (g)	205.0	86.5	190.0	22.9-641.0	65
Total fat (g)	34.7	38.9	20.4	0.5-271.4	20

Table N3a. Percent of Women Who Consumed 6 Major Food Groups, NPNL Women, R1

	≥ 1 g	≥ 15 g
All starchy staples	100	100
All legumes and nuts	41	26
All dairy	26	13
Other animal source foods	100	94
Vitamin A-rich fruits and vegetables [a]	47	30
Other fruits and vegetables	64	46

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table N3b. Percent of Women Who Consumed 9 Sub-Food Groups, NPNL Women, R1

	≥ 1 g	≥ 15 g
All starchy staples	100	100
All legumes and nuts	41	26
All dairy	26	13
Organ meat	11	6
Eggs	26	16
Flesh foods and other miscellaneous small animal protein	99	93
Vitamin A-rich dark green leafy vegetables [a]	30	23
Other vitamin A-rich vegetables and fruits [a]	22	9
Other fruits and vegetables	64	46

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table N3c. Percent of Women Who Consumed 13 Sub-Food Groups, NPNL Women, R1

	≥ 1 g	≥ 15 g
All starchy staples	100	100
All legumes and nuts	41	26
All dairy	26	13
Organ meat	11	6
Eggs	26	16
Small fish eaten whole with bones	12	7
All other flesh foods and miscellaneous small animal protein	98	91
Vitamin A-rich dark green leafy vegetables [a]	30	23
Vitamin A-rich deep yellow/orange/red vegetables [a]	20	6
Vitamin C-rich vegetables [b]	37	21
Vitamin A-rich fruits [a]	3	3
Vitamin C-rich fruits [b]	8	7
All other fruits and vegetables	50	30

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.
[b] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table N3d. Percent of Women Who Consumed 21 Sub-Food Groups, NPNL Women, R1

	≥ 1 g	≥ 15 g
Grains and grain products	100	100
All other starchy staples	31	22
Cooked dry beans and peas	31	24
Soybeans and soy products	18	1
Nuts and seeds	2	2
Milk/yogurt	21	11
Cheese	7	2
Beef, pork, veal, lamb, goat, game meat	63	54
Organ meat	11	6
Chicken, duck, turkey, pigeon, guinea hen, game birds	20	18
Large whole fish/dried fish/shellfish and other seafood	80	62
Small fish eaten whole with bones	12	7
Insects, grubs, snakes, rodents and other small animal	0	0
Eggs	26	16
Vitamin A-rich dark green leafy vegetables [a]	30	23
Vitamin A-rich deep yellow/orange/red vegetables [a]	20	6
Vitamin C-rich vegetables [b]	37	21
All other vegetables	48	28
Vitamin A-rich fruits [a]	3	3
Vitamin C-rich fruits [b]	8	7
All other fruits	7	2

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.
[b] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table N4a. Summary of Food Group Intake (FGI-6) for NPNL Women, for All R1 Observation Days and for Days When the Food Was Consumed

	All (n = 1,798)					Among those who consume			
Food group	Mean amount (g)	Mean energy (kcal)	Median amount (g)	Median energy (kcal)	Percent consuming	Mean amount (g)	Mean energy (kcal)	Median amount (g)	Median energy (kcal)
All starchy staples	519.9	748.3	480.0	679.0	100	519.9	748.3	480.0	679.0
All legumes and nuts	15.8	19.8	0.0	0.0	41	38.7	48.2	22.6	21.1
All dairy	6.4	16.2	0.0	0.0	26	24.6	62.0	11.8	38.1
Other animal source foods	123.3	397.1	100.0	244.0	100	123.9	398.9	100.0	245.0
Vitamin A-rich fruits and vegetables [a]	16.6	9.1	0.0	0.0	47	35.4	19.5	22.5	11.0
Other fruits and vegetables	32.1	16.2	10.0	4.8	64	50.4	25.4	29.7	11.6

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table N4b. Summary of Food Group Intake (FGI-9) for NPNL Women, for All R1 Observation Days and for Days When the Food Was Consumed

	All (n = 1,798)					Among those who consume			
Food group	Mean amount (g)	Mean energy (kcal)	Median amount (g)	Median energy (kcal)	Percent consuming	Mean amount (g)	Mean energy (kcal)	Median amount (g)	Median energy (kcal)
All starchy staples	519.9	748.3	480.0	679.0	100	519.9	748.3	480.0	679.0
All legumes and nuts	15.8	19.8	0.0	0.0	41	38.7	48.2	22.6	21.1
All dairy	6.4	16.2	0.0	0.0	26	24.6	62.0	11.8	38.1
Organ meat	3.7	7.1	0.0	0.0	11	35.2	66.9	20.0	21.8
Eggs	8.0	12.3	0.0	0.0	26	30.5	47.1	20.0	31.5
Flesh foods and other miscellaneous small animal protein	111.6	377.8	86.7	222.9	99	112.4	380.5	87.6	224.9
Vitamin A-rich dark green leafy vegetables [a]	9.8	5.2	0.0	0.0	30	32.4	17.1	22.5	12.6
Other vitamin A-rich vegetables and fruits [a]	6.8	4.0	0.0	0.0	22	30.3	17.8	10.0	5.1
Other fruits and vegetables	32.1	16.2	10.0	4.8	64	50.4	25.4	29.7	11.6

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table N4c. Summary of Food Group Intake (FGI-13) for NPNL Women, for All R1 Observation Days and for Days When the Food Was Consumed

	All (n = 1,798)					Among those who consume			
Food group	**Mean amount (g)**	**Mean energy (kcal)**	**Median amount (g)**	**Median energy (kcal)**	**Percent consuming**	**Mean amount (g)**	**Mean energy (kcal)**	**Median amount (g)**	**Median energy (kcal)**
All starchy staples	519.9	748.3	480.0	679.0	100	519.9	748.3	480.0	679.0
All legumes and nuts	15.8	19.8	0.0	0.0	41	38.7	48.2	22.6	21.1
All dairy	6.4	16.2	0.0	0.0	26	24.6	62.0	11.8	38.1
Organ meat	3.7	7.1	0.0	0.0	11	35.2	66.9	20.0	21.8
Eggs	8.0	12.3	0.0	0.0	26	30.5	47.1	20.0	31.5
Small fish eaten whole with bones	3.1	4.2	0.0	0.0	12	26.4	36.0	15.0	22.1
All other flesh foods and miscellaneous small animal protein	108.6	373.6	83.3	218.0	98	110.4	379.9	85.0	224.8
Vitamin A-rich dark green leafy vegetables [a]	9.8	5.2	0.0	0.0	30	32.4	17.1	22.5	12.6
Vitamin A-rich deep yellow/orange/red vegetables [a]	2.5	1.2	0.0	0.0	20	12.6	6.1	8.7	4.3
Vitamin C-rich vegetables [b]	8.1	2.4	0.0	0.0	37	21.6	6.5	20.0	4.8
Vitamin A-rich fruits [a]	4.3	2.8	0.0	0.0	3	140.6	90.6	115.0	70.4
Vitamin C-rich fruits [b]	10.9	7.0	0.0	0.0	8	135.0	87.0	80.0	75.6
All other fruits and vegetables	13.1	6.7	0.9	0.8	50	26.2	13.4	20.0	9.3

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.
[b] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table N4d. Summary of Food Group Intake (FGI-21) for NPNL Women, for All R1 Observation Days and for Days When the Food Was Consumed

Food group	All (n = 1,798)					Among those who consume			
	Mean amount (g)	Mean energy (kcal)	Median amount (g)	Median energy (kcal)	Percent consuming	Mean amount (g)	Mean energy (kcal)	Median amount (g)	Median energy (kcal)
Grains and grain products	503.5	723.7	459.5	652.1	100	503.5	723.7	459.5	652.1
All other starchy staples	16.3	24.6	0.0	0.0	31	53.3	80.4	39.6	41.4
Cooked dry beans and peas	13.7	16.5	0.0	0.0	31	43.7	52.7	36.3	26.2
Soybeans and soy products	1.2	1.1	0.0	0.0	18	7.1	6.5	4.9	4.2
Nuts and seeds	0.9	2.2	0.0	0.0	2	46.7	88.1	20.0	66.0
Milk/yogurt	5.7	14.1	0.0	0.0	21	27.8	68.2	15.0	50.3
Cheese	0.7	2.1	0.0	0.0	7	9.5	28.9	5.9	17.8
Beef, pork, veal, lamb, goat, game meat	51.6	262.7	20.0	90.7	63	82.2	418.0	60.0	252.7
Organ meat	3.7	7.1	0.0	0.0	11	35.2	66.9	20.0	21.8
Chicken, duck, turkey, pigeon, guinea hen, game birds	19.7	51.7	0.0	0.0	20	98.6	258.7	80.0	223.2
Large whole fish/dried fish/shellfish and other seafood	37.2	59.2	22.5	37.0	80	46.5	73.9	40.0	53.8
Small fish eaten whole with bones	3.1	4.2	0.0	0.0	12	26.4	36.0	15.0	22.1
Insects, grubs, snakes, rodents and other small animal	0.0	0.0	0.0	0.0	0				
Eggs	8.0	12.3	0.0	0.0	26	30.5	47.1	20.0	31.5
Vitamin A-rich dark green leafy vegetables [a]	9.8	5.2	0.0	0.0	30	32.4	17.1	22.5	12.6
Vitamin A-rich deep yellow/orange/red vegetables [a]	2.5	1.2	0.0	0.0	20	12.6	6.1	8.7	4.3
Vitamin C-rich vegetables [b]	8.1	2.4	0.0	0.0	37	21.6	6.5	20.0	4.8
All other vegetables	11.0	4.5	0.7	0.5	48	23.1	9.4	20.0	7.5
Vitamin A-rich fruits [a]	4.3	2.8	0.0	0.0	3	140.6	90.6	115.0	70.4
Vitamin C-rich fruits [b]	10.9	7.0	0.0	0.0	8	135.0	87.0	80.0	75.6
All other fruits	2.1	2.2	0.0	0.0	7	29.7	30.7	5.7	13.2

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.
[b] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table N5. Diversity Scores for Various Diversity Indicators, NPNL Women, R1

Indicator	Number of food groups and level	Mean	SD	Median	Range
FGI-6	6 major food groups	3.8	1.2	4.0	2-6
FGI-6R [a]	6 major food groups	3.1	1.0	3.0	1-6
FGI-9	9 food subgroups	4.2	1.5	4.0	2-9
FGI-9R [a]	9 food subgroups	3.3	1.1	3.0	1-7
FGI-13	13 food subgroups	4.6	1.8	4.0	2-11
FGI-13R [a]	13 food subgroups	3.5	1.3	3.0	1-9
FGI-21	21 food subgroups	5.7	2.4	5.0	2-15
FGI-21R [a]	21 food subgroups	4.1	1.6	4.0	1-11

[a] "R" indicates that at least 15 g must be consumed in order for the food group/subgroup to ―count" in the score.

Table N6. Percent of Observation Days at Each Food Group Diversity Score, NPNL Women, R1

Number of food groups eaten	Diversity indicators							
	FGI-6	FGI-6R	FGI-9	FGI-9R	FGI-13	FGI-13R	FGI-21	FGI-21R
1	0	1	0	1	0	1	0	2
2	17	32	14	26	13	26	6	12
3	25	33	21	32	18	30	12	24
4	30	25	27	25	21	22	17	26
5	20	8	20	12	19	14	18	17
6	8	1	11	3	14	6	15	10
7			6	0	9	2	12	6
8			2	0	4	0	8	2
9			0	0	2	0	5	1
10					0	0	3	0
11					0	0	2	0
12					0	0	1	0
13					0	0	1	0
14							0	0
15							0	0
16							0	0
17							0	0
18							0	0
19							0	0
20							0	0
21							0	0

Table N7a. Percent of Observation Days on Which Different Food Groups Were Consumed, By Food Group Diversity Score, NPNL Women, R1 (FGI-6 - 1 g Minimum)

	Number of food groups eaten					
	1	**2**	**3**	**4**	**5**	**6**
Percent (number) of observation days at each diversity score	0 (0)	17 (304)	25 (451)	30 (541)	20 (355)	8 (147)
Food groups	**Percent of observation days on which each food group was consumed**					
All starchy staples	–	100	100	100	100	100
All legumes and nuts	–	0	26	41	72	100
All dairy	–	0	15	18	45	100
Other animal source foods	–	100	99	100	100	100
Vitamin A-rich fruits and vegetables [a]	–	0	20	56	86	100
Other fruits and vegetables	–	0	41	86	98	100

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table N7b. Percent of Observation Days on Which Different Food Groups Were Consumed, By Food Group Diversity Score, NPNL Women, R1 (FGI-6R - 15 g Minimum)

	Number of food groups eaten					
	1	**2**	**3**	**4**	**5**	**6**
Percent (number) of observation days at each diversity score	1 (22)	32 (573)	33 (589)	25 (451)	8 (150)	1 (13)
Food groups	**Percent of observation days on which each food group was consumed**					
All starchy staples	100	100	100	100	100	100
All legumes and nuts	0	1	30	36	77	100
All dairy	0	1	10	19	44	100
Other animal source foods	0	94	93	98	99	100
Vitamin A-rich fruits and vegetables [a]	0	1	22	61	81	100
Other fruits and vegetables	0	3	46	86	98	100

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table N7c. Percent of Observation Days on Which Different Food Groups Were Consumed, By Food Group Diversity Score, NPNL Women, R1 (FGI-9 - 1 g Minimum)

	Number of food groups eaten								
	1	2	3	4	5	6	7	8	9
Percent (number) of observation days at each diversity score	0 (0)	14 (246)	21 (377)	27 (484)	20 (355)	11 (192)	6 (103)	2 (37)	0 (4)
Food groups	**Percent of observation days on which each food group was consumed**								
All starchy staples	–	100	100	100	100	100	100	100	100
All legumes and nuts	–	0	24	34	61	69	90	100	100
All dairy	–	0	14	15	32	53	87	100	100
Organ meat	–	0	3	6	8	18	55	70	100
Eggs	–	0	12	21	37	57	48	78	100
Flesh foods and other miscellaneous small animal protein	–	99	98	99	100	100	100	100	100
Vitamin A-rich dark green leafy vegetables [a]	–	0	13	38	42	52	35	60	100
Other vitamin A-rich vegetables and fruits [a]	–	0	8	10	27	54	85	92	100
Other fruits and vegetables	–	0	29	77	93	97	100	100	100

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table N7d. Percent of Observation Days on Which Different Food Groups Were Consumed, By Food Group Diversity Score, NPNL Women, R1 (FGI-9R - 15 g Minimum)

	Number of food groups eaten								
	1	2	3	4	5	6	7	8	9
Percent (number) of observation days at each diversity score	1 (22)	26 (469)	32 (578)	25 (452)	12 (210)	3 (59)	0 (8)	0 (0)	0 (0)
Food groups	**Percent of observation days on which each food group was consumed**								
All starchy staples	100	100	100	100	100	100	100	–	–
All legumes and nuts	0	2	24	34	56	83	100	–	–
All dairy	0	1	9	15	35	39	88	–	–
Organ meat	0	0	5	7	15	22	25	–	–
Eggs	0	0	15	18	38	54	75	–	–
Flesh foods and other miscellaneous small animal protein	0	92	92	97	97	100	100	–	–
Vitamin A-rich dark green leafy vegetables [a]	0	1	14	41	47	61	50	–	–
Other vitamin A-rich vegetables and fruits [a]	0	0	5	12	24	42	63	–	–
Other fruits and vegetables	0	4	38	76	88	98	100	–	–

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table N7e. Percent of Observation Days on Which Different Food Groups Were Consumed, By Food Group Diversity Score, NPNL Women, R1 (FGI-13 - 1 g Minimum)

	Number of food groups eaten												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Percent (number) of observation days at each diversity score	0 (0)	13 (228)	18 (325)	21 (373)	19 (332)	14 (247)	9 (165)	4 (77)	2 (42)	0 (8)	0 (1)	0 (0)	0 (0)
Food groups	**Percent of observation days on which each food group was consumed**												
All starchy staples	–	100	100	100	100	100	100	100	100	100	100	–	–
All legumes and nuts	–	0	24	35	46	63	66	82	98	100	100	–	–
All dairy	–	0	15	15	25	31	59	74	95	88	100	–	–
Organ meat	–	0	4	5	7	12	30	38	45	88	0	–	–
Eggs	–	0	11	20	28	41	49	56	76	75	100	–	–
Small fish eaten whole with bones	–	1	8	13	13	14	16	22	14	50	0	–	–
All other flesh foods and miscellaneous small animal protein	–	98	97	98	99	99	100	100	100	100	100	–	–
Vitamin A-rich dark green leafy vegetables [a]	–	0	13	30	42	44	42	52	60	88	100	–	–
Vitamin A-rich deep yellow/orange/red vegetables [a]	–	0	4	8	13	29	58	73	81	75	100	–	–
Vitamin C-rich vegetables [b]	–	0	7	24	50	70	71	78	93	88	100	–	–
Vitamin A-rich fruits [a]	–	0	4	2	3	5	4	5	5	13	100	–	–
Vitamin C-rich fruits [b]	–	0	6	7	5	11	14	21	33	38	100	–	–
All other fruits and vegetables	–	0	8	43	69	82	92	100	100	100	100	–	–

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.
[b] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table N7f. Percent of Observation Days on Which Different Food Groups Were Consumed, By Food Group Diversity Score, NPNL Women, R1 (FGI-13R - 15 g Minimum)

	Number of food groups eaten												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Percent (number) of observation days at each diversity score	1 (26)	26 (459)	30 (530)	22 (395)	14 (244)	6 (102)	2 (35)	0 (6)	0 (1)	0 (0)	0 (0)	0 (0)	0 (0)
Food groups	**Percent of observation days on which each food group was consumed**												
All starchy staples	100	100	100	100	100	100	100	100	100	–	–	–	–
All legumes and nuts	0	2	25	35	43	57	69	100	100	–	–	–	–
All dairy	0	1	9	17	23	36	34	67	100	–	–	–	–
Organ meat	0	0	5	8	12	15	9	33	0	–	–	–	–
Eggs	0	1	15	20	27	37	46	67	100	–	–	–	–
Small fish eaten whole with bones	0	2	6	11	11	8	26	33	0	–	–	–	–
All other flesh foods and miscellaneous small animal protein	0	90	89	94	96	96	97	100	100	–	–	–	–
Vitamin A-rich dark green leafy vegetables [a]	0	2	15	31	49	58	74	33	0	–	–	–	–
Vitamin A-rich deep yellow/orange/red vegetables [a]	0	0	1	8	12	28	34	50	100	–	–	–	–
Vitamin C-rich vegetables [b]	0	1	10	26	45	63	86	67	100	–	–	–	–
Vitamin A-rich fruits [a]	0	0	3	4	6	3	6	50	100	–	–	–	–
Vitamin C-rich fruits [b]	0	0	6	8	16	15	29	33	0	–	–	–	–
All other fruits and vegetables	0	1	17	41	62	84	91	67	100	–	–	–	–

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.
[b] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table N7g. Percent of Observation Days on Which Different Food Groups Were Consumed, By Food Group Diversity Score, NPNL Women, R1 (FGI-21 - 1 g Minimum)

	Number of food groups eaten																				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
Percent (number) of observation days at each diversity score	0 (0)	6 (107)	12 (213)	17 (297)	18 (320)	15 (274)	12 (207)	8 (143)	5 (93)	3 (59)	2 (42)	1 (23)	1 (12)	0 (6)	0 (2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Food groups	**Percent of observation days on which each food group was consumed**																				
Grains and grain products	–	100	100	100	100	100	100	100	100	100	100	100	100	100	100	–	–	–	–	–	–
All other starchy staples	–	0	8	16	24	36	41	44	54	70	79	83	100	100	100	–	–	–	–	–	–
Cooked dry beans and peas	–	0	10	17	25	33	44	42	56	71	81	96	100	100	100	–	–	–	–	–	–
Soybeans and soy products	–	0	1	6	10	16	22	29	36	49	71	91	92	100	100	–	–	–	–	–	–
Nuts and seeds	–	0	1	0	2	4	1	4	8	3	14	4	0	0	50	–	–	–	–	–	–
Milk/yogurt	–	0	7	13	17	20	23	21	40	51	67	91	75	100	100	–	–	–	–	–	–
Cheese	–	0	1	1	3	3	7	19	31	31	19	9	33	33	0	–	–	–	–	–	–
Beef, pork, veal, lamb, goat, game meat	–	11	39	52	59	66	76	86	96	97	98	100	100	100	100	–	–	–	–	–	–
Organ meat	–	0	3	2	8	7	11	9	24	34	55	65	83	100	50	–	–	–	–	–	–
Chicken, duck, turkey, pigeon, guinea hen, game birds	–	3	14	18	20	20	23	25	29	29	31	30	50	33	50	–	–	–	–	–	–
Large whole fish/dried fish/shellfish and other seafood	–	82	77	76	82	83	81	82	77	81	79	83	92	100	100	–	–	–	–	–	–
Small fish eaten whole with bones	–	2	9	10	13	13	16	13	13	14	14	17	17	0	50	–	–	–	–	–	–
Insects, grubs, snakes, rodents and other small animal	–	0	0	0	0	0	0	0	0	0	0	0	0	0	0	–	–	–	–	–	–
Eggs	–	1	9	13	21	28	34	50	50	58	52	48	50	67	50	–	–	–	–	–	–
Vitamin A-rich dark green leafy vegetables [a]	–	1	11	23	30	35	40	48	47	44	43	39	42	50	100	–	–	–	–	–	–
Vitamin A-rich deep yellow/orange/red vegetables [a]	–	0	1	4	9	14	26	43	47	70	79	83	92	100	100	–	–	–	–	–	–
Vitamin C-rich vegetables [b]	–	0	2	15	30	50	59	75	71	70	57	61	83	100	100	–	–	–	–	–	–
All other vegetables	–	0	4	23	39	58	72	83	89	92	100	100	100	100	100	–	–	–	–	–	–
Vitamin A-rich fruits [a]	–	0	3	2	3	3	3	7	2	2	10	9	0	0	50	–	–	–	–	–	–
Vitamin C-rich fruits [b]	–	0	3	6	4	7	12	14	16	19	17	26	25	17	50	–	–	–	–	–	–
All other fruits	–	0	0	1	3	5	10	6	15	19	36	65	67	100	50	–	–	–	–	–	–

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.
[b] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table N7h. Percent of Observation Days on Which Different Food Groups Were Consumed, By Food Group Diversity Score, NPNL Women, R1 (FGI-21R - 15 g Minimum)

