Out-of-Home Food Intake Is Often Omitted from Mothers’ Recalls of School Children’s Intake in Rural Kenya1,2

Constance A. Gewa,1 Suzanne P. Murphy,5 and Charlotte G. Neumann3,4

1Department of Community Health Sciences, School of Public Health and 4Department of Pediatrics, School of Medicine, University of California, Los Angeles, CA 90095; and 5Cancer Research Center of Hawaii, University of Hawaii, Honolulu, HI 96813

Abstract
Children often consume foods from outside the home (OH foods), which can decrease the accuracy of dietary recalls collected from the parents. The objectives of this study were to describe the types and composition of OH foods consumed by rural school-aged Kenyan children, to assess their contribution to the daily intake of the child, and to evaluate the ability of the mother to estimate intake of OH foods. To capture any seasonal differences, the study was conducted twice, once during a food shortage season and again during the subsequent harvest season. School children were asked to recall the types and amounts of OH foods consumed on the previous day. Mothers were asked to report on the types and amounts of all foods consumed by their children during the day of interest. OH foods contributed 13 and 19% of daily energy intake in the food shortage and harvest seasons, respectively, but mothers missed 77 and 41% of the OH energy intake. OH foods were most likely to be fruits (guavas, mangoes, and wild fruit) and starchy foods (bread and fried wheat dough). Nutrients most likely to be under-reported on the mothers’ recalls were vitamin C (59 and 26% was missed in the food shortage and harvest seasons, respectively) and vitamin A (~22% was missed in both seasons). To ensure that all food intake is recalled, it is important that school children be included in dietary assessment interviews about their own intakes. J. Nutr. 137: 2154–2159, 2007.

Introduction
Children often consume foods from outside the home (OH)6 (1–3), which can decrease the accuracy of dietary recalls collected from the parents. Consumption of OH foods has been documented among school-age children and adult populations in developed nations (2,3), but few studies have assessed OH consumption among populations in less developed countries. Studies among Nigerian adolescents, college students, and urban market women found that substantial amounts of their daily nutrient intake came from street foods (1,4,5). A study among Kenyan urban populations found that adult men, who spent large amounts of their days outside the home, reported higher consumption of OH foods when compared with adult women and children (6). However, little is known about the contribution of OH foods to total intake among school children, especially those living in rural settings.

The types of OH foods consumed may change with the seasons. For example, during times of food abundance, such as harvest times, communities tend to consume higher amounts of the commonly cultivated foods. In periods of food shortage, however, less familiar OH foods often are eaten as a survival strategy (7–10). In 2000, Kenya suffered a period of food shortages associated with failed “long rains” between March and May (11) and with extensive crop losses, the population was forced to rely on other survival strategies to place food on their tables. Significantly decreased individual and household energy intake levels have been reported during hunger/lean seasons in different parts of Africa (12–14). With less food being offered at the table, school-age children, who generally spend a large part of their day outside, will look for and consume other OH foods.

As part of the ongoing Child Nutrition Project (CNP), a feeding intervention study from 1998–2001 (15), we were able to obtain a self-reported measure of OH foods that the school children consumed both during the season of food shortage and the subsequent harvest time the following year.

The objectives of this study were 1) to describe the types and composition of OH foods consumed by rural school-aged Kenyan children; 2) to assess their contribution to the daily intake of the child; and 3) to evaluate the ability of the mother/caretaker to estimate the child’s OH foods by the 24-h recall method.

Subjects and Methods

Subjects. The OH study targeted all the 900 school children participating in the CNP study. However, because of difficulties in accessing the...
children on a timely basis, only 619 and 259 children were interviewed during the food shortage and harvest seasons, respectively. Of those interviewed, 16 (food shortage season) and 14 (harvest season) did not have matching 24-h recalls for comparison, leaving sample sizes of 603 and 245 school children. A total of 150 children participated in both seasons. Informed verbal consent for the OH study was obtained from the mothers and verbal assent from the school children. The UCLA Institutional Review Board, University of Nairobi Human Subjects Review Board, and the Kenyan Ministry of Education, Science and Technology approved the study. Also, verbal consent was obtained from the local administrators, community chiefs, and residents.

**Socioeconomic status score.** A composite socioeconomic status (SES) score was developed for each family based on land ownership and usage, income, household possessions, types of houses, and involvement of parents in leadership and community positions. The SES score has been validated by community leaders using their own criteria for ranking SES (15).

**Dietary intake.** Dietary data collection during the food shortage period began in mid May, 2000 and lasted 4.5 mo. During the harvest period, data collection was conducted in February and March, 2001. A single 24-h recall (from the mother/caretaker) and OH food recall (from the child) was obtained for the same day in both seasons. The 24-h recall was already being used for dietary assessment as part of the larger CNP study. A standard recall protocol was followed and has been previously described (15). Mothers were not asked to identify whether a food was consumed at home or OH. Enumerators who were already administering 24-h recall interviews to the mothers were trained to administer the OH food recall interviews to the school children. The same interviewer conducted both the 24-h and the OH food recall interviews in the home. School children were interviewed without their mother’s/caretaker’s presence. OH foods were defined as any food consumed while outside the home. The school children were asked if they had, on the previous day, consumed any foods while outside the home. If they responded positively, they were then asked to recall the type and amount of OH foods consumed. Time spent outside the home was categorized into 3 time periods to assist in the recall: “on the way to school/out-of-home destination,” “at school/out-of-home destination” and “on the way back home.” The school children were then asked if they had consumed any other OH foods outside the defined time zones such as during chores or play. We recorded all foods mentioned, with the exception of plain water, and probed further to obtain food descriptions, types, and amounts consumed. Thirteen percent (79 of 603) and 9.4% (23 of 245) of the children indicated that they had not consumed any OH foods in the food shortage and harvest seasons, respectively.

For both the 24-h recall and the OH recall, estimation guides consisting of food models, measuring cylinders (250 mL and 1000 mL), and local household measures were utilized. The food models were 2-dimensional line drawings of locally available foods in different sizes and the household measures consisted of spoon, cup, and tin measures. Children were asked about the primary ingredients used in mixed dishes consumed outside the home so that an appropriate standard recipe could be used. Standard recipes are average recipes that help in estimating the rec topsentation of the day’s intake. These adjusted 24-h recalls were then used in further analyses.

**Statistical analysis.** SAS version 8.2 (SAS Institute) was used for data analyses. The “mixed” procedure was used to compare nutrient intakes between seasons and to assess predictors of nutrient intake from OH foods for 150 children who participated in the study at both seasons. An a level of 0.05 was used to indicate statistical significance. Response variables were log-transformed (17) and adjusted for energy intake. Interactions with sex were included to test for any gender differences.

### Results

The demographics for the study subjects were similar for both surveys (during the food shortage season and the harvest season). Of the children with a complete set of recalls, 53 and 60% were male. School children’s ages ranged from 6 to 16 y during the food shortage season and 7 to 17 y in the harvest season. The mean age of all children was $9 \pm 1.4$ y and $9.7 \pm 1.7$ y in the food shortage and harvest seasons, respectively. Mothers/caretakers’ ages ranged from 20 to 59 y with a mean (±SD) of $34 \pm 7$ y. The household size was $7 \pm 3$ with a range from 2 to 18. SES scores were similar in the food shortage (77.5 ± 21.7) and harvest (76.0 ± 23) seasons.

### Types of OH foods reported.

School children reported consuming a median of 2 OH food items per day (range 1–9) during the food shortage and a median of 1 OH food during the harvest period (range 1–9). Most of the food items consumed by the school children while outside the home were single food items rather than mixed dishes (Table 1). Fruits and starchy foods were the most common types of OH foods reported during both seasons. The most common fruits in the food shortage season included wild fruits such as Vitex payos and avocado fruits, which contributed to the fat intake from OH foods. Sugarcane and hard candies (often sold at the local shops) were the most common sweets during this season. Meats were seldom reported as OH foods. During the harvest season, ripe mangoes were the most commonly consumed OH fruit. Boiled green maize-on-the-cob was also frequently reported. Termitie swarmers and wild fruits were not consumed and ripe papayas and sweets were less common in the harvest season.