	Number of food groups eaten																				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
Percent (number) of observation days at each diversity score	2 (29)	12 (222)	24 (439)	26 (461)	17 (312)	10 (171)	6 (105)	2 (39)	1 (15)	0 (4)	0 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Food groups	**Percent of observation days on which each food group was consumed**																				
Grains and grain products	100	100	100	100	100	100	100	100	100	100	100	–	–	–	–	–	–	–	–	–	–
All other starchy staples	0	1	10	21	28	47	48	62	67	50	100	–	–	–	–	–	–	–	–	–	–
Cooked dry beans and peas	0	6	15	22	29	40	49	59	73	100	0	–	–	–	–	–	–	–	–	–	–
Soybeans and soy products	0	0	1	1	1	2	1	10	0	0	100	–	–	–	–	–	–	–	–	–	–
Nuts and seeds	0	0	1	1	1	5	4	8	13	25	0	–	–	–	–	–	–	–	–	–	–
Milk/yogurt	0	1	5	10	16	19	23	39	40	75	0	–	–	–	–	–	–	–	–	–	–
Cheese	0	1	0	0	3	2	8	18	7	0	100	–	–	–	–	–	–	–	–	–	–
Beef, pork, veal, lamb, goat, game meat	0	21	47	61	63	68	76	77	100	100	100	–	–	–	–	–	–	–	–	–	–
Organ meat	0	0	3	5	8	13	11	15	7	0	0	–	–	–	–	–	–	–	–	–	–
Chicken, duck, turkey, pigeon, guinea hen, game birds	0	4	16	18	24	22	30	36	47	25	0	–	–	–	–	–	–	–	–	–	–
Large whole fish/dried fish/shellfish and other seafood	0	54	57	62	72	67	75	82	80	100	100	–	–	–	–	–	–	–	–	–	–
Small fish eaten whole with bones	0	3	7	7	8	9	11	13	13	25	0	–	–	–	–	–	–	–	–	–	–
Insects, grubs, snakes, rodents and other small animal	0	0	0	0	0	0	0	0	0	0	0	–	–	–	–	–	–	–	–	–	–
Eggs	0	2	9	14	22	26	31	39	60	50	100	–	–	–	–	–	–	–	–	–	–
Vitamin A-rich dark green leafy vegetables [a]	0	2	11	19	33	46	55	54	40	50	0	–	–	–	–	–	–	–	–	–	–
Vitamin A-rich deep yellow/orange/red vegetables [a]	0	0	1	4	7	12	31	21	40	25	100	–	–	–	–	–	–	–	–	–	–
Vitamin C-rich vegetables [b]	0	3	4	18	29	47	51	51	73	100	100	–	–	–	–	–	–	–	–	–	–
All other vegetables	0	3	8	24	42	55	77	67	87	75	100	–	–	–	–	–	–	–	–	–	–
Vitamin A-rich fruits [a]	0	0	1	3	4	7	2	8	13	25	100	–	–	–	–	–	–	–	–	–	–
Vitamin C-rich fruits [b]	0	1	3	7	9	13	13	33	20	50	0	–	–	–	–	–	–	–	–	–	–
All other fruits	0	0	1	1	2	1	5	10	20	25	0	–	–	–	–	–	–	–	–	–	–

[a] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.
[b] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table N8. Mean and Median Nutrient Intake and PA, NPNL Women [a]

Nutrient	Mean	SD	Median	EAR [b]	SD [b]	PA (Mean)	PA (Median)	Lambda (Box-Cox transformation) [c]
Energy	1,341	629	1,211					
Protein (All Sources) (% of kcal)	16	6	14					
Protein from animal sources (% of kcal)	10	7	9					
Total carbohydrate (% of kcal)	65	16	67					
Total fat (% of kcal)	20	14	15					
Thiamin (mg/d)	0.63	0.54	0.48	0.9	0.09	0.12	0.00	0.021
Riboflavin (mg/d)	0.69	1.32	0.49	0.9	0.09	0.11	0.00	-0.133
Niacin (mg/d)	15.58	11.09	12.98	11.0	1.6	0.60	0.83	0.069
Vitamin B6 (mg/d)	1.23	0.75	1.07	1.1	0.11	0.45	0.31	0.076
Folate (µg/d)	345.88	220.76	312.41	320	32	0.47	0.41	0.438
Vitamin B12 (µg/d)	5.13	6.59	3.35	2.0	0.2	0.78	1.00	0.197
Vitamin C (mg/d)	36.08	86.74	12.40	38	3.8	0.13	0.00	0.224
Vitamin A (RE/d)	560.20	2,248.50	232.20	270	54	0.38	0.19	0.028
Calcium (mg/d)	331.75	253.93	264.48	1,000 [d]	– [d]	0.15	0.25	-0.080
Iron (mg/d)	9.80	6.69	8.18	See table [e]	See table [e]	0.12	0.04	-0.160
Zinc (mg/d)	5.93	3.54	5.02	6	0.75	0.48	0.39	0.131
MPA across 11 micronutrients	0.34	0.23	0.32					

[a] Mean and median nutrient intakes are for the first observation day; PA are based on estimated usual intake calculated from both rounds of dietary data for the full sample.
[b] See Table A6-1 for sources for each EAR and SD. Requirements for NPNL women are presented here.
[c] This documents the transformation parameters selected for each nutrient. The power transformations result in approximately normal distributions.
[d] There is no EAR and no SD for calcium; 1,000 mg is the Adequate Intake (AI) for NPNL women.
[d] Iron requirements are nonsymetric for NPNL women of reproductive age: see Table A6-2 for iron requirements for NPNL women.

Table N10. Correlations between Food Group Diversity Scores and Estimated Usual Intakes of Individual Nutrients, NPNL Women [a, b]

	FGI-6		FGI-6R		FGI-9		FGI-9R		FGI-13		FGI-13R		FGI-21		FGI-21R	
Nutrients	Not controlling for energy	Controlling for energy	Not controlling for energy	Controlling for energy	Not controlling for energy	Controlling for energy	Not controlling for energy	Controlling for energy	Not controlling for energy	Controlling for energy	Not controlling for energy	Controlling for energy	Not controlling for energy	Controlling for energy	Not controlling for energy	Controlling for energy
Total energy	0.170 ***		0.186 ***		0.208 ***		0.236 ***		0.206 ***		0.242 ***		0.286 ***		0.354 ***	
Thiamin	0.161 ***	0.044	0.218 ***	0.117 ***	0.183 ***	0.032	0.254 ***	0.113 ***	0.184 ***	0.035	0.248 ***	0.096 ***	0.254 ***	0.047 *	0.342 ***	0.109 ***
Riboflavin	0.212 ***	0.130 ***	0.257 ***	0.181 ***	0.272 ***	0.179 ***	0.340 ***	0.255 ***	0.261 ***	0.164 ***	0.325 ***	0.225 ***	0.318 ***	0.160 ***	0.415 ***	0.239 ***
Niacin	0.065 **	-0.081 ***	0.143 ***	0.014	0.088 ***	-0.089 ***	0.181 ***	0.018	0.085 ***	-0.090 ***	0.184 ***	0.016	0.176 ***	-0.042	0.322 ***	0.106 ***
Vitamin B6	0.179 ***	0.076 **	0.222 ***	0.124 ***	0.208 ***	0.075 **	0.264 ***	0.131 ***	0.210 ***	0.081 ***	0.267 ***	0.129 ***	0.302 ***	0.132 ***	0.410 ***	0.227 ***
Folate	0.148 ***	0.055 *	0.211 ***	0.123 ***	0.182 ***	0.069 **	0.256 ***	0.143 ***	0.180 ***	0.067 **	0.254 ***	0.136 ***	0.205 ***	0.036	0.276 ***	0.075 **
Vitamin B12	0.035	-0.031	0.100 ***	0.033	0.075 **	-0.003	0.156 ***	0.075 **	0.077 **	0.000	0.158 ***	0.075 **	0.110 ***	0.004	0.240 ***	0.124 ***
Vitamin C	0.329 ***	0.296 ***	0.393 ***	0.360 ***	0.299 ***	0.254 ***	0.374 ***	0.328 ***	0.315 ***	0.272 ***	0.371 ***	0.324 ***	0.319 ***	0.257 ***	0.396 ***	0.327 ***
Vitamin A	0.286 ***	0.236 ***	0.305 ***	0.249 ***	0.331 ***	0.268 ***	0.380 ***	0.312 ***	0.315 ***	0.250 ***	0.361 ***	0.286 ***	0.328 ***	0.222 ***	0.415 ***	0.294 ***
Calcium	0.244 ***	0.181 ***	0.314 ***	0.258 ***	0.258 ***	0.172 ***	0.340 ***	0.256 ***	0.274 ***	0.194 ***	0.346 ***	0.260 ***	0.305 ***	0.178 ***	0.407 ***	0.265 ***
Iron	0.227 ***	0.153 ***	0.243 ***	0.159 ***	0.289 ***	0.206 ***	0.321 ***	0.225 ***	0.276 ***	0.189 ***	0.312 ***	0.202 ***	0.336 ***	0.191 ***	0.387 ***	0.193 ***
Zinc	0.195 ***	0.098 ***	0.196 ***	0.073 **	0.251 ***	0.143 ***	0.268 ***	0.131 ***	0.240 ***	0.127 ***	0.261 ***	0.109 ***	0.325 ***	0.163 ***	0.378 ***	0.156 ***

[a] Usual intake of energy and individual nutrients are estimated by the BLUP following the method described in section 11 of the protocol (Arimond et al. 2008).
[b] A "*" indicates a coefficient that is statistically significant at $p < 0.05$; ** indicates $p < 0.01$, and *** indicates $p < 0.001$.

Table N11a. Correlation between Energy from 6 Major Food Groups and MPA, With and Without Controlling for Total Energy Intake, NPNL Women [a, b, c]

Major food groups	Correlation between MPA and energy from each food group:	Partial correlation coefficients for energy from each food group (controlling for total energy)
All starchy staples	0.443 ***	0.014
All legumes and nuts	0.133 ***	0.066 **
All dairy	0.214 ***	0.198 ***
Other animal source foods	0.510 ***	-0.064 **
Vitamin A-rich fruits and vegetables [d]	0.097 ***	0.089 ***
Other fruits and vegetables	0.204 ***	0.091 ***

[a] Numbers in bold indicate coefficients that changed direction when total energy was controlled for, with both coefficients being significant. A "*" indicates a coefficient that is statistically significant at $p < 0.05$; ** indicates $p < 0.01$, and *** indicates $p < 0.001$.
[b] Energy from food groups is from first observation day; MPA is based on estimated usual intake, calculated using repeat observations for the entire sample.
[c] MPA was normalized using the Box Cox transformation method.
[d] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table N11b. Correlation between Energy from 9 Sub-Food Groups and MPA, With and Without Controlling for Total Energy Intake, NPNL Women [a, b, c]

Major food groups	Correlation between MPA and energy from each food group:	Partial correlation coefficients for energy from each food group (controlling for total energy)
All starchy staples	0.443 ***	0.014
All legumes and nuts	0.133 ***	0.066 **
All dairy	0.214 ***	0.198 ***
Organ meat	0.187 ***	0.137 ***
Eggs	0.184 ***	0.101 ***
Flesh foods and other miscellaneous small animal protein	0.489 ***	-0.095 ***
Vitamin A-rich dark green leafy vegetables [d]	0.015	0.041
Other vitamin A-rich vegetables and fruits [d]	0.108 ***	0.080 ***
Other fruits and vegetables	0.204 ***	0.091 ***

[a] Numbers in bold indicate coefficients that changed direction when total energy was controlled for, with both coefficients being significant. A "*" indicates a coefficient that is statistically significant at $p < 0.05$; ** indicates $p < 0.01$, and *** indicates $p < 0.001$.
[b] Energy from food groups is from first observation day; MPA is based on estimated usual intake, calculated using repeat observations for the entire sample.
[c] MPA was normalized using the Box Cox transformation method.
[d] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

Table N11c. Correlation between Energy from 13 Sub-Food Groups and MPA, With and Without Controlling for Total Energy Intake, NPNL Women [a, b, c]

Major food groups	Correlation between MPA and energy from each food group:	Partial correlation coefficients for energy from each food group (controlling for total energy)
All starchy staples	0.443 ***	0.014
All legumes and nuts	0.133 ***	0.066 **
All dairy	0.214 ***	0.198 ***
Organ meat	0.187 ***	0.137 ***
Eggs	0.184 ***	0.101 ***
Small fish eaten whole with bones	0.049 *	0.067 **
All other flesh foods and miscellaneous small animal protein	0.486 ***	-0.098 ***
Vitamin A-rich dark green leafy vegetables [d]	0.015	0.041
Vitamin A-rich deep yellow/orange/red vegetables [d]	0.136 ***	0.069 **
Vitamin C-rich vegetables [e]	0.054 *	0.013
Vitamin A-rich fruits [d]	0.082 ***	0.067 **
Vitamin C-rich fruits [e]	0.164 ***	0.097 ***
All other fruits and vegetables	0.121 ***	0.018

[a] Numbers in bold indicate coefficients that changed direction when total energy was controlled for, with both coefficients being significant. A "*" indicates a coefficient that is statistically significant at $p < 0.05$; ** indicates $p < 0.01$, and *** indicates $p < 0.001$.
[b] Energy from food groups is from first observation day; MPA is based on estimated usual intake, calculated using repeat observations for the entire sample.
[c] MPA was normalized using the Box Cox transformation method.
[d] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.
[e] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table N11d. Correlation between Energy from 21 Sub-Food Groups and MPA, With and Without Controlling for Total Energy Intake, NPNL Women [a, b, c]

Major food groups	Correlation between MPA and energy from each food group:	Partial correlation coefficients for energy from each food group (controlling for total energy)
Grains and grain products	0.426 ***	0.007
All other starchy staples	0.112 ***	0.030
Cooked dry beans and peas	0.091 ***	0.049 *
Soybeans and soy products	0.102 ***	-0.007
Nuts and seeds	0.099 ***	0.052 *
Milk/yogurt	0.186 ***	0.185 ***
Cheese	0.138 ***	0.079 ***
Beef, pork, veal, lamb, goat, game meat	0.393 ***	-0.197 ***
Organ meat	0.187 ***	0.137 ***
Chicken, duck, turkey, pigeon, guinea hen, game birds	0.228 ***	0.072 **
Large whole fish/dried fish/shellfish and other seafood	0.258 ***	0.289 ***
Small fish eaten whole with bones	0.049 *	0.067 **
Insects, grubs, snakes, rodents and other small animal	–	–
Eggs	0.184 ***	0.101 ***
Vitamin A-rich dark green leafy vegetables [d]	0.015	0.041
Vitamin A-rich deep yellow/orange/red vegetables [d]	0.136 ***	0.069 **
Vitamin C-rich vegetables [e]	0.054 *	0.013
All other vegetables	0.140 ***	0.111 ***
Vitamin A-rich fruits [d]	0.082 ***	0.067 **
Vitamin C-rich fruits [e]	0.164 ***	0.097 ***
All other fruits	0.067 **	-0.036

[a] Numbers in bold indicate coefficients that changed direction when total energy was controlled for, with both coefficients being significant. A "*" indicates a coefficient that is statistically significant at $p < 0.05$; ** indicates $p < 0.01$, and *** indicates $p < 0.001$.

[b] Energy from food groups is from first observation day; MPA is based on estimated usual intake, calculated using repeat observations for the entire sample.

[c] MPA was normalized using the Box Cox transformation method.

[d] Vitamin A-rich fruits and vegetables are defined as those with ≥ 120 RE/100 g as eaten.

[e] Vitamin C-rich fruits and vegetables are defined as those with ≥ 9 mg/100 g as eaten.

Table N12. Total Energy Intake (kcal), by Food Group Diversity Scores, NPNL Women, R1 [a]

Number of food groups eaten	Diversity indicators: Median total energy intake (range)															
	FGI-6		FGI-6R		FGI-9		FGI-9R		FGI-13		FGI-13R		FGI-21		FGI-21R	
1	–	–	708	(404-1209)	–	–	708	(404-1209)	–	–	651	(404-1209)	–	–	618	(404-1209)
2	1082	(334-3800)	1126	(334-3800)	1053	(334-3800)	1106	(334-3800)	1050	(334-3800)	1098	(334-3800)	782	(334-2332)	878	(334-2570)
3	1160	(373-3985)	1208	(369-3985)	1133	(373-3481)	1177	(369-3948)	1138	(373-3481)	1177	(369-3948)	989	(373-2917)	1074	(369-3297)
4	1190	(376-4055)	1293	(376-4155)	1147	(376-3985)	1229	(376-3985)	1180	(425-3985)	1233	(386-4155)	1138	(376-3985)	1247	(386-3985)
5	1327	(369-4155)	1363	(429-2990)	1257	(369-4055)	1408	(429-4155)	1189	(369-3207)	1322	(376-4055)	1236	(369-3481)	1385	(376-3948)
6	1421	(491-3363)	1902	(1171-2998)	1371	(429-4155)	1589	(713-2969)	1208	(410-3667)	1446	(588-3667)	1226	(399-3249)	1348	(429-4155)
7					1511	(491-3363)	2136	(1171-2998)	1442	(429-4155)	1597	(713-2969)	1293	(410-3948)	1456	(607-3667)
8					1421	(734-3234)	–	–	1443	(610-3363)	2193	(1892-2238)	1316	(429-3297)	1648	(803-4055)
9					–	–	–	–	1642	(734-3330)	–	–	1596	(676-4155)	1892	(1047-2687)
10									2000	(804-2755)	–	–	1359	(491-4055)	–	–
11									–	–	–	–	1659	(789-3363)	–	–
12									–	–	–	–	1441	(916-2736)	–	–
13									–	–	–	–	1900	(1177-3234)	–	–
14													1799	(734-2182)	–	–
15													–	–	–	–
16													–	–	–	–
17													–	–	–	–
18													–	–	–	–
19													–	–	–	–
20													–	–	–	–
21													–	–	–	–

[a] Light shading indicates impossible values (beyond range of possible scores). A — indicates that a cell has fewer than 5 observations. Cells with fewer than 10 observations have dark shading.

Table N13. Relationship between Food Group Diversity Scores and Total Energy Intake, NPNL Women [a]

	Food group diversity score (mean)	Food group diversity score (median)	Total energy intake (mean)	Total energy intake (median)	Correlation Coefficient [b]	
FGI-6	3.8	4.0	1341	1211	0.170	***
FGI-6R [c]	3.1	3.0	1341	1211	0.186	***
FGI-9	4.2	4.0	1341	1211	0.208	***
FGI-9R [c]	3.3	3.0	1341	1211	0.236	***
FGI-13	4.6	4.0	1341	1211	0.206	***
FGI-13R [c]	3.5	3.0	1341	1211	0.242	***
FGI-21	5.7	5.0	1341	1211	0.286	***
FGI-21R [c]	4.1	4.0	1341	1211	0.354	***

[a] Food group diversity scores and mean and median energy intakes are from first observation day; BLUP for energy intake (calculated using repeat observations for the entire sample) is used for correlation analysis.
[b] A "*" indicates a coefficient that is statistically significant at $p < 0.05$; ** indicates $p < 0.01$, and *** indicates $p < 0.001$.
[c] Refers to minimum intake of 15 g for each of the food groups/sub-food groups.

Table N14. MPA by Food Group Diversity Scores, NPNL Women [a, b]

Number of food groups eaten	Diversity indicators															
	FGI-6		FGI-6R		FGI-9		FGI-9R		FGI-13		FGI-13R		FGI-21		FGI-21R	
	Median MPA (range)															
1	–	–	0.01	(0.00-0.21)	–	–	0.01	(0.00-0.21)	–	–	0.02	(0.00-0.26)	–	–	0.02	(0.00-0.31)
2	0.25	(0.00-0.85)	0.26	(0.00-0.85)	0.23	(0.00-0.83)	0.24	(0.00-0.83)	0.24	(0.00-0.83)	0.24	(0.00-0.83)	0.17	(0.00-0.83)	0.17	(0.00-0.83)
3	0.29	(0.00-0.91)	0.31	(0.00-0.92)	0.28	(0.00-0.86)	0.30	(0.00-0.92)	0.27	(0.00-0.86)	0.29	(0.00-0.92)	0.23	(0.00-0.77)	0.25	(0.00-0.83)
4	0.31	(0.00-0.92)	0.38	(0.00-0.94)	0.30	(0.00-0.92)	0.36	(0.00-0.91)	0.30	(0.00-0.92)	0.34	(0.00-0.91)	0.28	(0.00-0.86)	0.34	(0.00-0.89)
5	0.37	(0.00-0.94)	0.48	(0.03-0.92)	0.33	(0.00-0.92)	0.45	(0.01-0.92)	0.31	(0.00-0.89)	0.42	(0.00-0.91)	0.31	(0.00-0.91)	0.42	(0.00-0.92)
6	0.49	(0.00-0.91)	0.65	(0.19-0.91)	0.45	(0.00-0.92)	0.60	(0.17-0.94)	0.33	(0.00-0.92)	0.55	(0.06-0.94)	0.33	(0.00-0.90)	0.46	(0.02-0.91)
7					0.50	(0.03-0.94)	0.63	(0.47-0.91)	0.46	(0.00-0.94)	0.58	(0.17-0.90)	0.38	(0.00-0.92)	0.49	(0.06-0.94)
8					0.45	(0.05-0.83)	–	–	0.50	(0.04-0.90)	0.63	(0.45-0.91)	0.38	(0.00-0.86)	0.60	(0.17-0.91)
9					–	–	–	–	0.57	(0.05-0.90)	–	–	0.48	(0.01-0.94)	0.58	(0.24-0.75)
10									0.54	(0.14-0.91)	–	–	0.40	(0.03-0.91)	–	–
11									–	–	–	–	0.51	(0.04-0.91)	–	–
12									–	–	–	–	0.58	(0.19-0.90)	–	–
13									–	–	–	–	0.57	(0.19-0.83)	–	–
14													0.63	(0.05-0.73)	–	–
15													–	–	–	–
16													–	–	–	–
17													–	–	–	–
18													–	–	–	–
19													–	–	–	–
20													–	–	–	–
21													–	–	–	–

[a] Food group diversity scores are from first observation day; MPA is based on estimated usual intake, calculated using repeat observations for the entire sample.
[b] Light shading indicates impossible values (beyond range of possible scores). A — indicates that a cell has fewer than 5 observations. Cells with fewer than 10 observations have dark shading.

Table N15. Relationship between MPA and Food Group Diversity Scores, NPNL Women [a]

	Food group diversity score		MPA		Correlation coefficient [b]		Partial correlation controlling for total energy intake [b]	
	(mean)	(median)	(mean)	(median)				
FGI-6	3.8	4.0	0.34	0.32	0.205	***	0.117	***
FGI-6R [c]	3.1	3.0	0.34	0.32	0.269	***	0.206	***
FGI-9	4.2	4.0	0.34	0.32	0.255	***	0.151	***
FGI-9R [c]	3.3	3.0	0.34	0.32	0.335	***	0.253	***
FGI-13	4.6	4.0	0.34	0.32	0.255	***	0.153	***
FGI-13R [c]	3.5	3.0	0.34	0.32	0.334	***	0.242	***
FGI-21	5.7	5.0	0.34	0.32	0.322	***	0.160	***
FGI-21R [c]	4.1	4.0	0.34	0.32	0.445	***	0.288	***

[a] Food group diversity scores are from first observation day, MPA is based on the first observation day and repeat observations for the entire sample. MPA was transformed to approximate normality, and transformed MPA and BLUP for total energy intake were used for correlation analysis.
[b] A "*" indicates a coefficient that is statistically significant at $p < 0.05$; ** indicates $p < 0.01$, and *** indicates $p < 0.001$.
[c] Refers to minimum intake of 15g for each of the food groups/sub-food groups.

Table N16. Results of Ordinary Least Squares Regression Analysis of the Determinants of MPA, NPNL Women [a, b]

	FGI-6		FGI-6R		FGI-9		FGI-9R		FGI-13		FGI-13R		FGI-21		FGI-21R	
	Not controlling for energy															
	B	**Standard error**	**B**	**Standard error**	**B**	**Standard error**	**B**	**Standard error**	**B**	**Standard error**	**B**	**Standard error**	**B**	**Standard error**	**B**	**Standard error**
Constant	-1.524 ***	0.218	-1.568 ***	0.214	-1.524 ***	0.216	-1.589 ***	0.210	-1.487 ***	0.215	-1.547 ***	0.210	-1.472 ***	0.211	-1.597 ***	0.200
Woman's height	0.005 ***	0.001	0.005 ***	0.001	0.005 ***	0.001	0.005 ***	0.001	0.005 ***	0.001	0.005 ***	0.001	0.004 **	0.001	0.004 ***	0.001
Age	-0.007 ***	0.001	-0.007 ***	0.001	-0.007 ***	0.001	-0.007 ***	0.001	-0.007 ***	0.001	-0.007 ***	0.001	-0.006 ***	0.001	-0.006 ***	0.001
Dietary diversity score	0.053 ***	0.006	0.085 ***	0.007	0.051 ***	0.005	0.091 ***	0.006	0.042 ***	0.004	0.078 ***	0.005	0.040 ***	0.003	0.085 ***	0.004
Adjusted R^2	0.107 ***		0.138 ***		0.124 ***		0.170 ***		0.124 ***		0.170 ***		0.155 ***		0.243 ***	
	Controlling for energy															
	B	**Standard error**	**B**	**Standard error**	**B**	**Standard error**	**B**	**Standard error**	**B**	**Standard error**	**B**	**Standard error**	**B**	**Standard error**	**B**	**Standard error**
Constant	-1.465 ***	0.161	-1.518 ***	0.158	-1.468 ***	0.160	-1.526 ***	0.156	-1.451 ***	0.159	-1.500 ***	0.156	-1.436 ***	0.159	-1.512 ***	0.154
Woman's height	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Age	-0.003 ***	0.000	-0.003 ***	0.000	-0.003 ***	0.000	-0.003 ***	0.000	-0.003 ***	0.000	-0.003 ***	0.000	-0.003 ***	0.000	-0.003 ***	0.000
Dietary diversity score	0.025 ***	0.005	0.052 ***	0.005	0.025 ***	0.004	0.055 ***	0.005	0.021 ***	0.003	0.046 ***	0.004	0.018 ***	0.002	0.046 ***	0.003
Total energy intake [c]	0.348 ***	0.009	0.342 ***	0.009	0.344 ***	0.009	0.335 ***	0.009	0.344 ***	0.009	0.335 ***	0.009	0.338 ***	0.009	0.316 ***	0.009
Adjusted R^2	0.516 ***		0.533 ***		0.520 ***		0.542 ***		0.521 ***		0.541 ***		0.524 ***		0.552 ***	

[a] A"*" indicates a coefficient that is statistically significant at $p < 0.05$; ** indicates $p < 0.01$, and *** indicates $p < 0.001$. For the adjusted R^2, the stars indicate the significance level of the F statistic of the regression.
[b] MPA was transformed to approximate a normal distribution and the transformed variable was used in the regressions.
[c] Energy was divided by 1,000 before running the regressions to take into account the large scale of the energy variable and the small scale of MPA.

FIGURES

Histograms of intakes for 11 micronutrients (R1 data): Figures N1-N11

Histograms for intra-individual SDs of intake, based on data from two rounds: Figures N12-N22

Histograms for FGIs (R1 data): Figures N23-N30

Histograms of PA for 11 micronutrients, based on data from two rounds: Figures N31-N41