### Nutrient intake.

Total energy intake and energy intake from OH foods was significantly higher for boys than for girls at both seasons. However, the percent of energy from OH foods did not

**Food group and nutrient intake calculations.** Food groups of interest included starchy foods, vegetables, fruits, dairy, meat, fish, dry beans/peas, nuts, high fat foods, fats, sweets, and beverages. Single food items and ingredients in food mixtures were each assigned to the appropriate food group. Nutrient intakes were calculated for each child using an international food composition table that was adapted for use in this study (16). This table contains complete nutrient values for the common foods consumed in rural Kenya. The nutrient content of less common foods, such as termitie swarmers, wild fruit, and loquots, were estimated from similar foods. Nutrients of interest included energy, carbohydrates, protein, fat, iron, zinc, and calcium; vitamins B-12, A, and C; and riboflavin.

**Identifying foods that were missed on the 24-h recall.** Food items on the OH recall were matched to the 24-h recall and were considered the same if the food appeared in both the OH recall and the 24-h recall interview at approximately the same time of day. Those that appeared only on the OH recall were considered missed by the mother’s 24-h recall. A revised 24-h recall was developed by adding the missed foods from the OH recall. If a food item was similar on the 2 recalls, but not exactly the same, we did not count it as a missed food and assumed that the mother’s version was correct. These mis-specified items did not occur often (<3% of the food items) and were almost always mixtures. We assumed that the mother was more knowledgeable about the composition of mixtures than the child. The revised recall was then used to calculate a new daily nutrient intake estimate, which should provide a more accurate representation of the day’s intake. These adjusted 24-h recalls were then used in further analyses.
TABLE 1  List of commonly consumed OH foods by season in decreasing order of occurrence

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<thead>
<tr>
<th>Food shortage season</th>
<th>Mixed dishes</th>
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<tr>
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<tr>
<td>Wild fruit</td>
<td>Tea</td>
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<tr>
<td>(Vitex payos)</td>
<td>Meat soup</td>
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<tr>
<td>Avocado</td>
<td>Githeri</td>
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<tr>
<td>Guavas</td>
<td>Porridge</td>
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<tr>
<td>Sugarcane</td>
<td>Fried wheat dough</td>
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<tr>
<td>Macadamia nuts</td>
<td>Biscuits/cookies</td>
</tr>
<tr>
<td>Hard candy</td>
<td>Plain white bread</td>
</tr>
<tr>
<td>Ripe bananas</td>
<td></td>
</tr>
<tr>
<td>Termite swarmers</td>
<td></td>
</tr>
<tr>
<td>Meat</td>
<td></td>
</tr>
<tr>
<td>Soft drink/fruit juice</td>
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<tr>
<td>Milk</td>
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<table>
<thead>
<tr>
<th>Harvest season</th>
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<tbody>
<tr>
<td>Ripen mangoes</td>
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<tr>
<td>Boiled green maizes</td>
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<tr>
<td>Macadamia nuts</td>
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<tr>
<td>Loquats</td>
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<tr>
<td>Hard candy</td>
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<tr>
<td>Ripe papaya</td>
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<tr>
<td>Ripe bananas</td>
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<tr>
<td>Guavas</td>
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<td>Milk</td>
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Differ: 13.5% for boys vs. 12.8% for girls (P = 0.80) during the food shortage season and 20.8% for boys vs. 17.3% for girls (P = 0.50) during the harvest season. Therefore, for simplicity, the intakes are given for the genders combined (Table 2).

As expected, both the total daily nutrient intake and intake from OH foods were higher in the harvest season compared with the food shortage season (Table 2). OH foods provided mean daily intakes of 987 ± 1062 kcal (236 ± 254 kcal) and 1540 ± 2381 kcal (368 ± 569 kcal) in the food shortage and harvest seasons, respectively, representing 13 and 19% of the daily energy intake. Significant between-season differences were noted in OH foods’ contributions to some nutrients (Fig. 1A). OH foods provided substantial amounts of vitamin C (~65% of total intake in both seasons) and vitamin A (~30% of intake in the food shortage season and 70% in the harvest season).

In multivariate analyses, interactions with the child’s gender were tested and then removed from the model, because they were not significant. The food shortage season was associated with significantly lower intakes of energy, vitamins A and C, folate, and calcium compared with the harvest season (Table 3). Although the regression coefficients cannot be interpreted directly because the response variables were log-transformed in the analysis, we calculated that energy intake from OH foods in the food shortage season was only 42% of OH energy intake in the harvest season after adjusting for the other variables (Table 3). The food shortage season was also associated with lower vitamin A and C, calcium, and folate intakes from OH foods. These were equivalent to only 24, 29, 56, and 31% of harvest season OH vitamin A, vitamin C, calcium, and folate intakes, respectively. Being older was associated with higher energy intake from OH foods, whereas receiving CNP snacks at school was associated with a significantly lower energy intake from OH foods.

**OH foods omitted from the mothers’ recalls.** Eighty-four and 71% of the school children reported at least 1 OH food item that was not recalled by their mothers/caretakers in the food shortage and harvest seasons, respectively. Overall, a higher percentage of OH items were not captured by the mothers’ 24-h recall during the food shortage season compared with the harvest season (80 vs. 54%). Starches and fruits in both seasons and vegetables in the harvest season were most likely to be omitted by the mothers (data not shown).

Notable amounts of energy and nutrients from the OH foods reported by the school children were omitted from mothers’ recalls. Seventy-seven and 41% of OH energy intake in the food shortage and harvest seasons, respectively, were omitted from the mothers’ recalls. Proportions of other nutrients from OH foods omitted by mothers ranged from 68% for vitamin B-12 to 88% for vitamin C in the food shortage season. Generally, omission levels were slightly lower in the harvest season, ranging from 32% for vitamin A to 82% for vitamin B-12.

The impact of such omissions on the total daily intake (including OH foods that were originally omitted from the mother’s recall) was assessed (Fig. 1B). Vitamins C and A were most affected. Overall, underestimation of actual daily nutrient intake tended to be higher in the food shortage season compared with...
the harvest season, with significant differences noted in fat and vitamin C omission rates.

Discussion

Researchers commonly rely on caretakers, especially mothers, to report on the types and amounts of food consumed by young children. The 24-h recall method continues to be the method of choice in research involving dietary assessment in Africa and elsewhere. However, despite improved recall strategies, such as the use of double-pass method (18,19), relatively high amounts of foods that children eat outside the home are likely to be missed on a caretaker’s 24-h recall of the child’s intake, because they may not be aware of the child’s consumption of many of these foods. Furthermore, mothers and/or adult respondents may have their own perception of what foods need to be reported on a recall. Garcia et al. (20) noted that mothers of Mexican preschoolers did not classify foods eaten between meals, such as fruit, sweet beverages, or cookies, as food. Nearly all OH foods also are between-meal food items and thus may be omitted from dietary recalls. Our study provides data to assess how well the 24-h recall captures school children’s OH foods and thus makes an important contribution to improving recall methodology among study populations that include children.

Although the proportion of energy from OH food items increased in the harvest season, giving an indication of increased food availability and accessibility in the study area, the variety was lower than during the food shortage season. Wild fruit, termites, and macadamia nuts, which were reported during the food shortage season, are not commonly found within the homes. However, the most common OH food items during the harvest season (ripe mangoes and maize-on-the-cob) were often found within the homes and farms. The presence of unfamiliar foods and the greater variety of OH foods during the food shortage season show that careful probing is needed in dietary assessments of both parents and children during this season. Unusual foods that were reported during an earlier drought in the study area included yellow maize, cassava tubers, green papaya, insects, and grubs (21). Foods that are not normally cultivated, such as wild fruits, leaves, roots, and barks, are important food sources during lean seasons and have also been reported in other parts of Africa (7,9). Gathered wild fruits, seeds, and grasses helped offset the effects of food shortages among Zimbabwean households (9). A study among Burkina Faso women noted that cereal depletion seasons were accompanied by increased consumption of wild foods such as shea nuts and leafy vegetables (10). Although there is still lacking or limited information on the composition of wild foods such as insects, fruits, and leaves, these foods are more likely to contribute to significant portions of daily dietary micronutrient intake. For example, consumption of wild vegetables among Vietnamese women contributed to a significant proportion of the food variety and daily intakes of calcium, iron, thiamin, riboflavin, niacin, vitamin C, and folate (22–24). Among Benin women, foods gathered from wild sources provided 6–9% of their daily energy intake, with the highest consumption during the preharvest seasons (8).