Histogram of MPA, based on data from two rounds: Figure N42

Figure N1. Distribution of Thiamin Intakes, NPNL Women

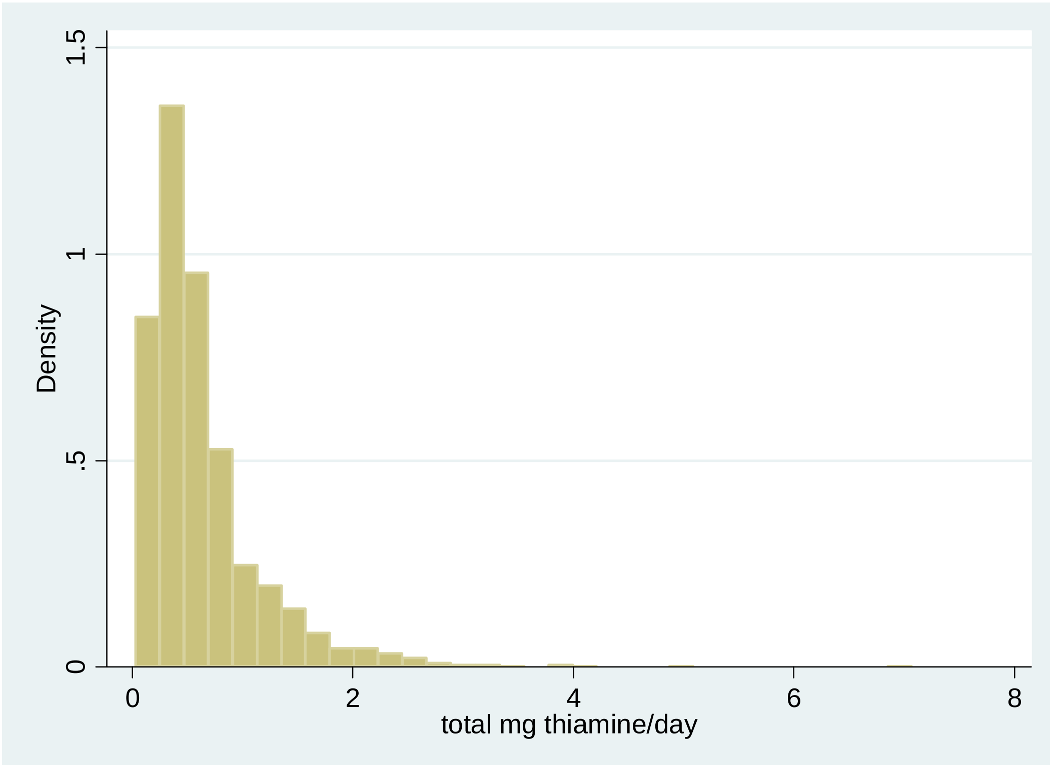


Figure N2. Distribution of Riboflavin Intakes, NPNL Women

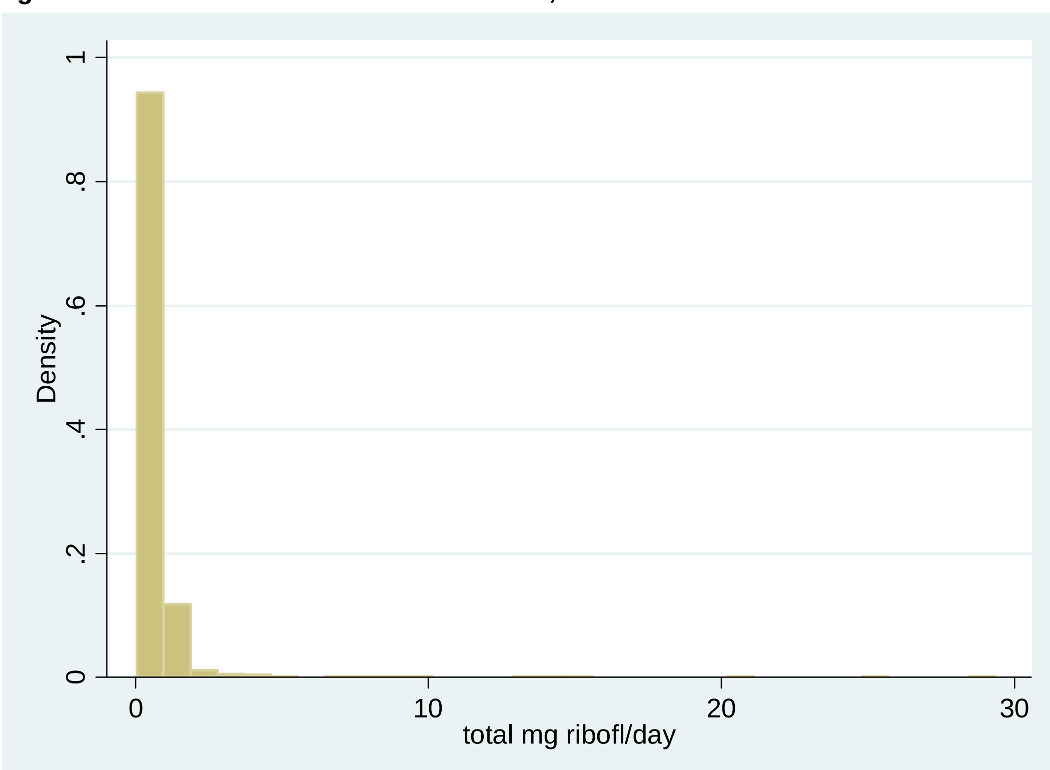


Figure N3. Distribution of Niacin Intakes, NPNL Women

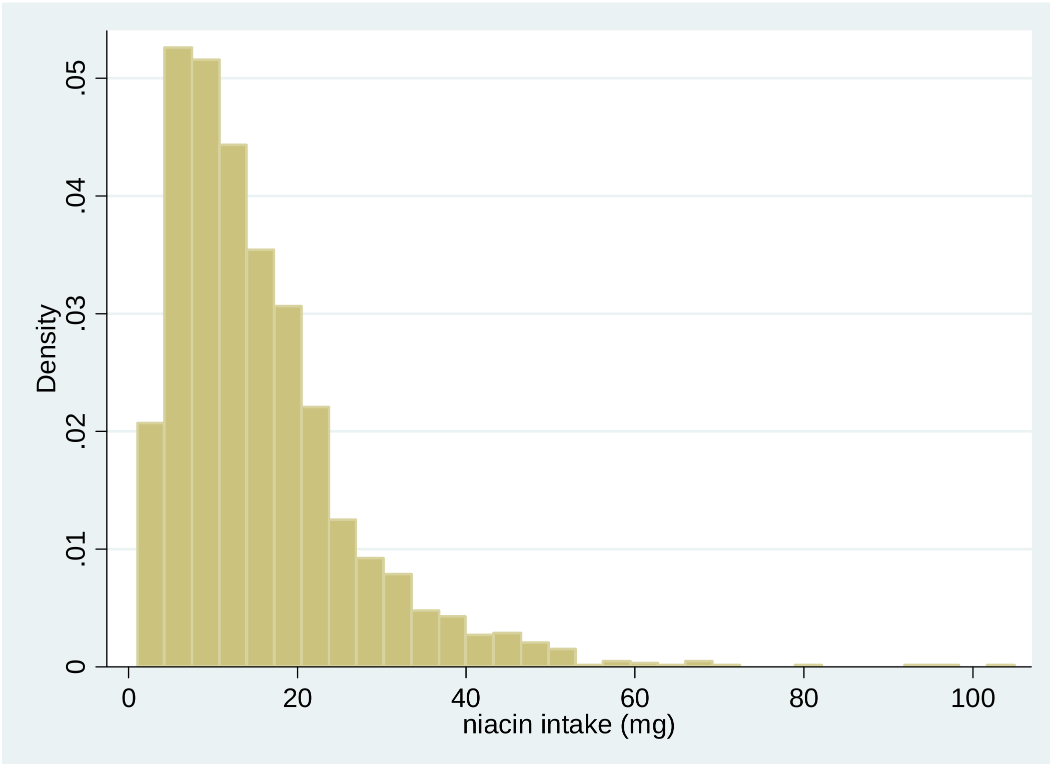


Figure N4. Distribution of Vitamin B6 Intakes, NPNL Women

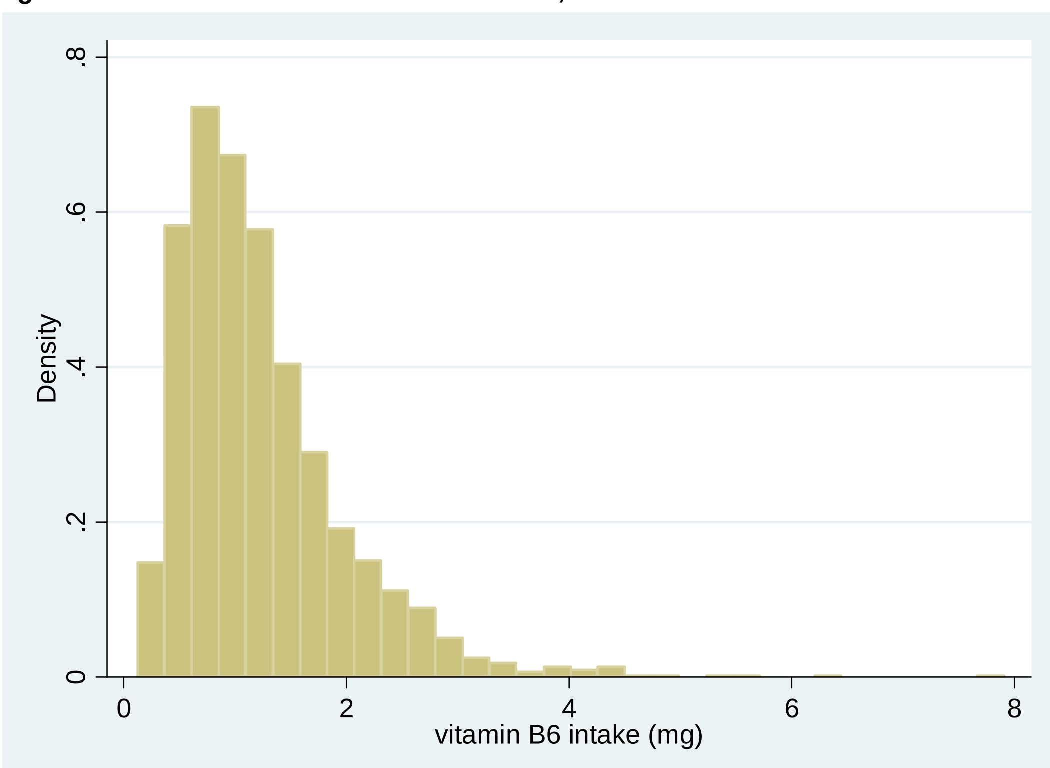


Figure N5. Distribution of Folate Intakes, NPNL Women

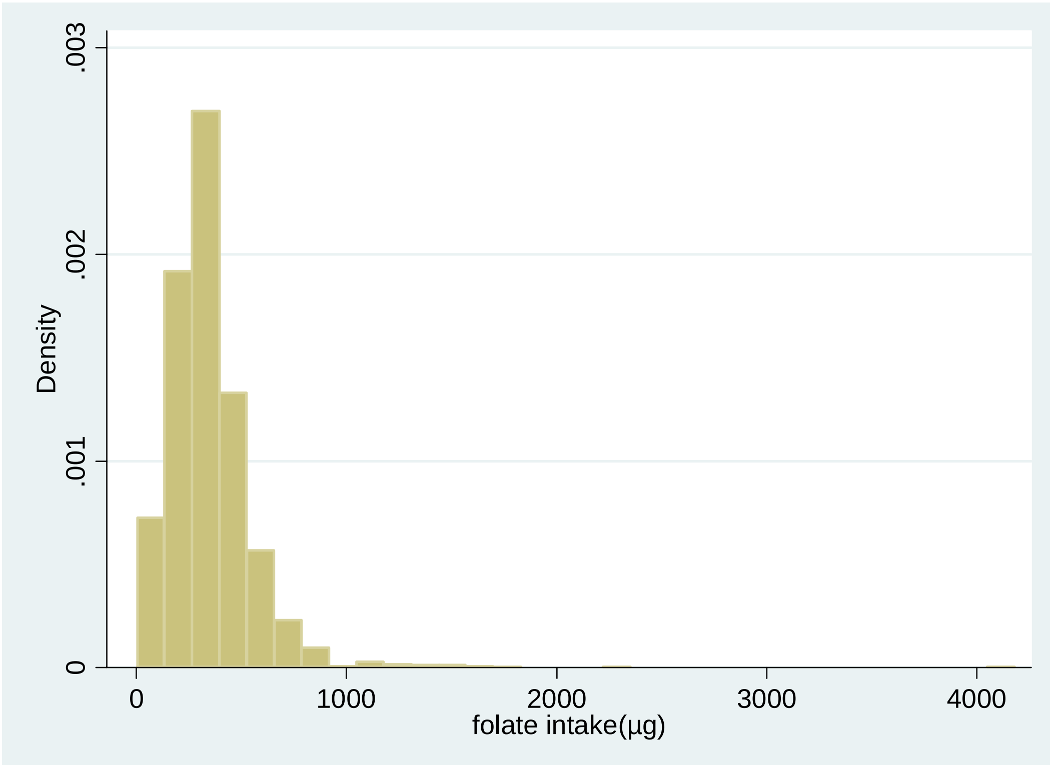


Figure N6. Distribution of Vitamin B12 Intakes, NPNL Women

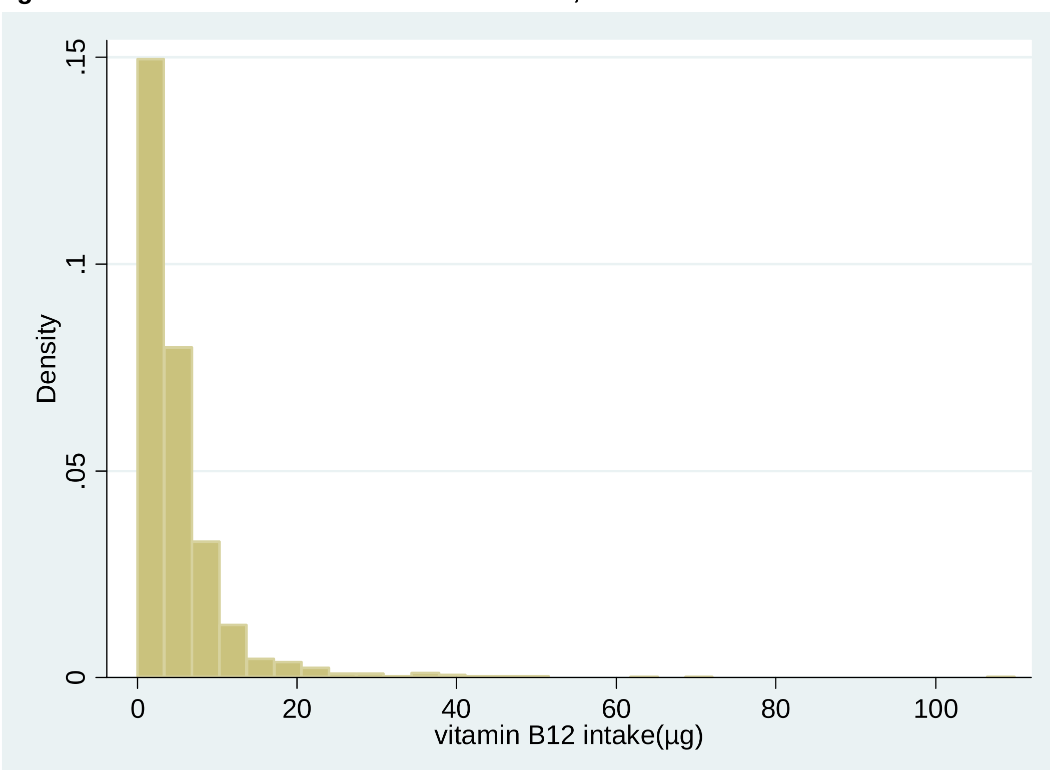


Figure N7. Distribution of Vitamin C Intakes, NPNL Women

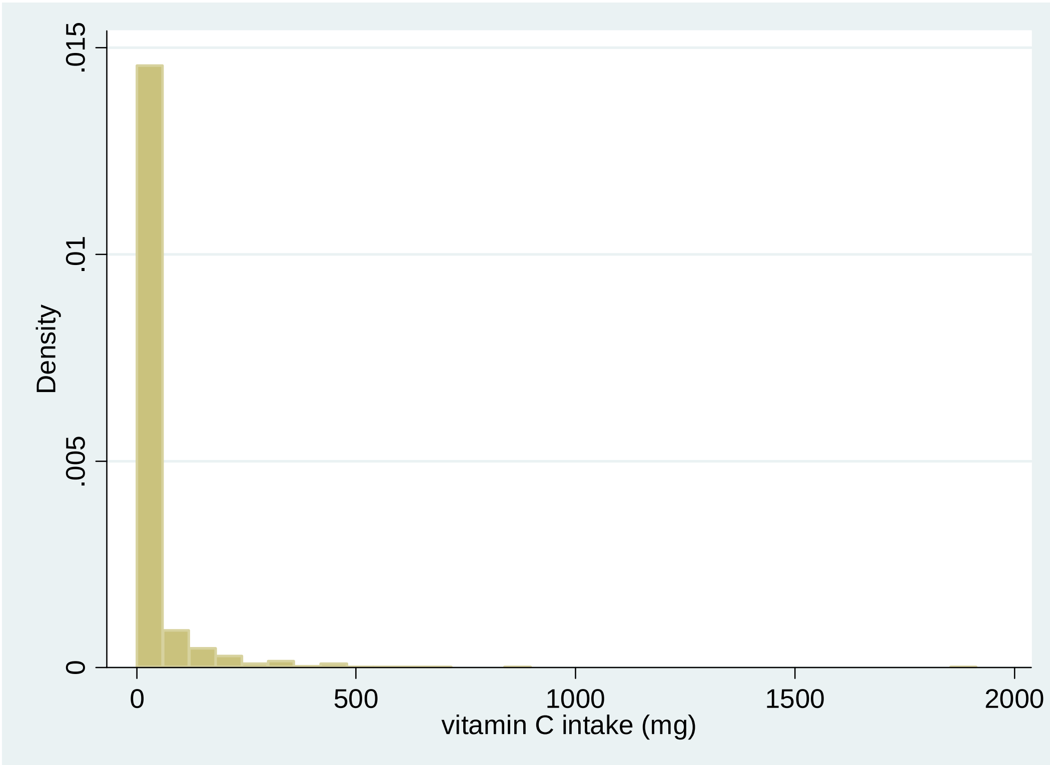


Figure N8. Distribution of Vitamin A Intakes, NPNL Women

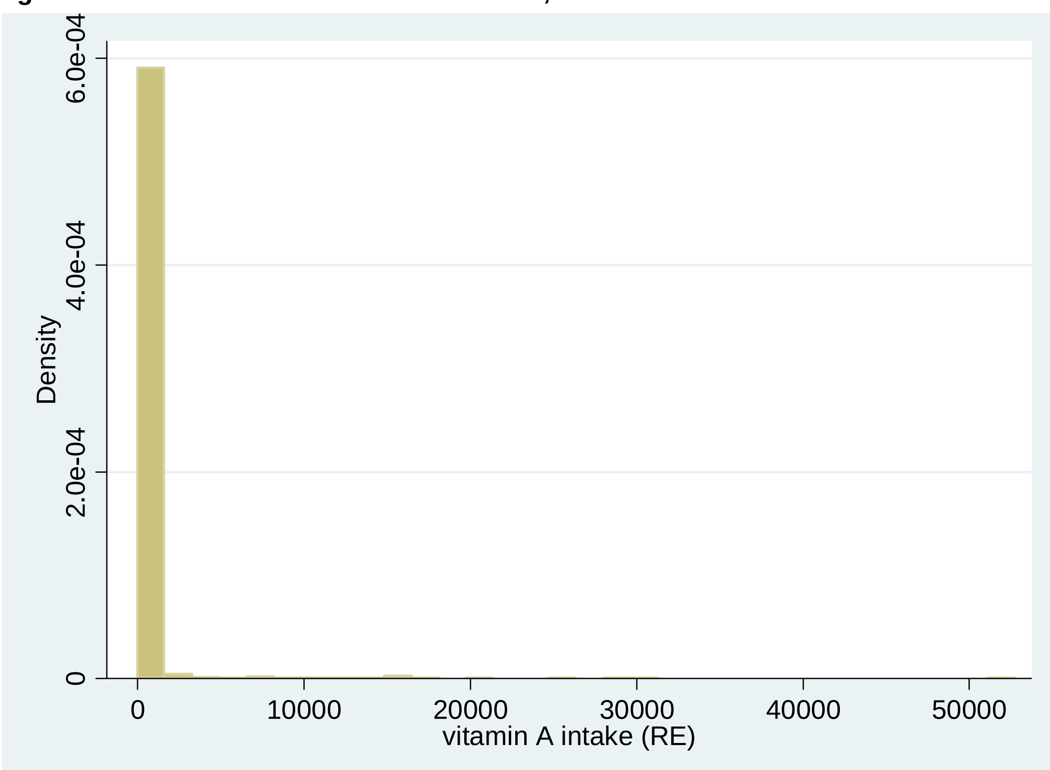


Figure N9. Distribution of Calcium Intakes, NPNL Women

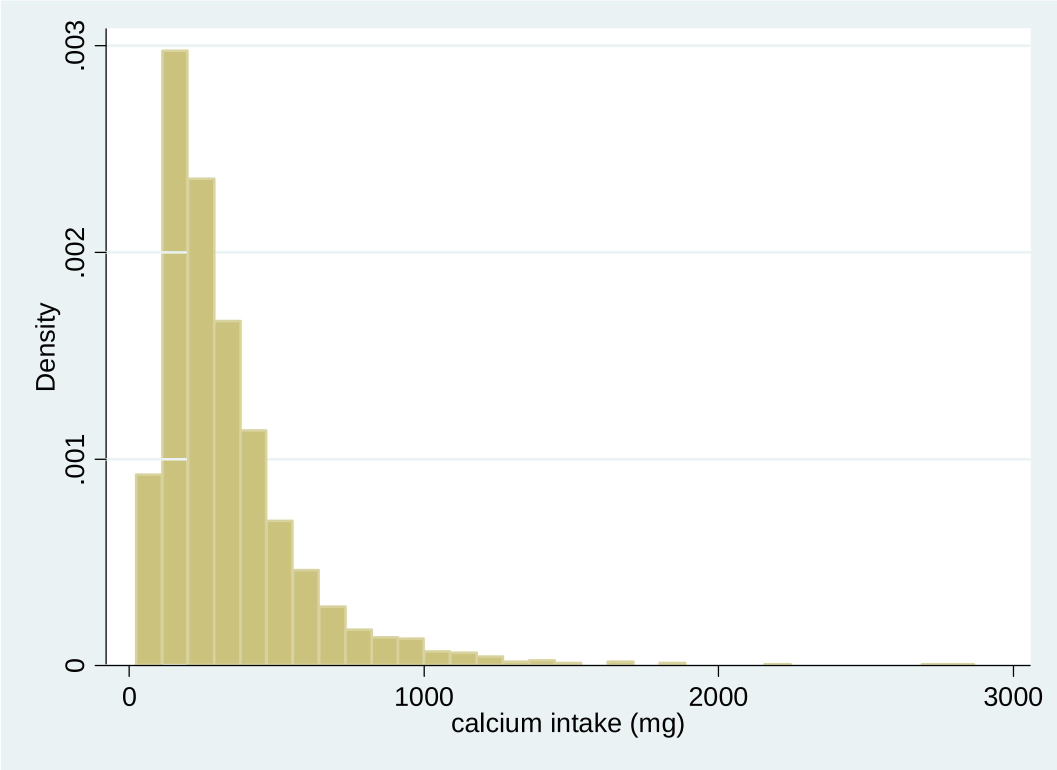


Figure N10. Distribution of Iron Intakes, NPNL Women

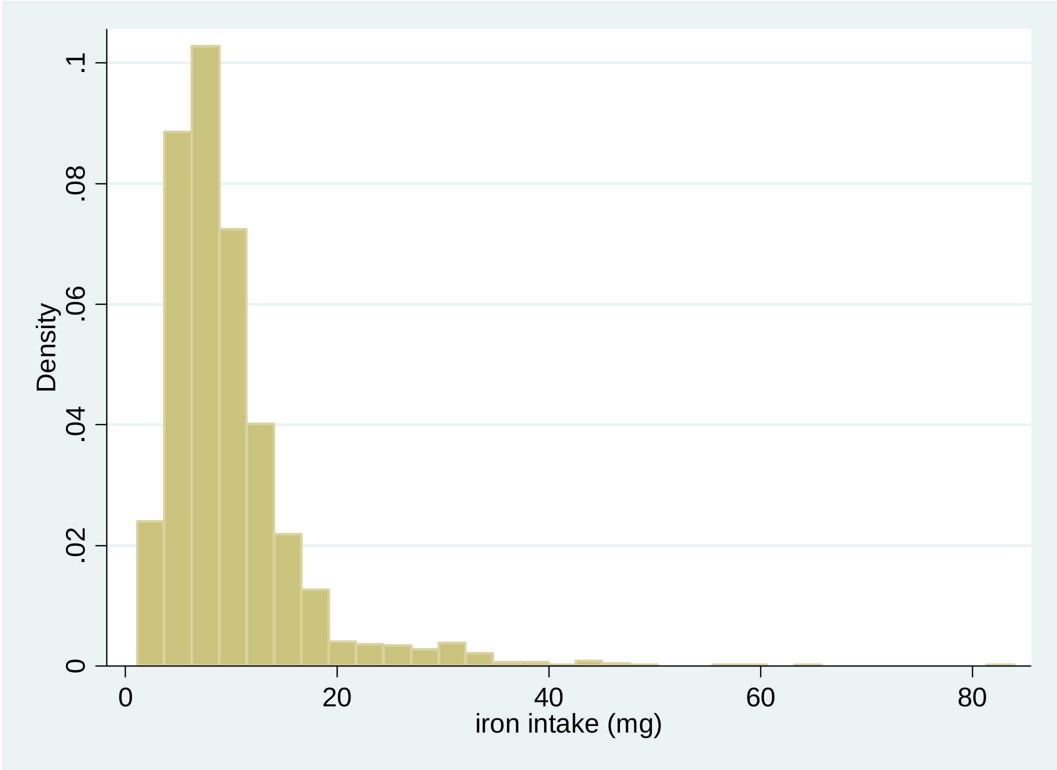


Figure N11. Distribution of Zinc Intakes, NPNL Women

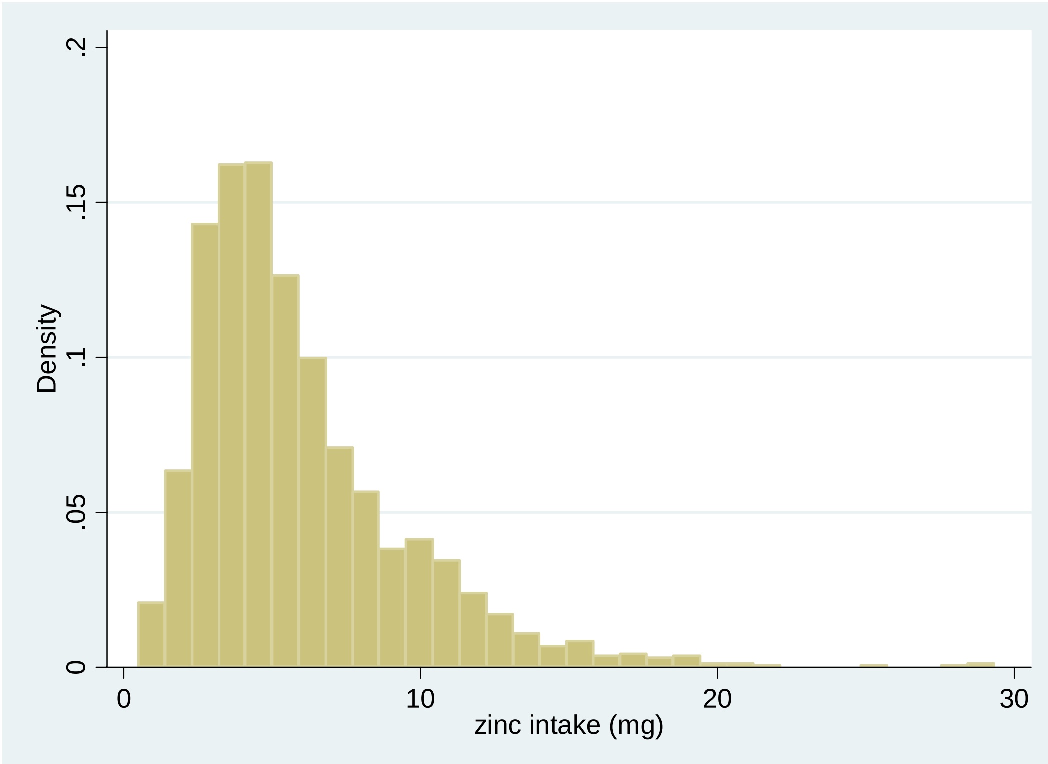


Figure N12. Intra-Individual SD of Thiamin Intakes, NPNL Women