Older children reported significantly higher amounts of energy from OH foods. Older children are likely to be more aggressive than the younger school children in gathering OH foods. Children who received any CNP food supplement also reported less energy from OH foods compared with those that did not, perhaps because they were not as hungry while outside the home.

OH foods provided 13–19% of the children’s energy intake in this study. Non-home-prepared foods contributed 13–22% of...
school children’s intake in urban Kenya (6), while street foods provided 25% of daily energy intake among Nigerian adolescents (4). Whereas the urban Kenyan school children received only 12–14% of vitamin A from non-home-prepared foods, the rural Kenyan school children in the current study received 28–71% of their daily vitamin A intake from OH foods.

Relatively high amounts of OH foods were omitted from the mothers’/caretakers’ 24-h recall. The food shortage season contained the highest overall omission rates (80%) compared with the harvest season (54%). Mothers/caretakers did not seem to be aware of most of the OH foods in both seasons. As a result, 68–88% and 32–82% of nutrient intakes from OH foods during the food shortage season and harvest seasons, respectively, were missed on the analysis based on the caretaker’s recall. Such omissions highlight the importance of allowing school children to assist with dietary assessment. Children’s consumption of OH foods, especially for snacks such as candy, biscuits, cakes, salted snacks, and processed fruit drinks, is expected to increase as grocery stores and supermarkets open in areas where there previously were none, and accurately capturing this information is pertinent to describing and estimating changes in dietary patterns. Increased consumption of processed and ready-to-eat foods has been documented in urban areas in India, South Africa, and Tanzania (25–27).

Vitamins C and A were the nutrients most affected by OH food omissions. Such underestimates of intake may obscure relationships between nutrient intake and outcomes such as growth, deficiency states, infections, cognition, and activity. In addition, vitamin C is important in estimating iron bioavailability, because it is a strong enhancer of nonheme iron absorption (28). Thus, underestimating vitamin C intake will contribute to underestimation of absorption levels among different populations. Although to a lesser extent, school children’s energy intake estimates were also affected as a result of OH food omissions from the 24-h recall. Ten and 8% of the school children’s daily calories were not accounted for in the food shortage and harvest seasons, respectively.

The accuracy of estimates of energy intakes and nutrients is dependent on a comprehensive food composition table for local foods. We used an international table for these analyses (16), because it has been developed specifically for use in developing countries such as Kenya. Although most of the nutrient values in the table are based on food analyses, some of the values are imputed from similar foods. As a result, values for unusual foods may be less accurate than those for commonly consumed foods and the resulting intake calculations must be considered estimates rather than exact values.

Another limitation of our study was the assessment of OH foods using the child’s recall, because school children may not have accurately reported all of the OH foods. Ideally, the children should have been followed when they were outside the home so that amounts of foods consumed were observed and recorded, but our resources did not permit this approach. However, the interviewers were trained to provide careful probing and the school children that participated in this study were old enough (mean age of 9 and almost 10 y in food shortage and harvest seasons, respectively) to recall OH foods with accuracy. Dietary recalls, with or without memory prompts, have been shown to be feasible and relatively reliable among school-aged children, with accuracy levels increasing with children’s age or grade (29–31).

These results caution against the underutilization of children themselves and over reliance on proxies in assessing their dietary intake. School children spend appreciable amounts of their days outside the home and may consume substantial amounts of foods that are unknown to their mothers or other caretakers. Mothers and caretakers are key persons in dietary assessment studies, because they are involved in most of the food preparation and serving in Africa, as well as in most other developing countries. However, the mothers may need help in recalling and estimating foods, especially OH foods consumed. It is important that school children be included in dietary assessment interviews about their own intakes. Inclusion of children will reduce both food omission and misspecification in dietary recall methodology.

### Literature Cited