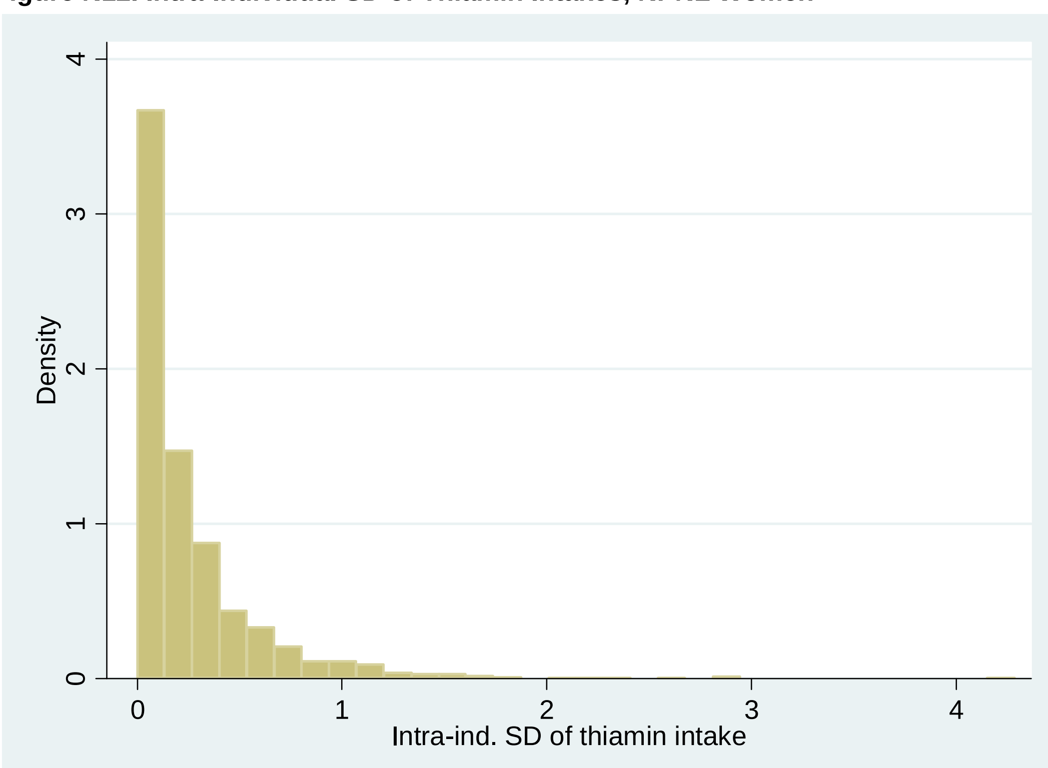


Figure N13. Intra-Individual SD of Riboflavin Intakes, NPNL Women

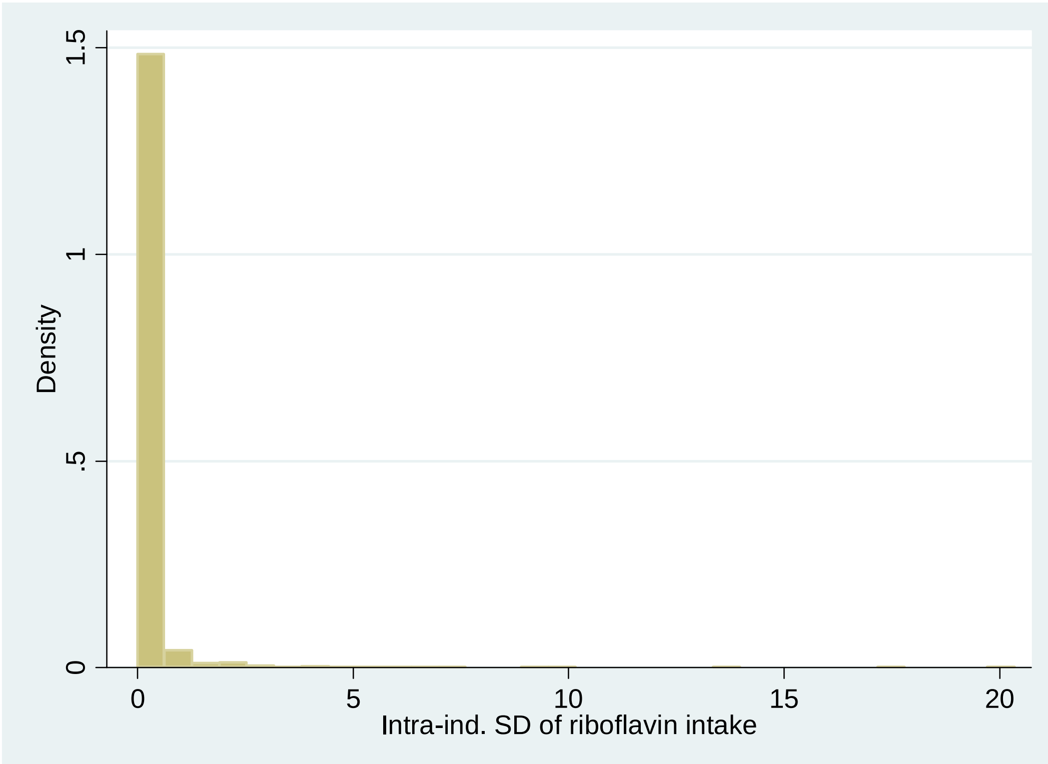


Figure N14. Intra-Individual SD of Niacin Intakes, NPNL Women

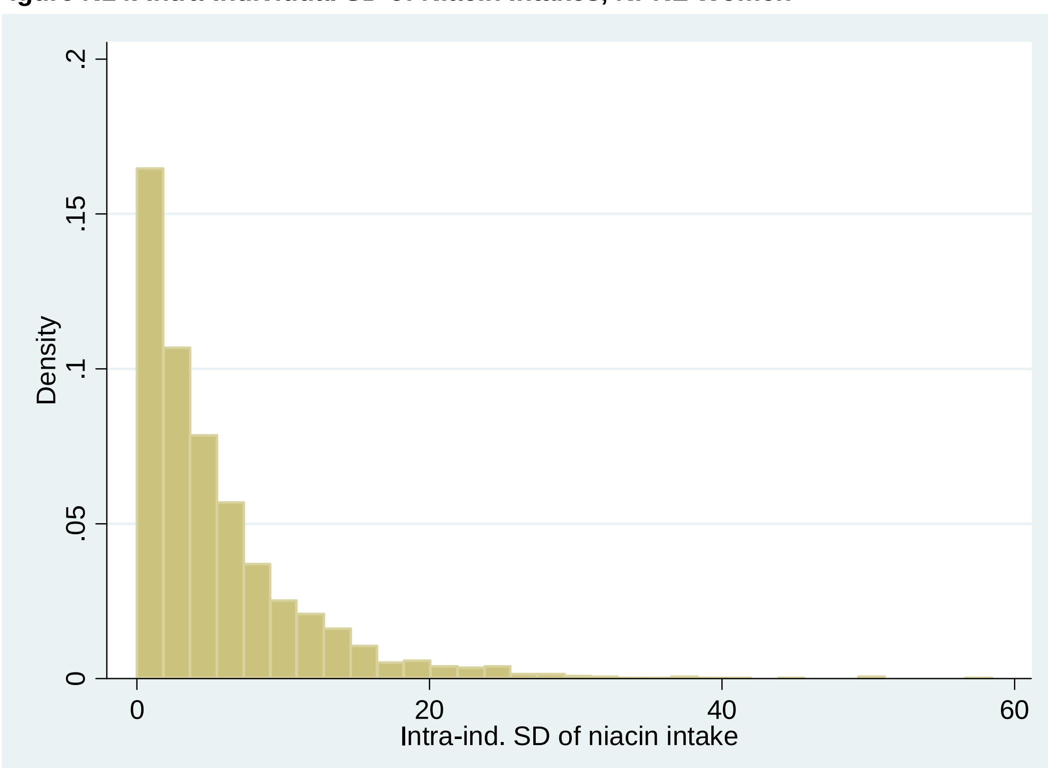


Figure N15. Intra-Individual SD of Vitamin B6 Intakes, NPNL Women

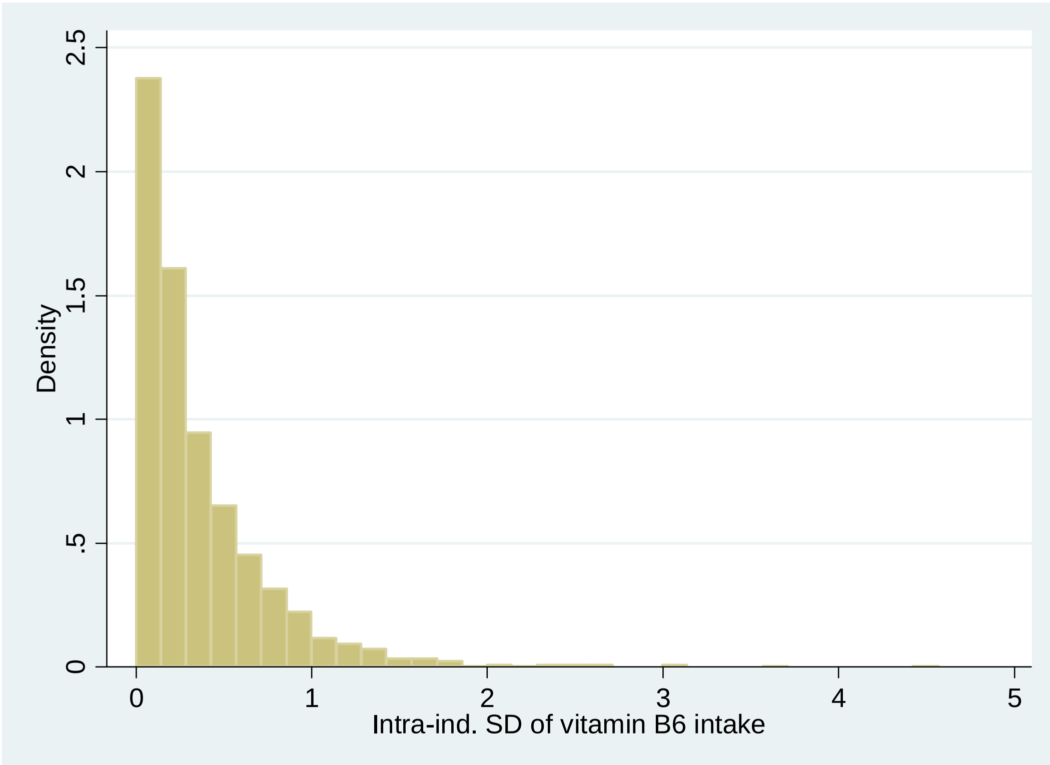


Figure N16. Intra-Individual SD of Folate Intakes, NPNL Women

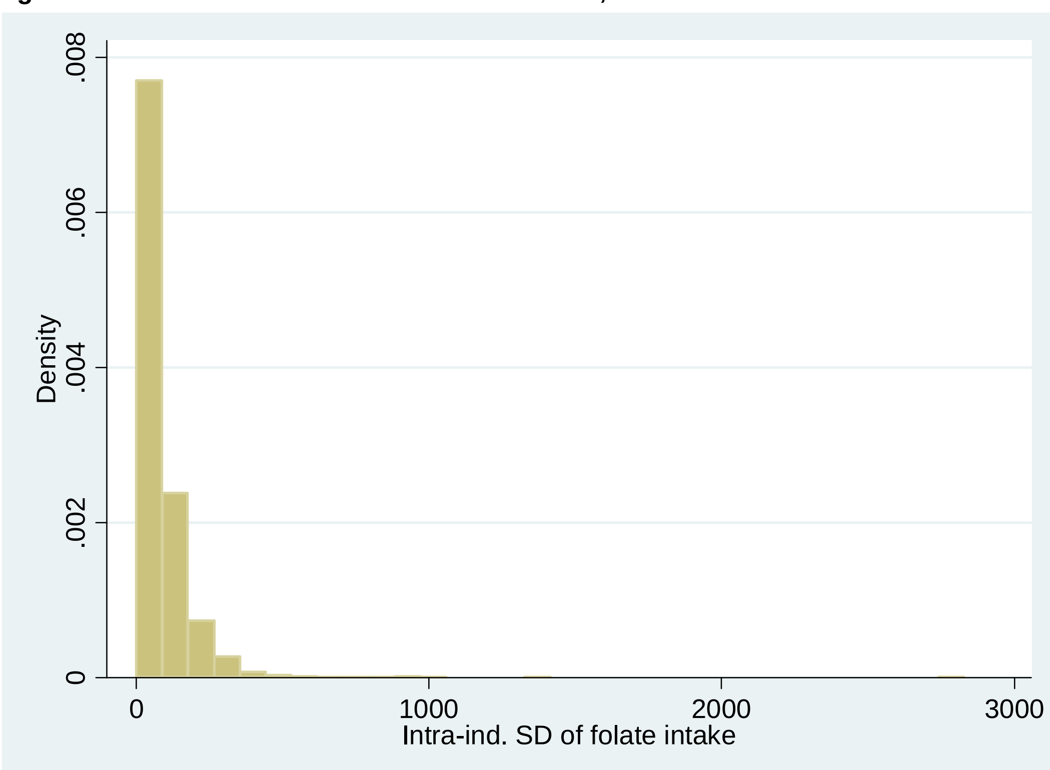


Figure N17. Intra-Individual SD of Vitamin B12 Intakes, NPNL Women

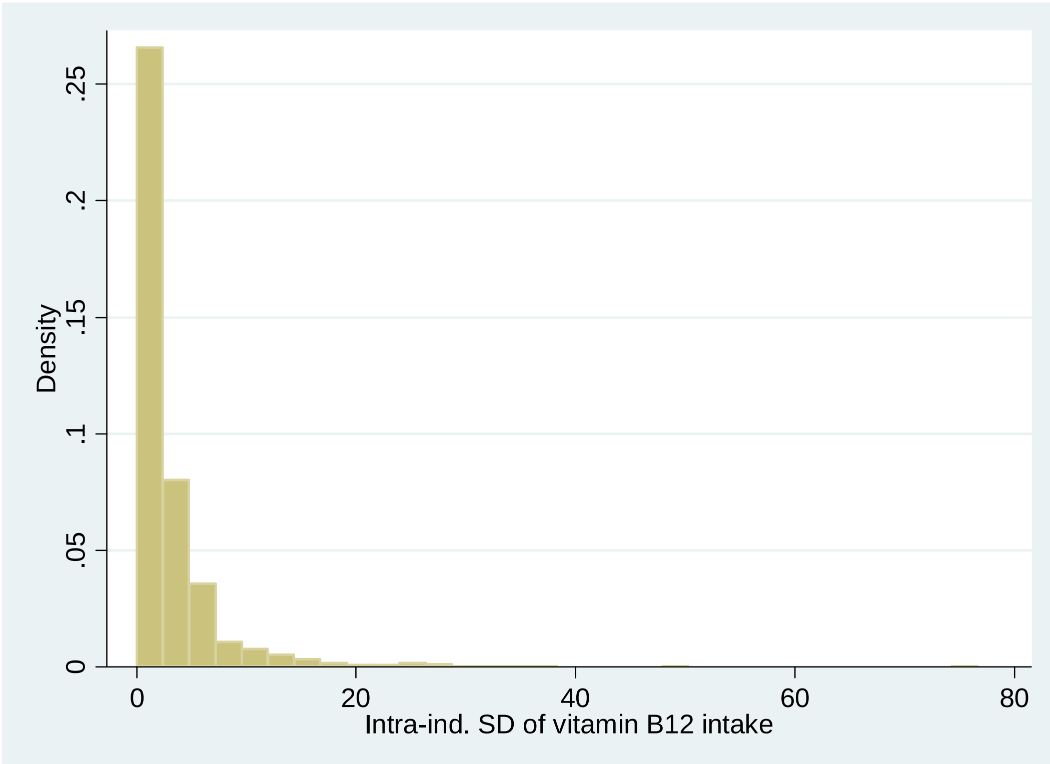


Figure N18. Intra-Individual SD of Vitamin C Intakes, NPNL Women

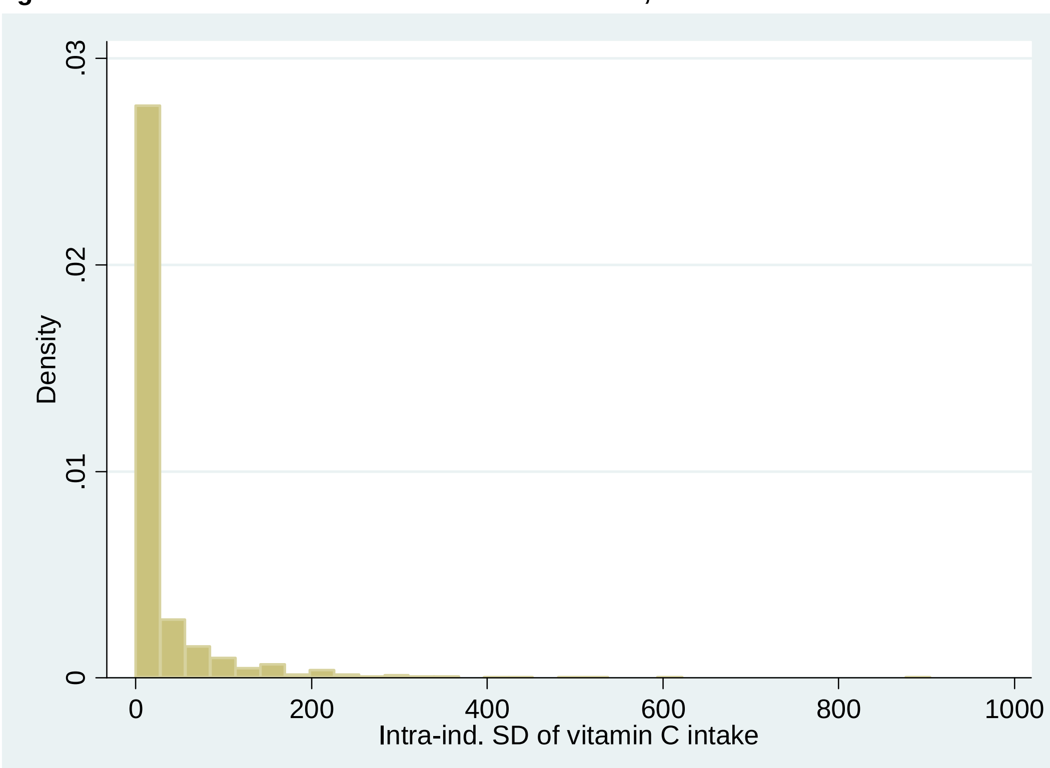


Figure N19. Intra-Individual SD of Vitamin A Intakes, NPNL Women

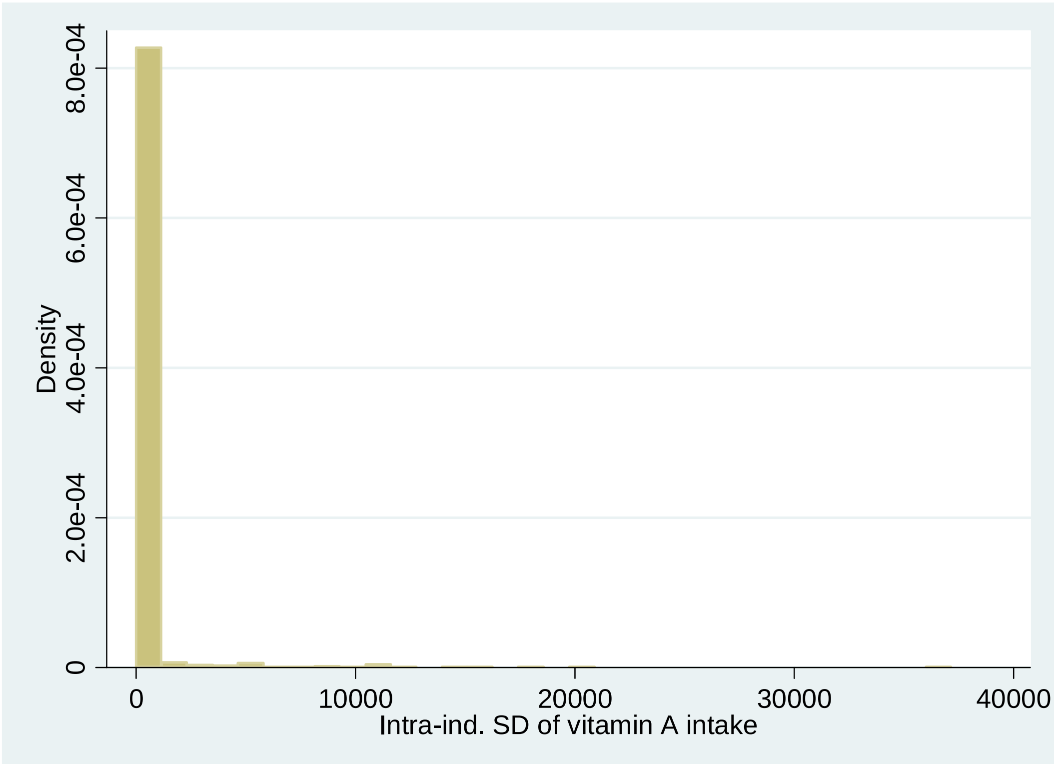


Figure N20. Intra-Individual SD of Calcium Intakes, NPNL Women

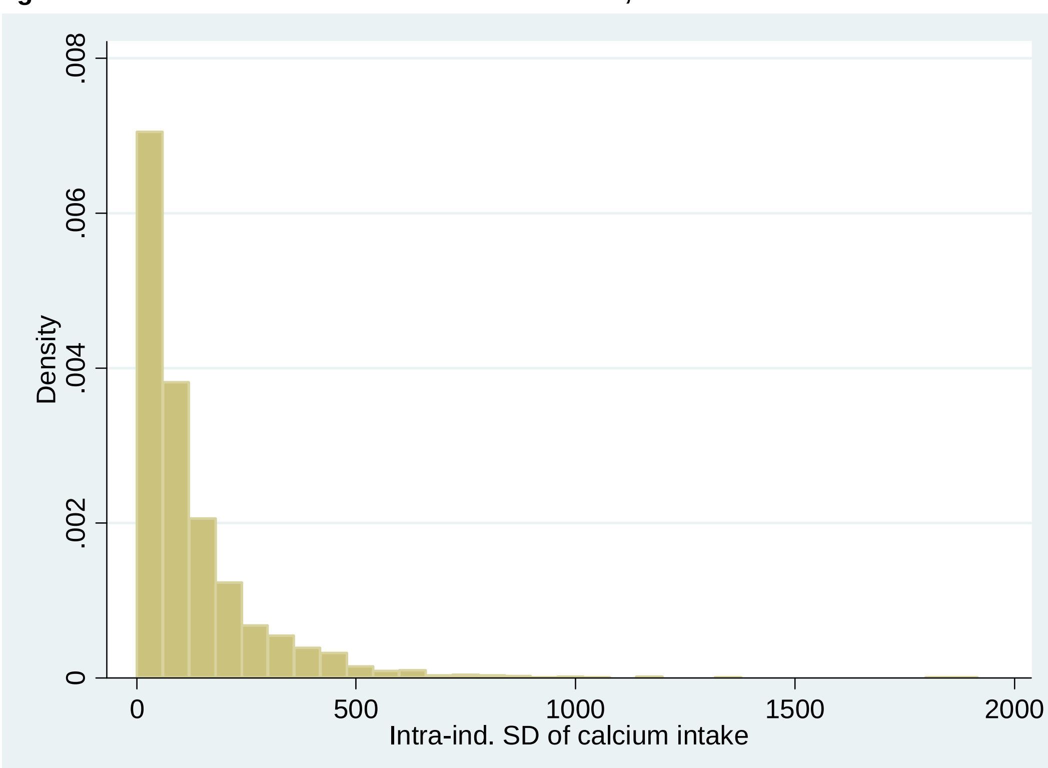


Figure N21. Intra-Individual SD of Iron Intakes, NPNL Women

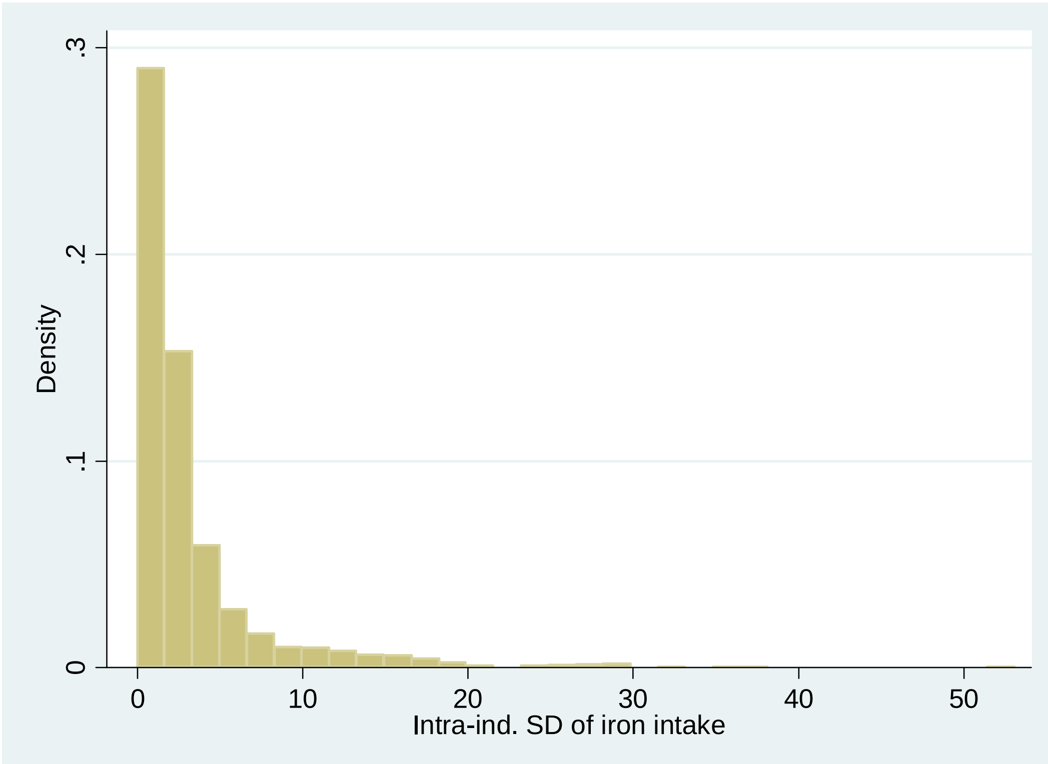


Figure N22. Intra-Individual SD of Zinc Intakes, NPNL Women

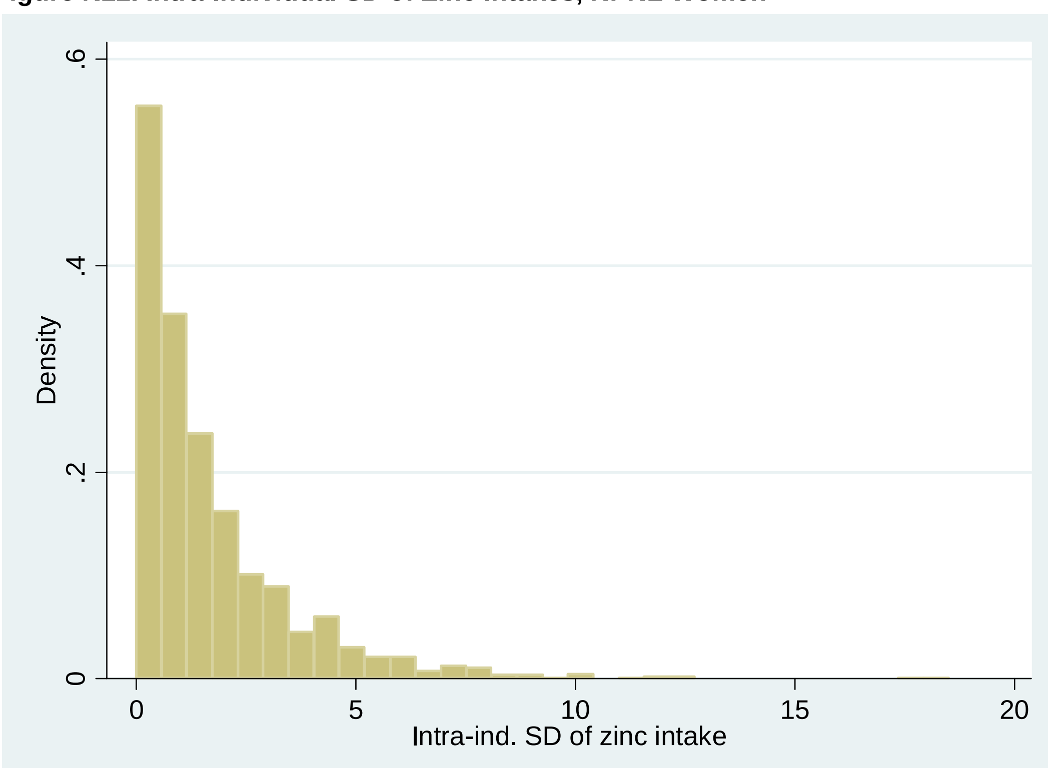


Figure N23. Distribution of Scores for FGI-6, NPNL Women

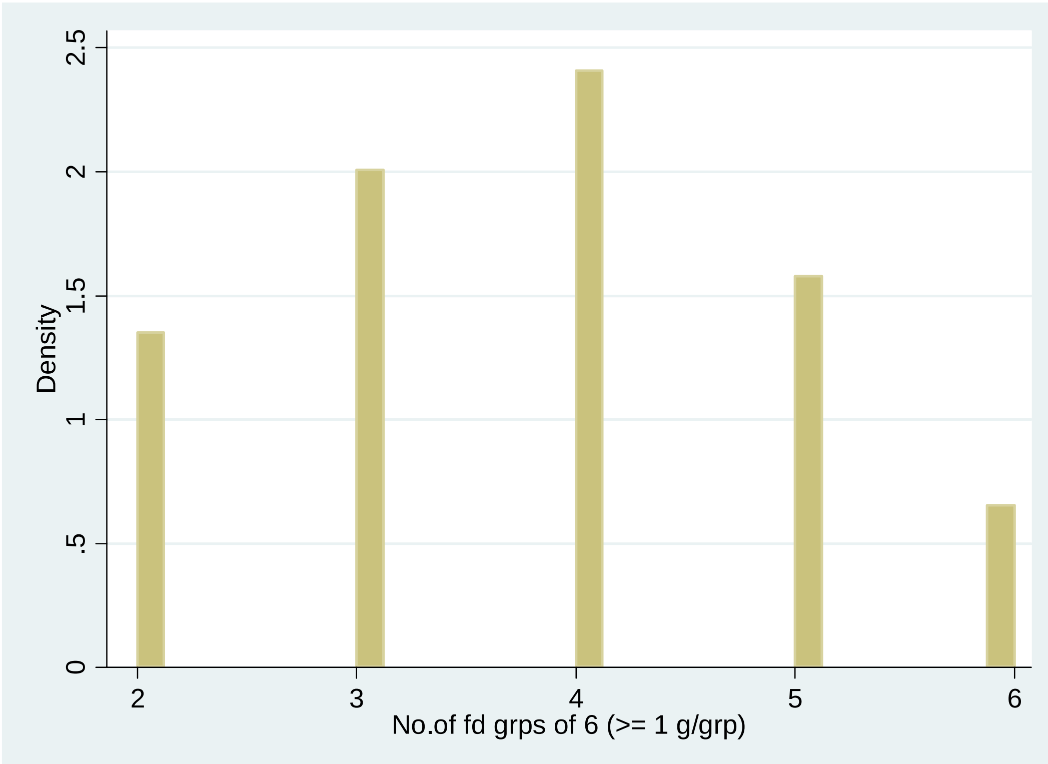


Figure N24. Distribution of Scores for FGI-6R, NPNL Women

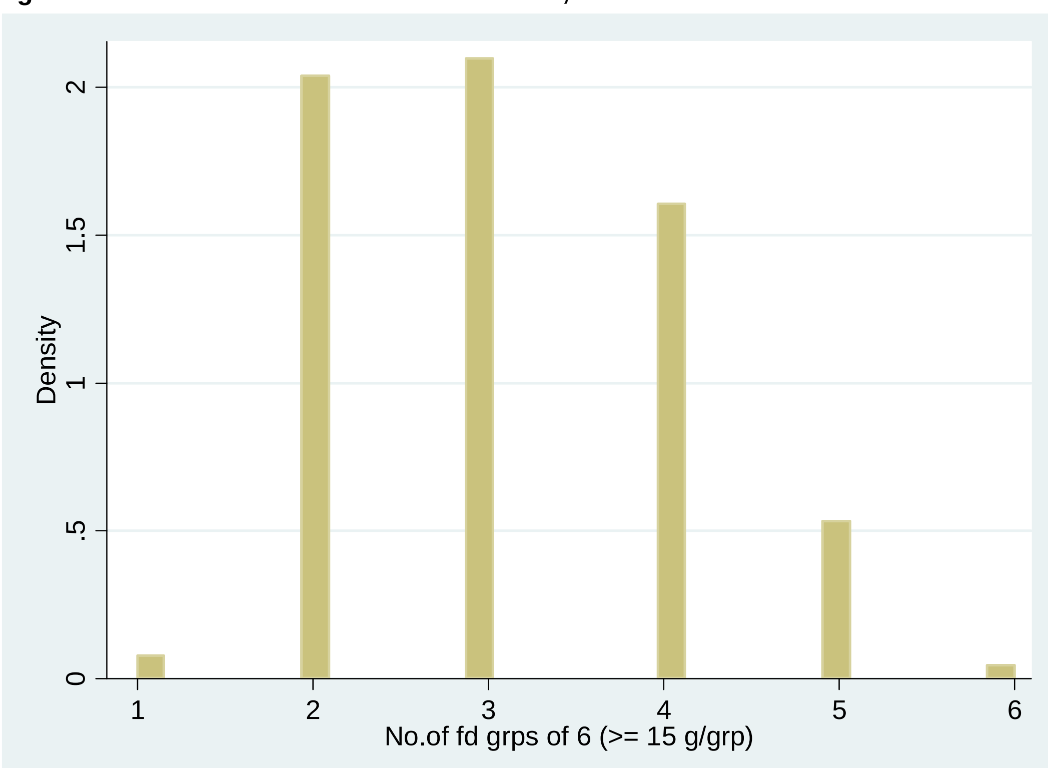


Figure N25. Distribution of Scores for FGI-9, NPNL Women

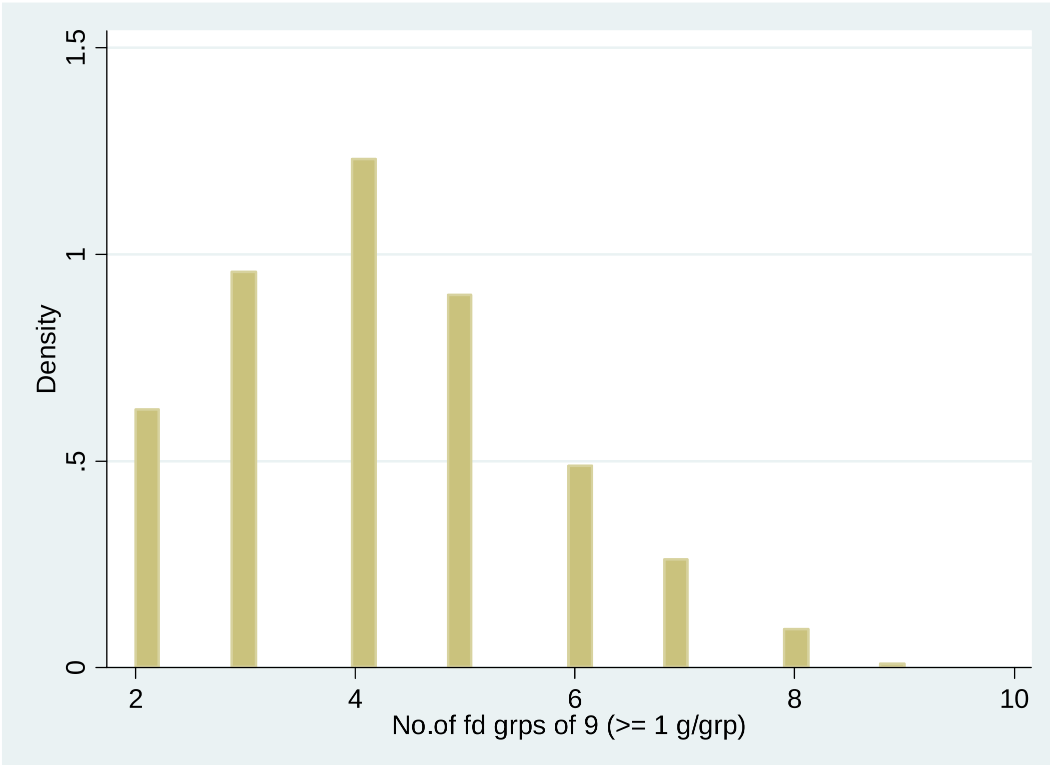


Figure N26. Distribution of Scores for FGI-9R, NPNL Women

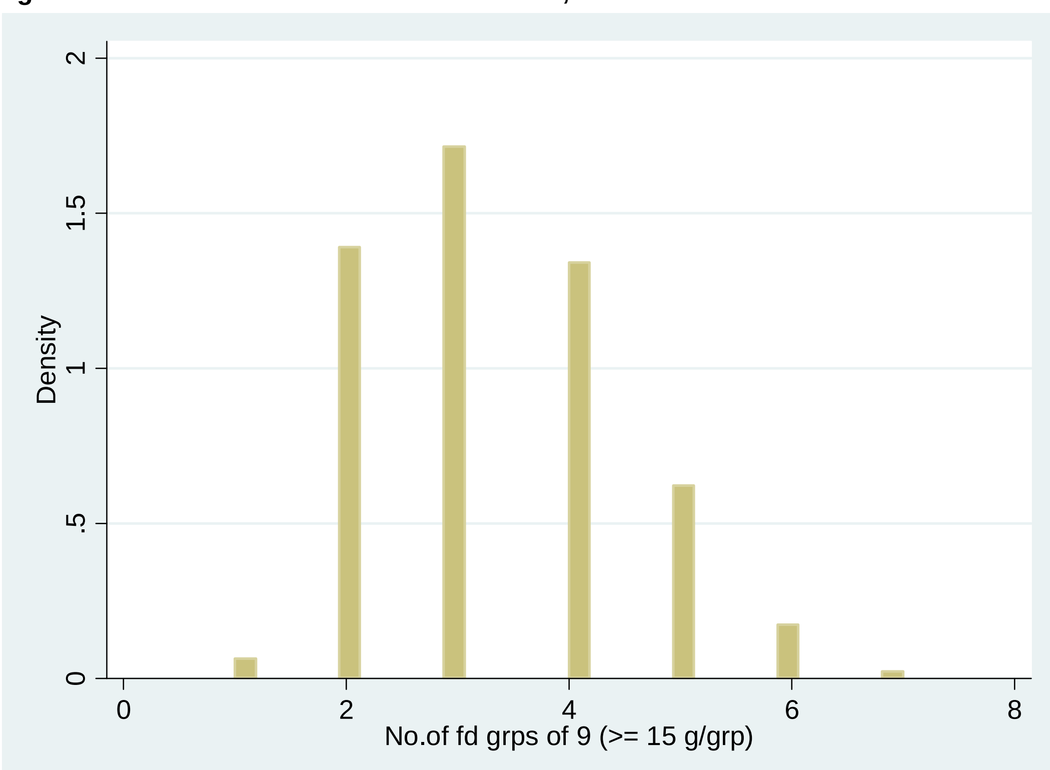


Figure N27. Distribution of Scores for FGI-13, NPNL Women

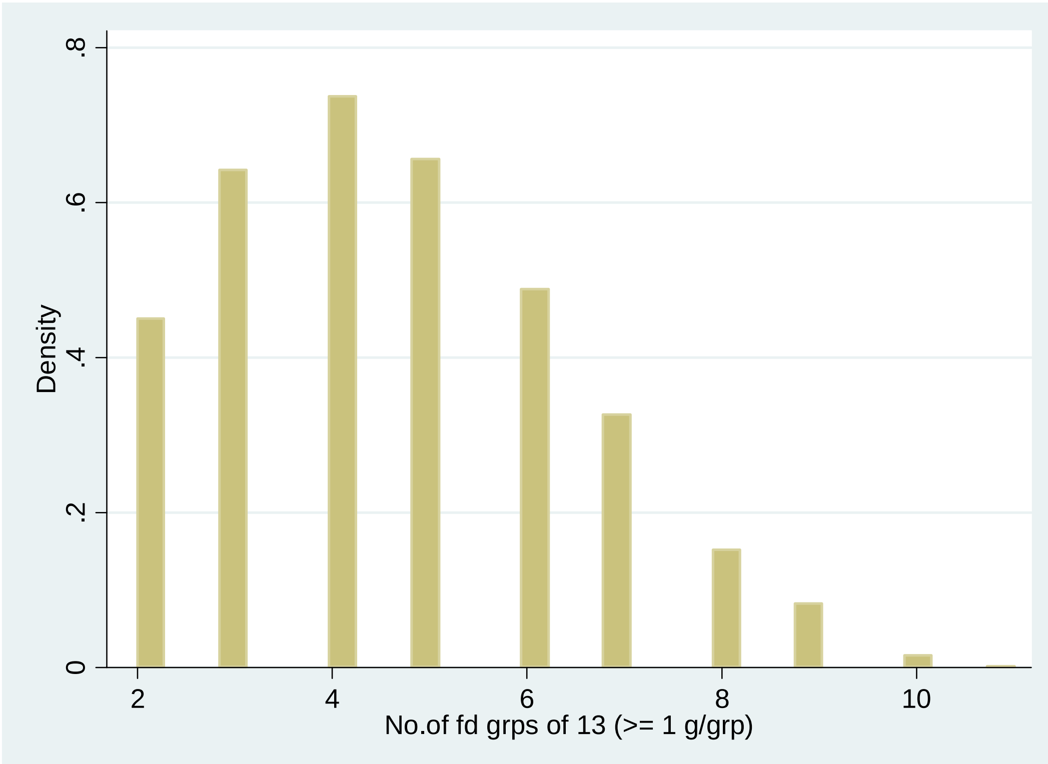


Figure N28. Distribution of Scores for FGI-13R, NPNL Women

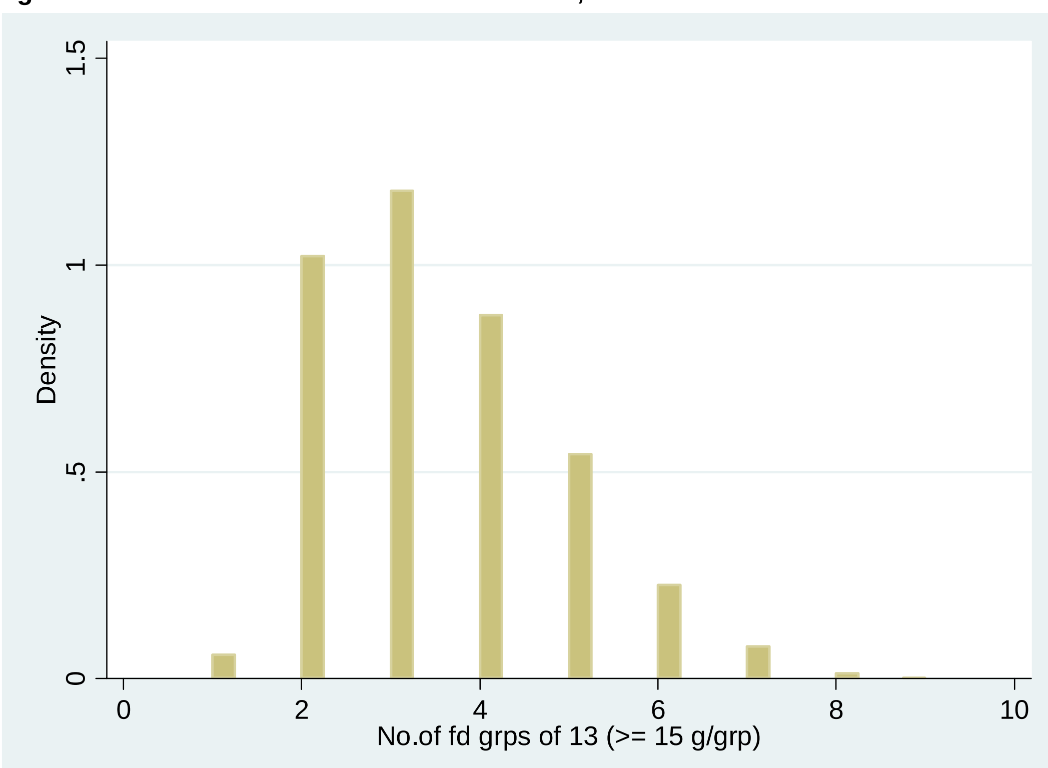


Figure N29. Distribution of Scores for FGI-21, NPNL Women

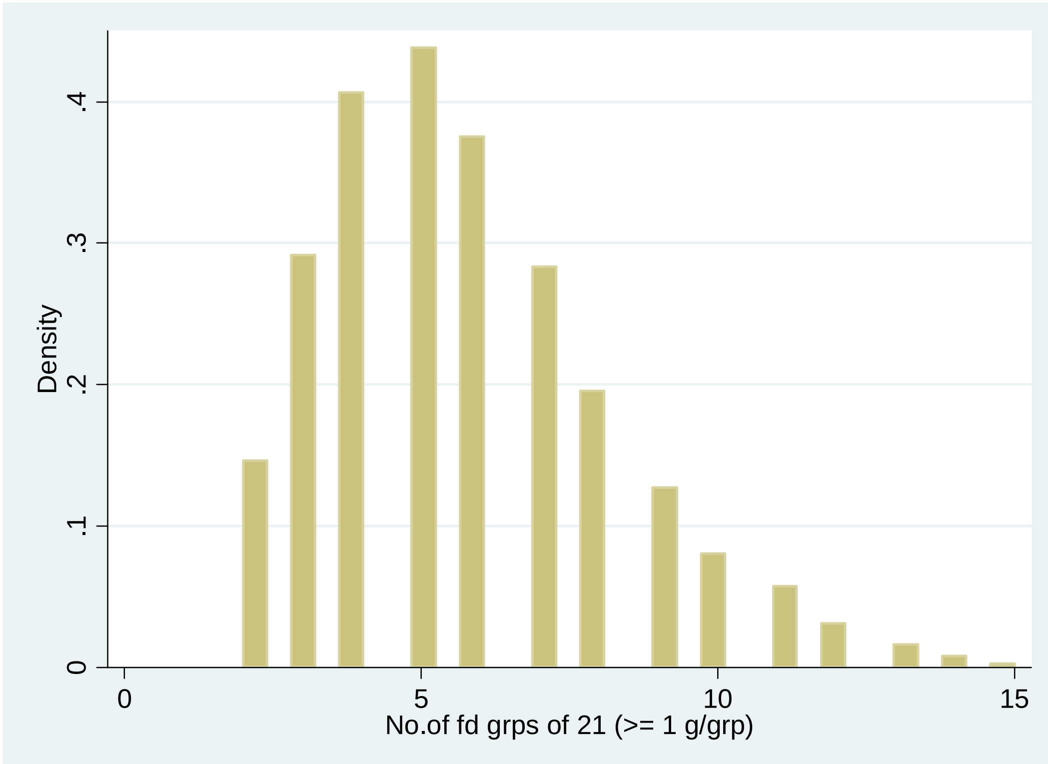


Figure N30. Distribution of Scores for FGI-21R, NPNL Women

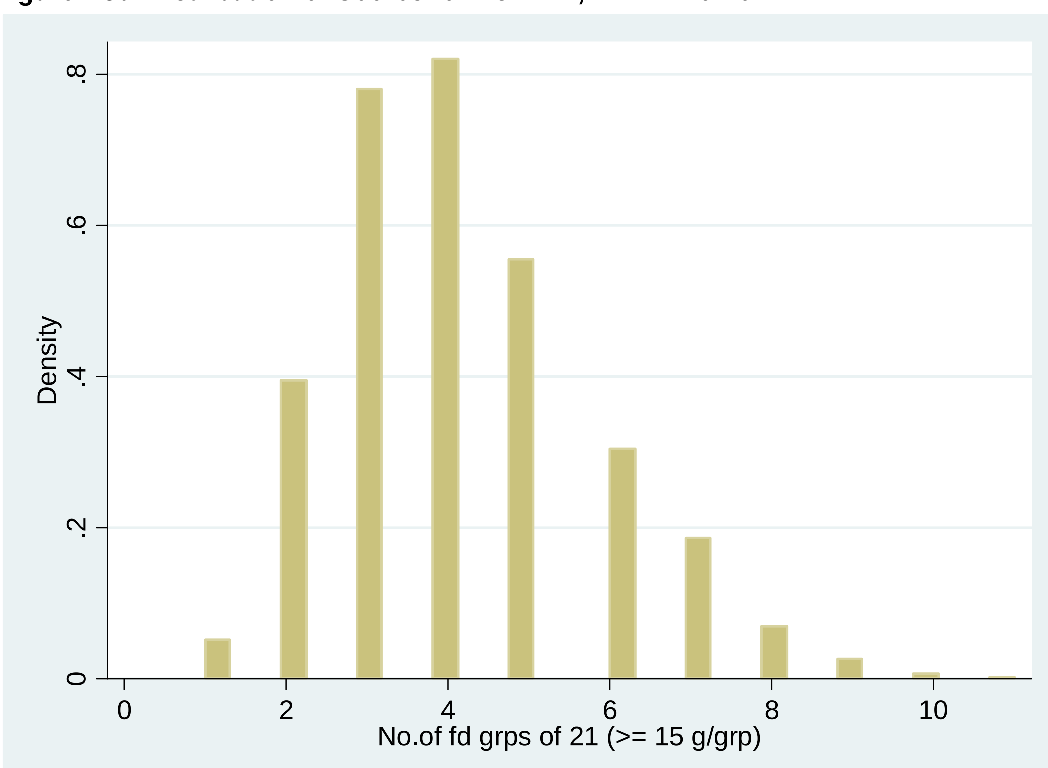


Table N6. Percent of Observation Days at Each Food Group Diversity Score, NPNL Women, R1

Number of food groups eaten	Diversity indicators							
	FGI-6	FGI-6R	FGI-9	FGI-9R	FGI-13	FGI-13R	FGI-21	FGI-21R
1	0	1	0	1	0	1	0	2
2	17	32	14	26	13	26	6	12
3	25	33	21	32	18	30	12	24
4	30	25	27	25	21	22	17	26
5	20	8	20	12	19	14	18	17
6	8	1	11	3	14	6	15	10
7			6	0	9	2	12	6
8			2	0	4	0	8	2
9			0	0	2	0	5	1
10					0	0	3	0
11					0	0	2	0
12					0	0	1	0
13					0	0	1	0
14							0	0
15							0	0
16							0	0
17							0	0
18							0	0
19							0	0
20							0	0
21							0	0

Figure N31. Distribution of PA for Thiamin, NPNL Women

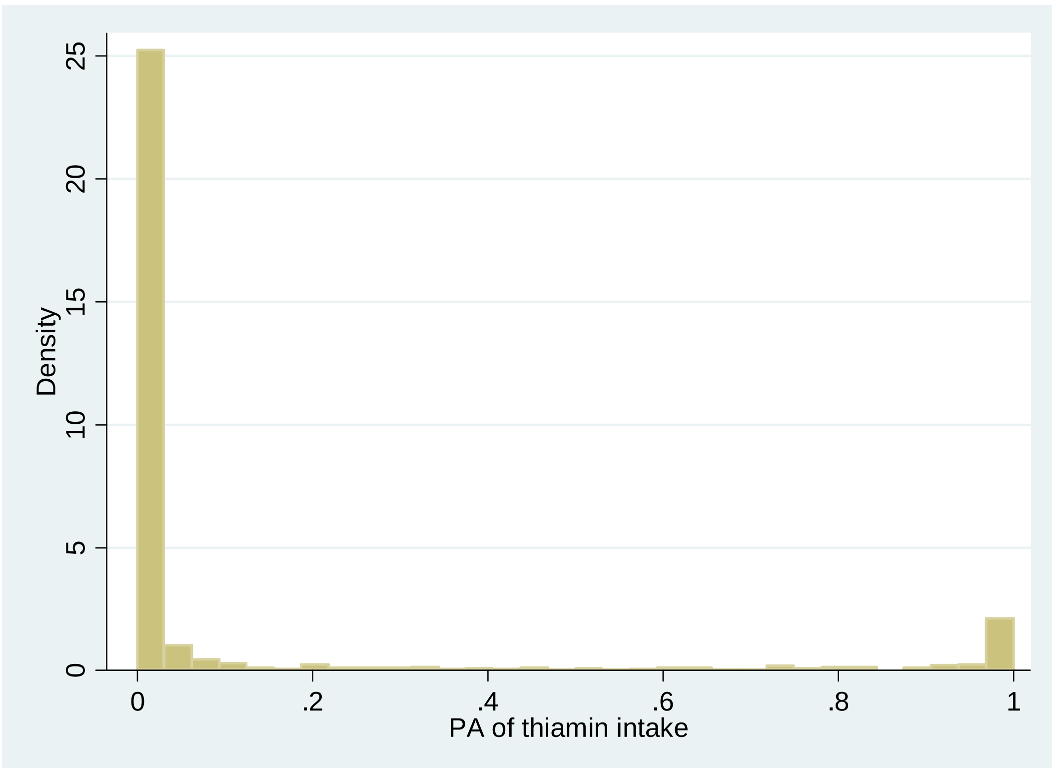


Figure N32. Distribution of PA for Riboflavin, NPNL Women

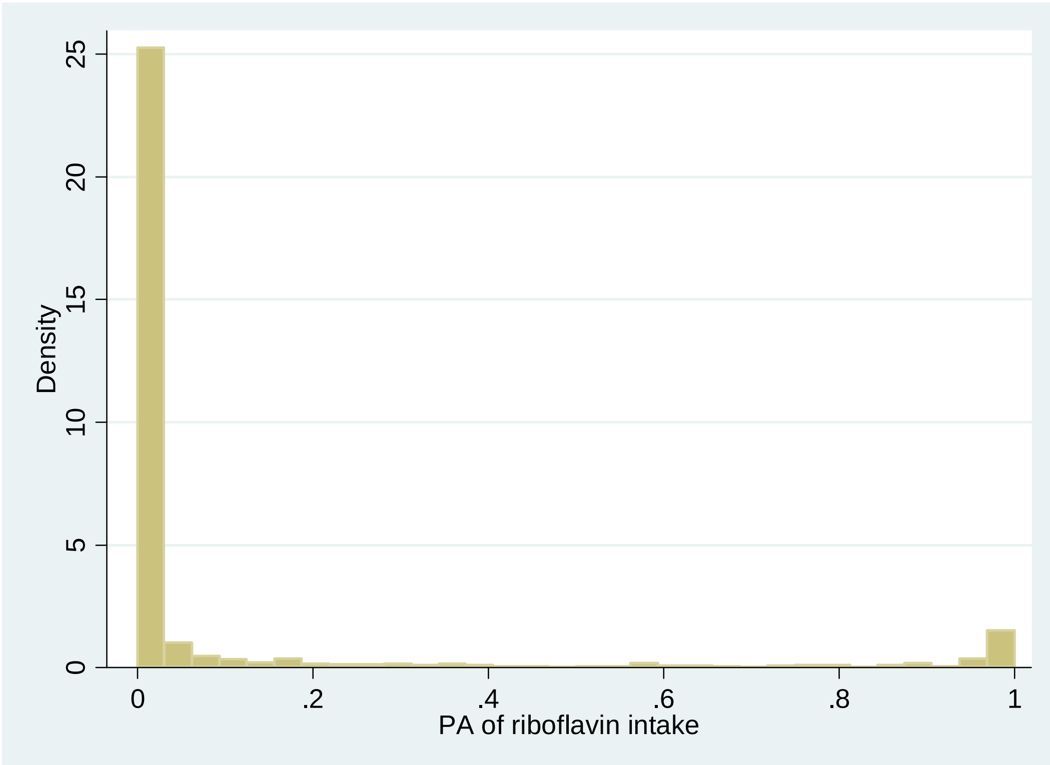


Figure N33. Distribution of PA for Niacin, NPNL Women

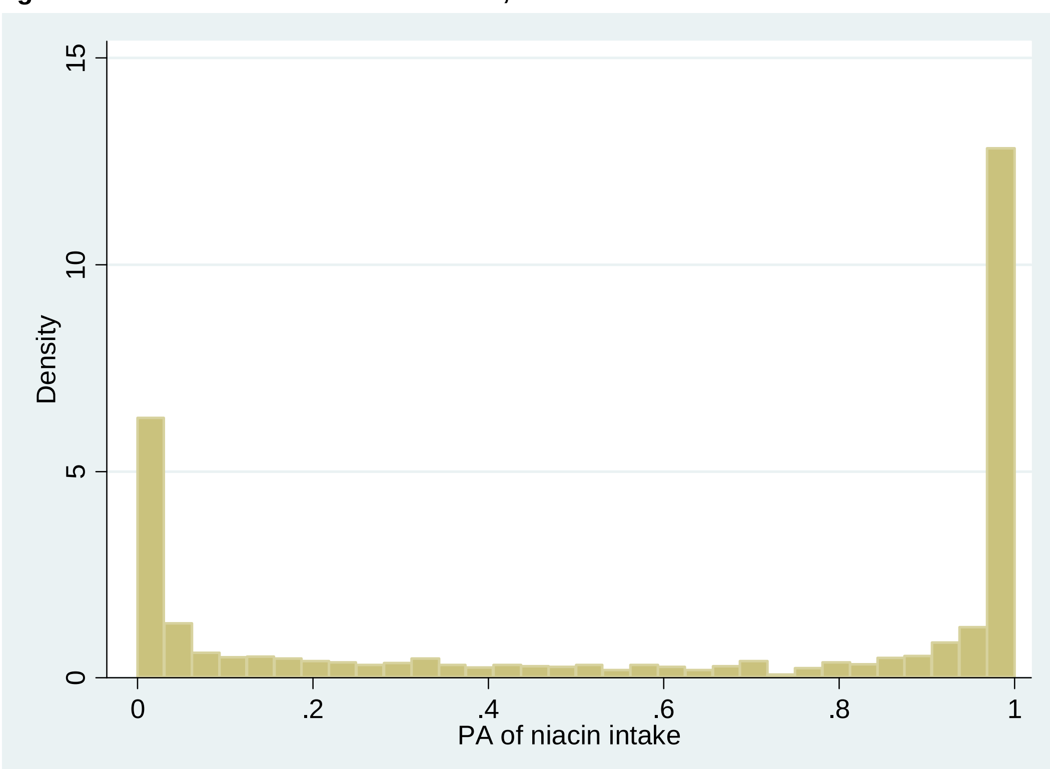


Figure N34. Distribution of PA for Vitamin B6, NPNL Women

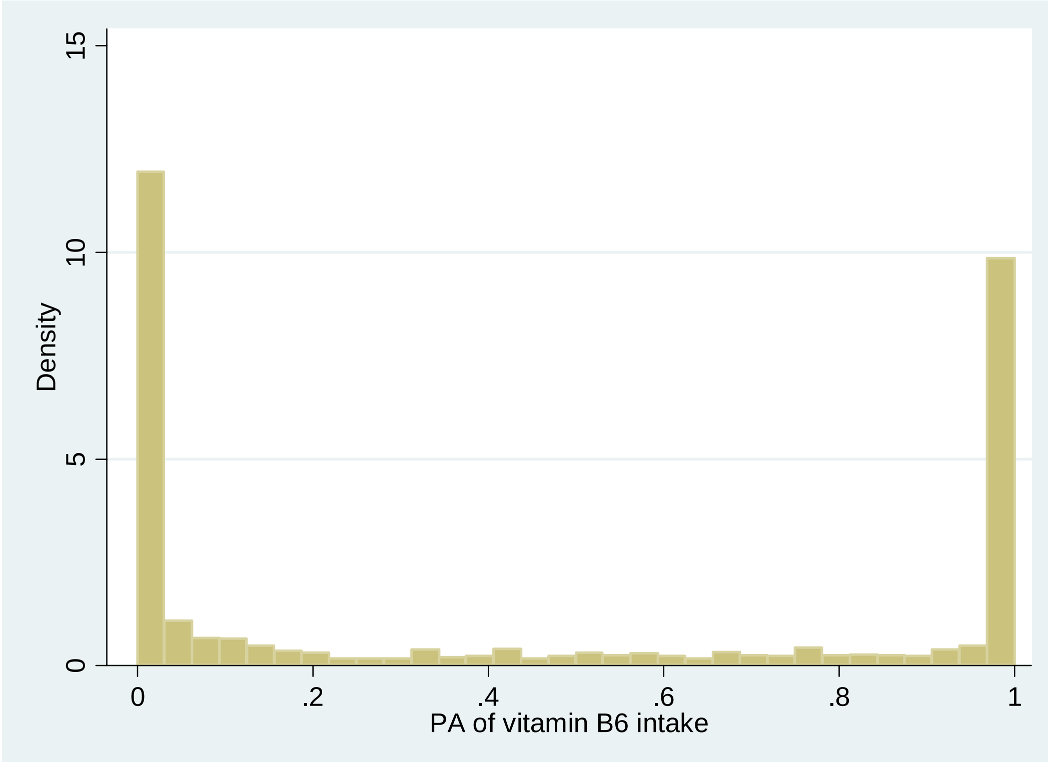


Figure N35. Distribution of PA for Folate, NPNL Women

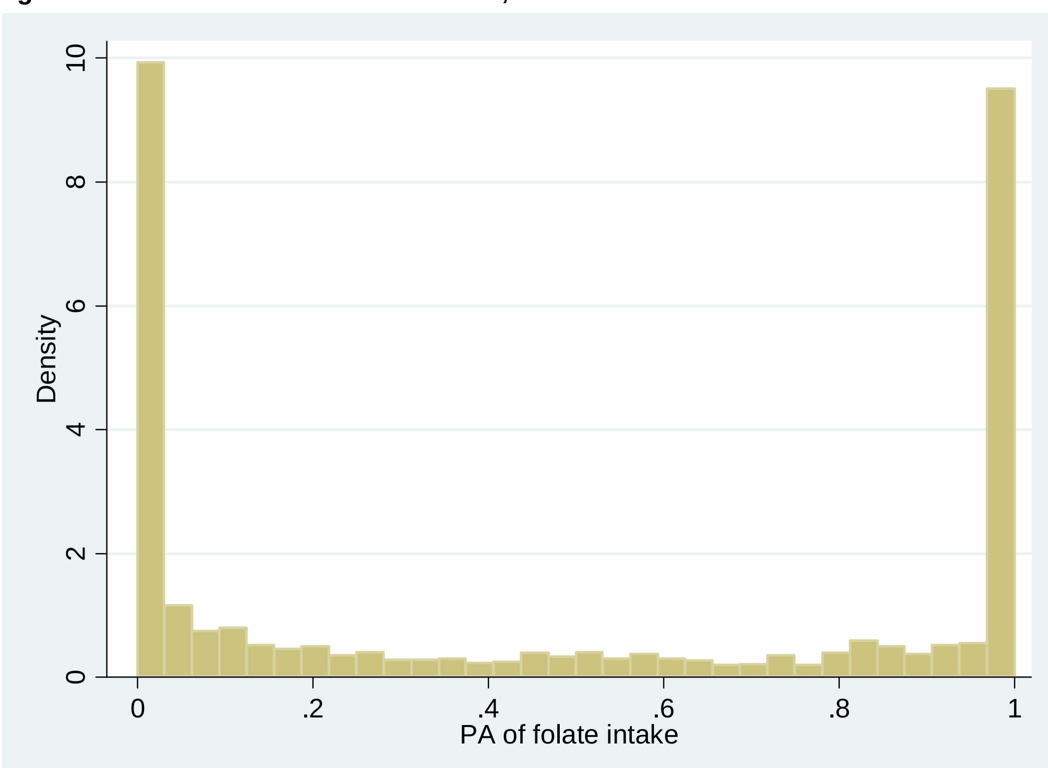


Figure N36. Distribution of PA for Vitamin B12, NPNL Women

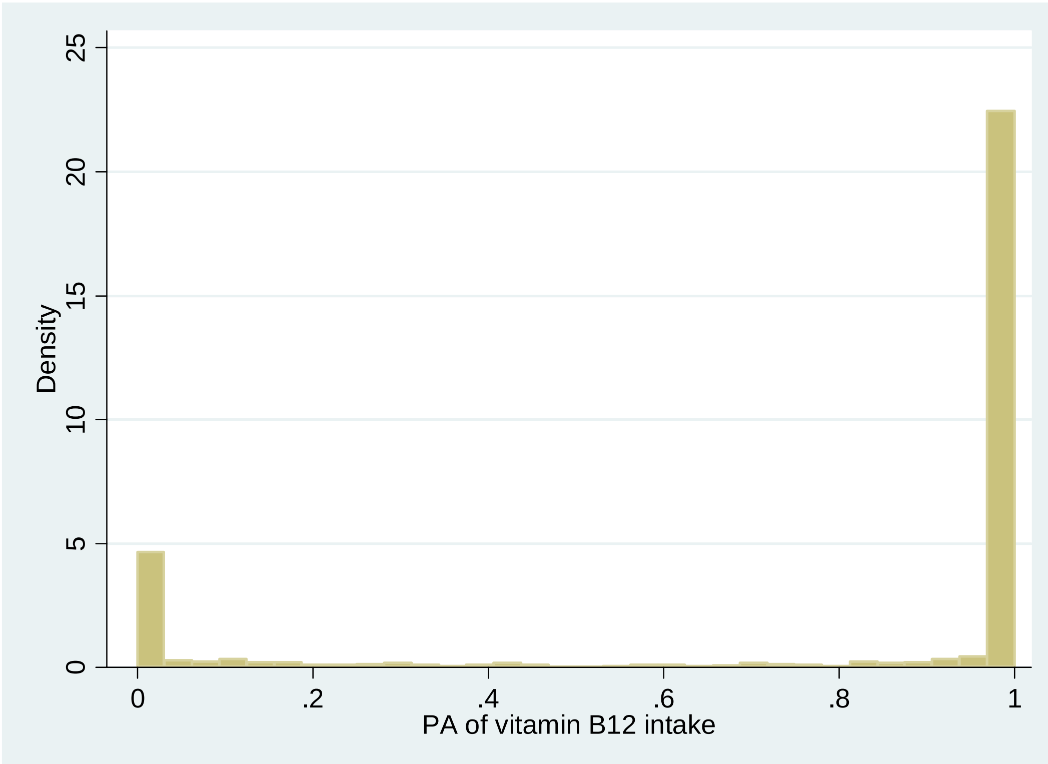


Figure N37. Distribution of PA for Vitamin C, NPNL Women

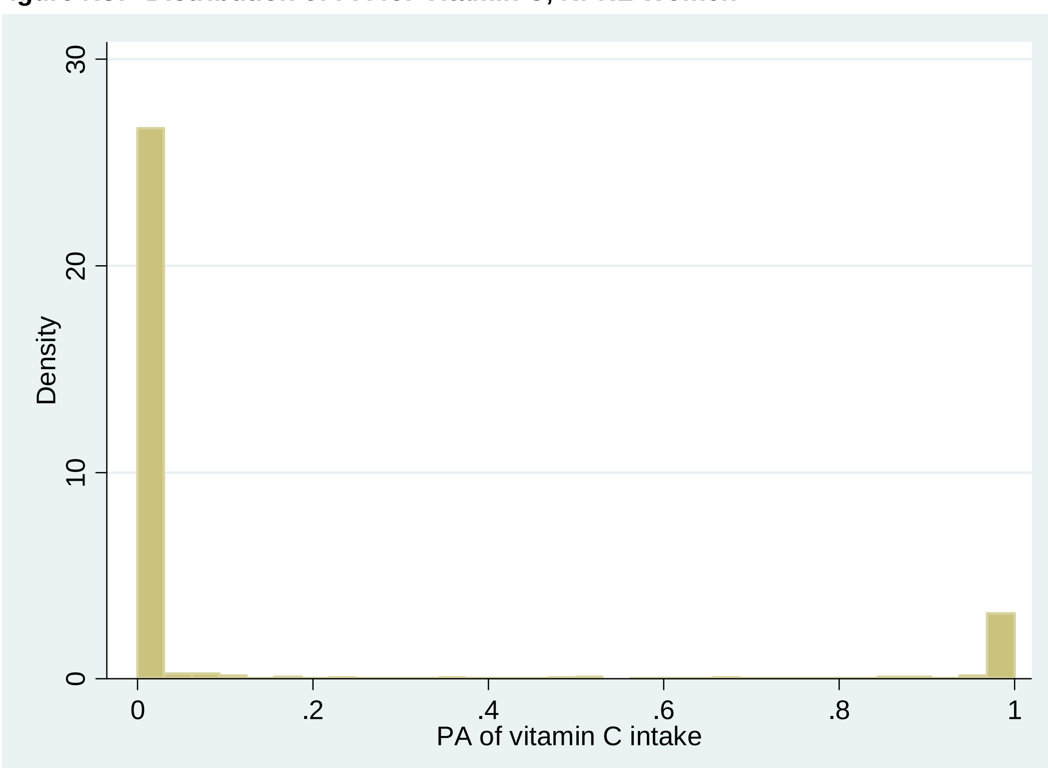


Figure N38. Distribution of PA for Vitamin A, NPNL Women

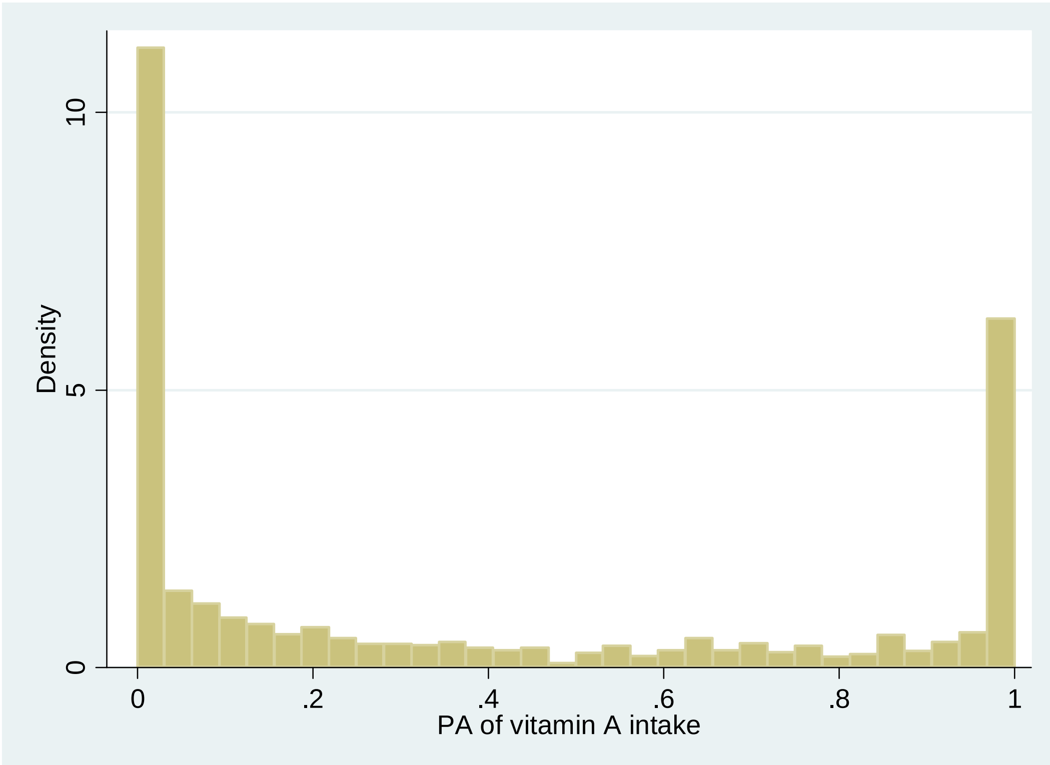


Figure N39. Distribution of PA for Calcium, NPNL Women

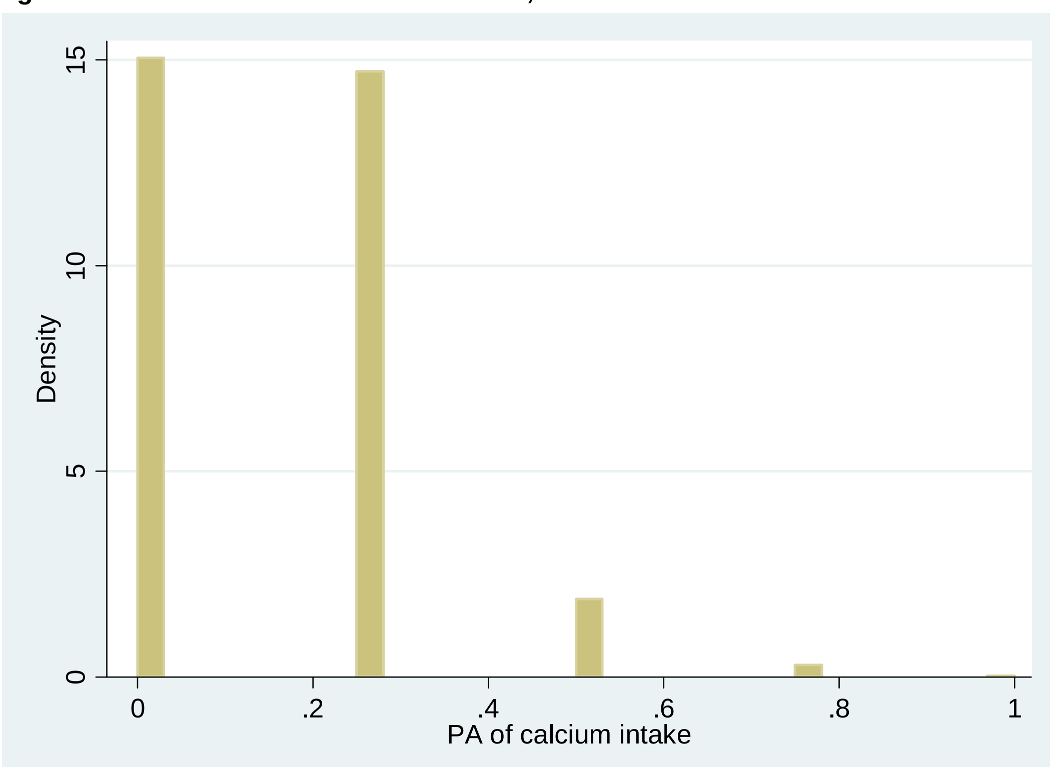


Figure N40. Distribution of PA for Iron, NPNL Women

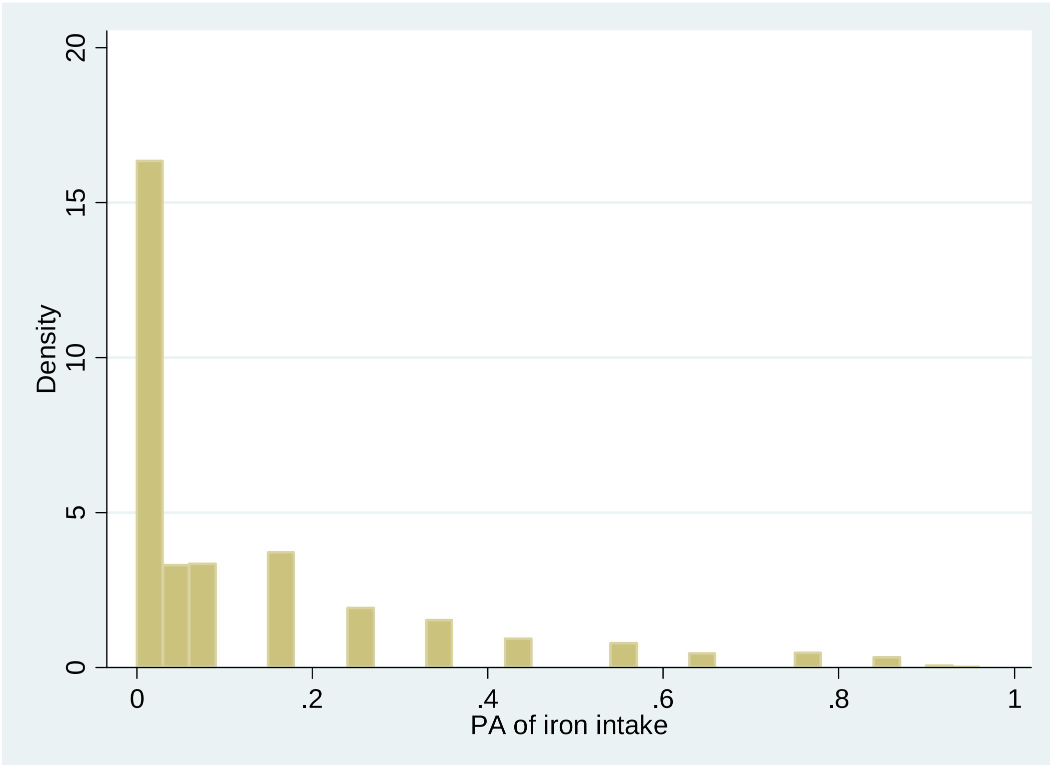


Figure N41. Distribution of PA for Zinc, NPNL Women

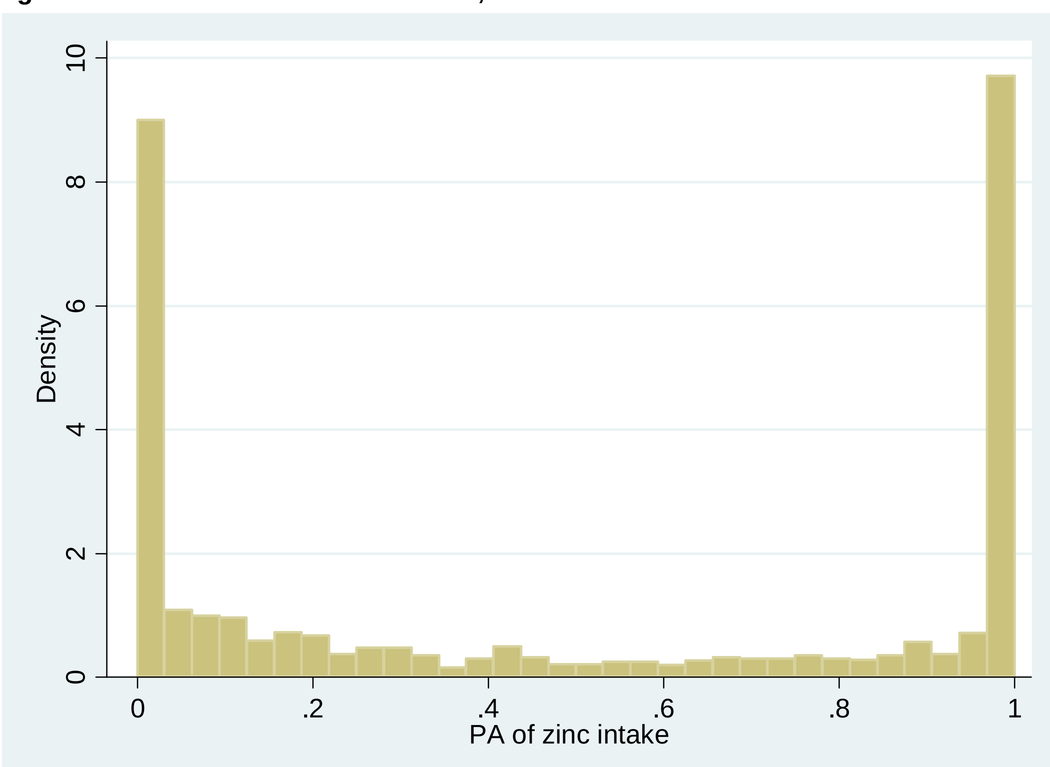
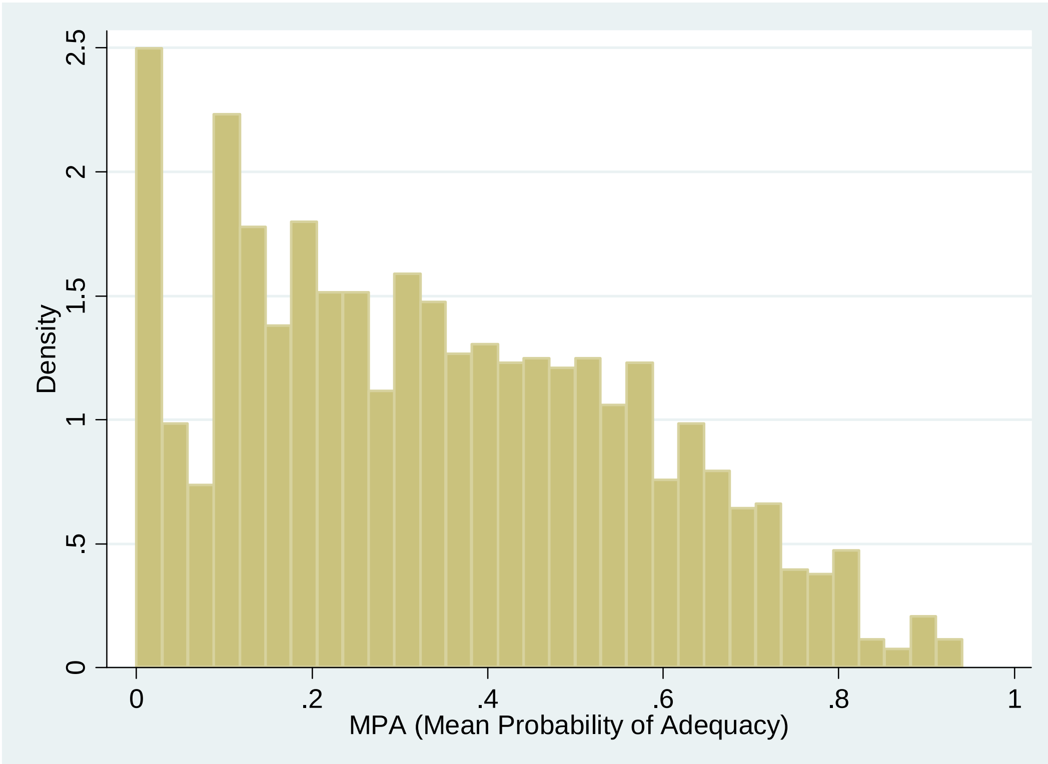


Figure N42. Distribution of MPA across 11 Micronutrients, NPNL Women



Appendix 4. Tables from Second Observation Day

Table A4-1. Description of Sample, All Women, R2

	n	Mean	SD	Median	Range
Age (year)	2045	34.8	11.6	41.0	20.0-49.0
Height (cm)	2045	151.0	5.2	150.8	132.7-168.8
Weight (kg)	2045	52.4	10.7	51.0	29.7-105.0
BMI	2045	23.0	4.4	22.4	13.4-41.9
Education [a]	2045	9.02	3.6	10	1-18
% Literate [b]	2045	96.6			
% Lactating	2045	8.2			
% Pregnant	2045	3.9			
	n	**Percent**			
BMI < 16	44	2.2			
BMI 16-16.9	69	3.4			
BMI 17-18.49	199	9.7			
BMI 18.5-24.9	1112	54.4			
BMI 25-29.9	477	23.3			
BMI ≥ 30	144	7.0			

[a] Years of schooling completed.
[b] Percent completing 3rd grade.

Table A4-2. Energy and Macronutrient Intakes, All Women, R2

	Mean	SD	Median	Range	Percent of kcal
Energy (kcal)	1,262.1	569.4	1,154.0	350.7-4,074.9	
Protein (g)	49.4	30.8	42.2	7.8-406.5	16
Animal source (g)	33.2	29.7	25.1	0.0-397.1	10
Plant source (g)	16.3	7.8	14.9	2.8-67.3	6
Total carbohydrate (g)	196.6	80.3	182.6	45.2-616.7	66
Total fat (g)	30.8	33.7	17.4	0.6-278.7	18.7

Table A4-8. Mean and Median Nutrient Intake, All Women, R2

Nutrient	Mean	SD	Median	EAR [a]	SD [a]
Energy	1,262.12	569.42	1,154.04		
Protein (All Sources) (% of kcal)	15.59	6.04	14.19		
Protein from animal sources (% of kcal)	10.11	6.83	8.67		
Total carbohydrate (% of kcal)	65.62	15.37	68.79		
Total fat (% of kcal)	18.67	13.79	14.51		
Thiamin (mg/d)	0.58	0.49	0.44	0.9	0.09
Riboflavin (mg/d)	0.62	0.81	0.47	0.9	0.09
Niacin (mg/d)	14.86	10.59	12.06	11	1.7
Vitamin B6 (mg/d)	1.17	0.71	0.99	1.1	0.11
Folate (µg/d)	327.84	179.41	304.19	320	32
Vitamin B12 (µg/d)	5.02	5.61	3.34	2.0	0.2
Vitamin C (mg/d)	37.61	82.89	10.63	38	3.8
Vitamin A (RE/d)	444.20	1,442.34	223.36	270	54
Calcium (mg/d) [d]	322.69	256.16	255.93	1,000 [b]	- [b]
Iron (mg/d)	9.46	6.45	7.79	See Table [c]	
Zinc (mg/d)	5.61	3.24	4.88	6	0.75

[a] See Table A6-1 for sources for each EAR and SD. Requirements for NPNL women are presented here. See Table A4-L8 for requirements for lactating women.
[b] There is no EAR and no SD for calcium; 1,000 mg is the AI value for both lactating and NPNL women.
[c] Iron requirements are nonsymetric for NPNL women of reproductive age: see Table A6-2 for iron requirements for NPNL women. See Table A4-L8 for requiremnts for lactating women.

Table A4-L1. Description of Sample, Lactating Women, R2

	n	Mean	SD	Median	Range
Age (year)	167	28.3	10.0	21.0	20.0-48.0
Height (cm)	167	150.2	5.3	149.9	138.6-163.0
Weight (kg)	167	49.4	8.3	49.0	31.6-75.7
BMI	167	21.9	3.4	21.4	14.7-32.3
Education[a]	167	8.20	3.1	9.0	0-15
% Literate[b]	167	95.8			
% Lactating	167	100.0			
% Pregnant	167	0.0			
	n	**Percent**			
BMI <16	2	1.2			
BMI 16-16.9	4	2.4			
BMI 17-18.49	20	12.0			
BMI 18.5-24.9	114	68.3			
BMI 25-29.9	24	14.4			
BMI ≥ 30	3	1.8			

[a] Years of schooling completed.
[b] Percent completing 3rd grade.

Table A4-L2. Energy and Macronutrient Intakes, Lactating Women, R2

	Mean	SD	Median	Range	Percent of kcal
Energy (kcal)	1,276.1	583.0	1,168.7	387.3-3,040.4	
Protein (g)	47.8	39.4	37.7	9.8-406.5	15
Animal source (g)	29.5	37.8	21.3	0.0-397.1	9
Plant source (g)	18.0	8.4	15.7	3.9-48.2	6
Total carbohydrate (g)	214.1	88.9	201.5	55.7-508.8	70
Total fat (g)	25.2	28.2	14.7	1.1-167.0	15

Table A4-L8. Mean and Median Nutrient Intake, Lactating Women, R2

Nutrient	Mean	SD	Median	EAR [a]	SD [a]
Energy	1,276	583	1,169		
Protein (All Sources) (% of kcal)	15	6	13		
Protein from animal sources (% of kcal)	9	7	7		
Total carbohydrate (% of kcal)	70	14	73		
Total fat (% of kcal)	15	12	13		
Thiamin (mg/d)	0.53	0.47	0.39	1.2	0.12
Riboflavin (mg/d)	0.54	0.44	0.43	1.3	0.13
Niacin (mg/d)	13.29	11.93	11.06	13	2.0
Vitamin B6 (mg/d)	1.18	0.81	0.96	1.7	0.17
Folate (µg/d)	359.54	217.80	344.71	450	45.0
Vitamin B12 (µg/d)	5.08	5.30	3.68	2.4	0.24
Vitamin C (mg/d)	35.46	66.10	9.30	58	5.8
Vitamin A (RE/d)	369.62	1,249.04	211.72	450	90
Calcium (mg/d)	339.64	255.16	264.99	1,000 [b]	- [b]
Iron (mg/d)	9.87	7.06	8.19	11.7	3.51
Zinc (mg/d)	5.67	3.58	4.94	7	0.88

[a] See Table A6-1 for sources for each EAR and SD. Requirements for lactating women are presented here.
[b] There is no EAR and no SD for calcium; 1,000 mg is the AI for lactating women.

Table A4-N1. Description of Sample, NPNL Women, R2

	n	Mean	SD	Median	Range
Age (year)	1798	35.9	11.5	42.0	20.0-49.0
Height (cm)	1798	151.1	5.1	150.9	132.7-168.8
Weight (kg)	1798	52.8	11.0	51.3	29.7-105.0
BMI	1798	23.1	4.5	22.5	13.4-41.9
Education[a]	1798	9.1	3.7	10.0	0-18
% Literate[b]	1798	96.7			
% Lactating	1798	0.0			
% Pregnant	1798	0.0			
	n	**Percent**			
BMI <16	42	2.3			
BMI 16-16.9	63	3.5			
BMI 17-18.49	175	9.7			
BMI 18.5-24.9	940	52.3			
BMI 25-29.9	438	24.4			
BMI ≥ 30	140	7.8			

[a] Years of schooling completed.
[b] Percent completing 3rd grade.

Table A4-N2. Energy and Macronutrient Intakes, NPNL Women, R2

	Mean	SD	Median	Range	Percent of kcal
Energy (kcal)	1,256.7	564.4	1,146.9	350.7-4,074.9	
Protein (g)	49.3	29.4	42.6	7.8-197.2	16
Animal source (g)	33.3	28.4	25.6	0.0-187.3	10
Plant source (g)	16.2	7.7	14.7	2.8-67.3	6
Total carbohydrate (g)	194.5	79.2	180.3	45.2-616.7	65
Total fat (g)	31.2	34.2	17.8	0.6-278.7	19

Table A4-N8. Mean and Median Nutrient Intake, NPNL Women, R2

Nutrient	Mean	SD	Median	EAR [a]	SD [a]
Energy	1,257	564	1,147		
Protein (All Sources) (% of kcal)	16	6	14		
Protein from animal sources (% of kcal)	10	7	9		
Total carbohydrate (% of kcal)	65	16	68		
Total fat (% of kcal)	19	14	15		
Thiamin (mg/d)	0.59	0.49	0.44	0.9	0.09
Riboflavin (mg/d)	0.62	0.81	0.47	0.9	0.09
Niacin (mg/d)	14.93	10.32	12.19	11	1.6
Vitamin B6 (mg/d)	1.16	0.69	0.98	1.1	0.11
Folate (µg/d)	323.45	171.83	301.87	320	32
Vitamin B12 (µg/d)	4.97	5.56	3.27	2.0	0.2
Vitamin C (mg/d)	36.74	82.15	10.63	38	3.8
Vitamin A (RE/d)	435.53	1,398.81	222.02	270	54
Calcium (mg/d)	317.28	245.78	250.56	1,000 [b]	- [b]
Iron (mg/d)	9.35	6.29	7.70	See Table [c]	
Zinc (mg/d)	5.58	3.18	4.84	6	0.75

[a] See Protocol Table A6-1 for sources for each EAR and SD. Requirements for NPNL women are presented here.
[b] There is no EAR and no SD for calcium; 1,000 mg is the AI value for NPNL women.
[c] Iron requirements are nonsymetric for NPNL women of reproductive age: see Table A6-2 for iron requirements for NPNL women.

Appendix 5. Women's Food Group Recall in DHS 5

579 Now I would like to ask you about (other) liquids or foods that (NAME FROM 577)/you may have had yesterday during the day or night. I am interested in whether your child/you had the item even if it was combined with other foods. **(15)**

Did (NAME FROM 577)/you drink (eat):		CHILD			MOTHER		
		YES	NO	DK	YES	NO	DK
a) Milk such as tinned, powdered, or fresh animal milk?	**a**	1	2	8	1	2	8
b) Tea or coffee?	**b**	1	2	8	1	2	8
c) Any other liquids?	**c**	1	2	8	1	2	8
d) Bread, rice, noodles, or other foods made from grains? **(16)**	**d**	1	2	8	1	2	8
e) Pumpkin, carrots, squash, or sweet potatoes that are yellow or orange inside? **(17)**	**e**	1	2	8	1	2	8
f) White potatoes, white yams, manioc, cassava, or any other foods made from roots?	**f**	1	2	8	1	2	8
g) Any dark green, leafy vegetables? **(18)**	**g**	1	2	8	1	2	8
h) Ripe mangoes, papayas, or [INSERT ANY OTHER LOCALLY AVAILABLE VITAMIN A-RICH FRUITS]?	**h**	1	2	8	1	2	8
i) Any other fruits or vegetables?	**i**	1	2	8	1	2	8
j) Liver, kidney, heart, or other organ meats?	**j**	1	2	8	1	2	8
k) Any meat, such as beef, pork, lamb, goat, chicken, or duck?	**k**	1	2	8	1	2	8
l) Eggs?	**l**	1	2	8	1	2	8
m) Fresh or dried fish or shellfish?	**m**	1	2	8	1	2	8
n) Any foods made from beans, peas, lentils, or nuts?	**n**	1	2	8	1	2	8
o) Cheese, yogurt, or other milk products?	**o**	1	2	8	1	2	8
p) Any oil, fats, or butter, or foods made with any of these?	**p**	1	2	8	1	2	8
q) Any sugary foods such as chocolates, sweets, candies, pastries, cakes, or biscuits?	**q**	1	2	8	1	2	8
r) Any other solid or semi-solid foods?	**r**	1	2	8	1	2	8

[15] A separate category for any foods made with red palm oil, palm nut, or palm nut pulp sauce must be added in countries where these items are consumed. A separate category for any grubs, snails, insects or other small protein food must be added in countries where these items are eaten. Items in each food group should be modified to include only those foods that are locally available and/or consumed in the country. Local terms should be used.

[16] Grains include millet, sorghum, maize, rice, wheat, or other local grains. Start with local foods (e.g., ugali, nshima, fufu, chapatti) then follow with bread, rice, noodles, etc.

[17] Items in this category should be modified to include only vitamin A rich tubers, starches, or yellow/orange/red vegetables that are consumed in the country.

[18] These include cassava leaves, bean leaves, kale, spinach, pepper leaves, taro leaves, amaranth leaves or other dark green, leafy vegetables.

Source: ORC Macro DHS website at: http://www.measuredhs.com/aboutsurveys/dhs/questionnaires.cfm. Accessed September 7, 2007.

Appendix 6: Estimated Average Requirements

Note that WHO/FAO requirements are not given separately for pregnant or lactating adolescents. For girls aged 15-18 who were pregnant or lactating, we used the requirements for pregnant/lactating adult women for most nutrients, as the requirements are higher. The exception to this is calcium, for which the requirement is higher for adolescents (1,300 mg/d), so this value (AI) was used for pregnant and lactating adolescents.

Table A6-1. EAR to be Used for Assessing PA [a, b]

	Females 19-50 years		Females 15-18 years		Pregnant women		Lactating women	
	EAR	SD [c]	EAR	SD [c]	EAR	SD [c]	EAR	SD [c]
Vit A (RE/d) [d]	270 [e]	54	365 [e]	73	370[e]	74	450 [e]	90
Vit C (mg/d)	38 [f]	3.8	33 [f]	3.3	46 [f]	4.6	58 [f]	5.8
Thiamin (mg/d)	0.9 [f]	0.09	0.9 [f]	0.09	1.2 [f]	0.12	1.2 [f]	0.12
Riboflavin (mg/d)	0.9 [f]	0.09	0.8 [f]	0.08	1.2 [f]	0.12	1.3 [f]	0.13
Niacin (mg/d)	11 [f]	1.6	12 [f]	1.8	14 [f]	2.1	13 [f]	2.0
Vit B_6 (mg/d)	1.1 [f]	0.11	1.0 [f]	0.1	1.6 [f]	0.16	1.7 [f]	0.17
Folate (µg/d)	320 [e]	32	330 [e]	33	520 [e]	52.0	450 [e]	45.0
Vit B_{12} (µg/d)	2.0 [e]	0.2	2.0 [e]	0.2	2.2 [e]	0.22	2.4 [e]	0.24
Calcium (mg/d) [g]	1,000	-	1,300	-	1,000		1,000	
Iron (mg/d)	See table A6-2	-	See Table A6-3	-	22 [h]	2.07	10% bioavail: 11.7 [i] 5% bioavail: 23.40	3.51 7.02
Zinc (mg/d)	Lower bioavail: 7 [j] Higher bioavail: 6 [k]	0.88 0.75	Lower bioavail: 9 Higher bioavail: 7	1.13 0.88	Lower bioavail: 10 Higher bioavail: 8	1.25 1.0	Lower bioavail: 8 Higher bioavail: 7	1.00 0.88

[a] All values are taken from WHO/FAO (2004) unless otherwise stated.
[b] Values for EAR are adjusted for an assumed bioavailability (WHO/FAO 2004). Thus, EAR refers to intake of the nutrients and not the physiological need for the absorbed nutrient.
[c] All SDs were calculated based on EAR and CV (SD = CV*EAR/100). CV is assumed to be 10 percent for all micronutrients except 15 percent for niacin (IOM 2000a), 20 percent for vitamin A (IOM 2000a), and 12.5 percent for zinc (IZiNCG 2004), 9.4 percent and 30 percent for iron, for pregnant and lactating women, respectively (IOM 2000a).
[d] One µg RE is equal to 1 µg all-trans-retinol, 6 µg β-carotene and 12 µg α-carotene or β-cryptoxanthin (WHO/FAO 2004). Note also the EAR for vitamin A refers to intake adequate to prevent the appearance of deficiency-related syndromes (WHO/FAO 2004).
[e] EAR taken from WHO/FAO (2004).
[f] EAR back-calculated from RNI (Recommended Nutrient Intake) (WHO/FAO 2004).
[g] This is not an EAR, but rather AI from IOM (1997). Following Foote et al. (2004), we calculate probabilities of adequacy to be 0 percent when intake ≤ 1/4 of the AI; 25 percent for intakes > 1/4 and ≤ 1/2 of the AI; 50 percent for intakes > 1/2 and ≤ 3/4 of the AI; 75 percent for intakes > 3/4 and ≤ AI; and 100 percent for intakes above the AI.
[h] EAR for iron intake, as presented in IOM (2000a, page 347). IOM estimates that bioavailability is 18 percent in the first trimester and 25 percent in the second and third. As information on month of pregnancy will not be available in most data sets, a weighted average of 23 percent absorption was used for all pregnant women.
[i] Gives EAR for iron for two levels of absorption for lactating women, based on IOM (2006). According to WHO/FAO (2004), either a very low (5 percent) or low (10 percent) absorption level can be assumed in a developing country setting.
[j] This is the estimated median requirement of zinc to be used for diets with a lower bioavailability (unrefined, cereal based diets), as suggested by IZiNCG (2004).
[k] This is the estimated median requirement of zinc to be used for diets with a higher bioavailability (mixed or refined vegetarian diets), as suggested by IZiNCG (2004).

Table A6-2. PA of Iron (mg/d) and Associated Ranges of Usual Intake in Adult Women Not Using Oral Contraceptives (OC) [a]

PA	Total absorbed iron	10% bioavailability	5% bioavailability
0	<0.796	<7.96	<15.91
0.04	0.796-0.879	7.96-8.79	15.91-17.59
0.07	0.880-0.981	8.80-9.81	17.60-19.65
0.15	0.982-1.120	9.82-11.20	19.66-22.42
0.25	1.121-1.237	11.21-12.37	22.43-24.76
0.35	1.238-1.343	12.38-13.43	24.77-26.88
0.45	1.344-1.453	13.44-14.53	26.89-29.08
0.55	1.454-1.577	14.54-15.77	29.09-31.56
0.65	1.578-1.734	15.78-17.34	31.57-34.69
0.75	1.735-1.948	17.35-19.48	34.70-38.98
0.85	1.949-2.349	19.49-23.49	38.99-47.01
0.92	2.350-2.789	23.50-27.89	47.02-55.79
0.96	2.790-3.281	27.90-32.81	55.80-65.63
1	>3.28	>32.81	>65.63

[a] This table was adapted from Table G-7 in IOM (2006), which gives PA for various levels of iron intake, assuming 18 percent absorption. In order to construct the table above, the associated level of *absorbed* iron was back-calculated from Table G-7. The table above presents usual intake levels to achieve the same amount of absorbed iron, but adjusted for absorption at two lower levels (10 percent and 5 percent).

Table A6-3. PA of Iron (mg/d) and Associated Ranges of Usual Intake in Adolescent Girls (15-18 Years) Not Using Oral Contraceptives (OC) [a]

PA	Total absorbed iron	10% bioavailability	5% bioavailability
0	<0.833	<8.33	<16.67
0.04	0.833-0.911	8.33-9.11	16.67-18.22
0.07	0.912-1.010	9.12-10.10	18.23-20.20
0.15	1.011-1.136	10.11-11.36	20.21-22.72
0.25	1.137-12.37	11.37-12.37	22.73-24.73
0.35	1.238-1.330.	12.38-13.30	24.74-26.60
0.45	1.331-1.424	13.31-14.24	26.61-28.49
0.55	1.425-1.526	14.25-15.26	28.50-30.53
0.65	1.526-1.647	15.27-16.47	30.54-32.94
0.75	1.648-1.805	16.48-18.05	32.95-26.11
0.85	1.806-2.077	18.06-20.77	36.12-41.54
0.92	2.078-2.354	20.78-23.54	41.55-47.09
0.96	2.355-2.664	23.55-26.64	47.10-53.28
1	>2.664	>26.64	>53.28

[a] This table was adapted from Table G-6 in IOM (2006), which gives PA for various levels of iron intake, assuming 18 percent absorption. In order to construct the table above, the associated level of *absorbed* iron was back-calculated from Table G-6. The table above presents usual intake levels to achieve the same amount of absorbed iron, but adjusted for absorption at two lower levels (10 percent and 5 percent).

DISCUSSION ON THE SELECTION OF EAR AND CV

Vitamin A

According to WHO/FAO,[45] the CV for vitamin A requirements is unknown. IOM, however, has used 20 percent. The WDDP uses the EAR of WHO/FAO with a CV of 20 percent. For adolescents (ages 15-18), WHO/FAO give a range for the EAR of 330-400 µg/d. The WDDP uses the mid-point of this range.

Calcium

WHO/FAO's EAR for calcium is quite high, and based on WDDP working group discussions, the justification for these high levels does not appear to be strong/persuasive. The group therefore proposed to use the method described in Foote et al.,[46] which takes the Adequate Intake (AI) of 1,000 mg/d as a starting point (or 1,300 mg/d for adolescents). The US Dietary Reference Intakes (US DRI) include AI when insufficient evidence is available to set an EAR and CV. The AI is an observed estimate of nutrient intake by a defined group of healthy people. Some seemingly healthy individuals may require higher intakes and some individuals may be at low risk on even lower intakes. The AI is believed to cover their needs, but lack of data or uncertainty in the data prevent being able to specify with confidence the percentage of individuals covered by this intake.[47] An individual with a usual intake of calcium at or above AI can be assumed to have an AI. Foote et al.[48] estimated probabilities of adequacy as follows:

0 percent when intake ≤ 1/4 of the AI,
25 percent for intakes > 1/4 and ≤ 1/2 of the AI,
50 percent for intakes > 1/2 and ≤ 3/4 of the AI,
75 percent for intakes > 3/4 and ≤ AI,
100 percent for intakes above the AI.

The AI is the same for pregnant and lactating women and adolescents and for NPNL women (1,000 mg/d for women and 1,300 mg/d for adolescents).

Iron

For estimating the probability of AI of iron for **NPNL women** the WDDP used a modified version of the PA tables in IOM.[49] The table is based on an assumption of 18 percent absorption, which is higher than expected in most developing country settings. The WDDP adjusted the table to find the PA for the two levels of absorption: five percent and ten percent. The tables above (one for adult women and one for adolescents) are thus entirely based on IOM.[50] Each researcher must select an assumed level of absorption (five percent or ten percent), based on his/her own expertise/knowledge of the local food intake.

For pregnant and lactating women, CVs have been given by the IOM. We therefore used the usual method of EAR for estimating PA for these two groups.

For pregnant women, the WDDP used the EAR suggested by IOM, because WHO/FAO[51] does not provide a requirement level for pregnant women. However, WHO/FAO states that iron absorption can increase up to approximately four times NPNL levels by the third trimester. Therefore, using IOM requirements – which assume 18 percent absorption in first trimester and 25 percent absorption in

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[45] 2004.
[46] 2004.
[47] IOM 1997.
[48] 2004.
[49] Table I-6 and I-7; 2000b.
[50] 2000b.
[51] 2004.

second and third trimesters – seems reasonable, in the absence of more specific guidance from WHO/FAO on absorption during pregnancy.

For lactating women, IOM gives an EAR for iron intake of 6.5 mg/d, assuming 18 percent absorption. We calculated the EAR of absorbed iron (6.5 mg times 18/100) as 1.17 mg/d. This is similar to the WHO/FAO EAR for lactating women (1.1 mg/day).[52] In the table above, we give EARs for two levels of absorption (five percent and ten percent). Researchers should apply the same levels of absorption as used for NPNL women. This study used coefficient of variation from IOM (30 percent) for lactating women.

Zinc

IZiNCG recently presented revised dietary zinc requirements, including EAR.[53] It also estimated a CV for the requirement distribution of 12.5 percent, indicating a narrower requirement distribution than implied by the WHO/FAO[54] CV of 25 percent. Hotz[55] assessed the internal validity of these new requirements and found that they predicted zinc status. They also yielded similar estimates of prevalence of zinc deficiency as did biochemical indicators, including among pregnant and non-pregnant women. Therefore, we adopted these requirements for the purposes of the WDDP.

As with the WHO/FAO requirements, researchers must choose a requirement depending on an assumption for absorption, which is based on knowledge of diet patterns and likely bioavailability. For mixed or refined vegetarian diets (with a phytate to zinc molar ratio of 4-18) an absorption level of 34 percent is suggested. For high phytate, unrefined cereal-based diets (molar ratio greater than 18), an absorption level of 25 percent is suggested.[56] Note that the level of absorption IZiNCG suggests for high phytate diets (25 percent) is considerably higher than the absorption level suggested by the WHO/FAO requirements document (15 percent).

[52] WHO/FAO 2004, page 265.
[53] IZiNCG 2004.
[54] 2004.
[55] 2007.
[56] IZiNCG 2004.