GLOBAL LIVESTOCK CRSP

# Changes in Dietary Quality for School Children in Kenyan Villages

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Child Nutrition Project

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*Little is known about the changes in dietary quality for children living in rural Kenya. Nutrient intakes of schoolchildren in the Embu District were measured cross-sectionally in 1984-85 as part of the Nutrition CRSP (n=138), and again in 1998 as part of the Child Nutrition Project (n=506). The average age of the children was 7.6 years at both timepoints. There was a substantial improvement in energy intake (from 1434 to 1791 kcal/d), as well as an increase in the percent of energy from fat (from 11% to 16%). The presence of a severe drought during 1984 contributed substantially to the lower energy intake at the earlier time point. However, intakes of protein and animal protein as a percent of energy were essentially unchanged. Intakes of most micronutrients improved only slightly; vitamin $B_{12}$, iron, zinc, and calcium intakes were particularly low relative to recommended intakes. Thus, in spite of the improvement in energy intake, the quality of the diet has not changed substantially. The prevalence of stunting (based on height for age) and malnutrition (based on weight for age) was high at both times, indicating that both the quantity and the quality of the diet remain poor for many young schoolchildren.*

## Background

The Nutrition Collaborative Research Support Program (NCRSP) was designed to measure the impact of mild to moderate malnutrition on various functional outcomes. One of the sites for the NCRSP was Embu District, Kenya, where there was known to exist a high prevalence of stunting and malnutrition, especially among children. As part of this study, dietary data were collected to determine nutrient intakes of young schoolchildren between 1984 and 1986. Both dietary quality (intake of protein, vitamins and minerals, compared to recommendations) and dietary quantity (energy intake compared to recommendations) were examined.

The Child Nutrition Project (CNP) of the Global Livestock Collaborative Research Support Program (GL-CRSP) was also conducted in Embu District, Kenya, approximately 15 years after the NCRSP (1998-2001). Once again, dietary data were collected for young schoolchildren, and dietary quality and quantity were examined. Thus, we have a unique opportunity to compare intake data from these two timepoints to see if there have been improvements in the diets.

## Measures and Data Analysis

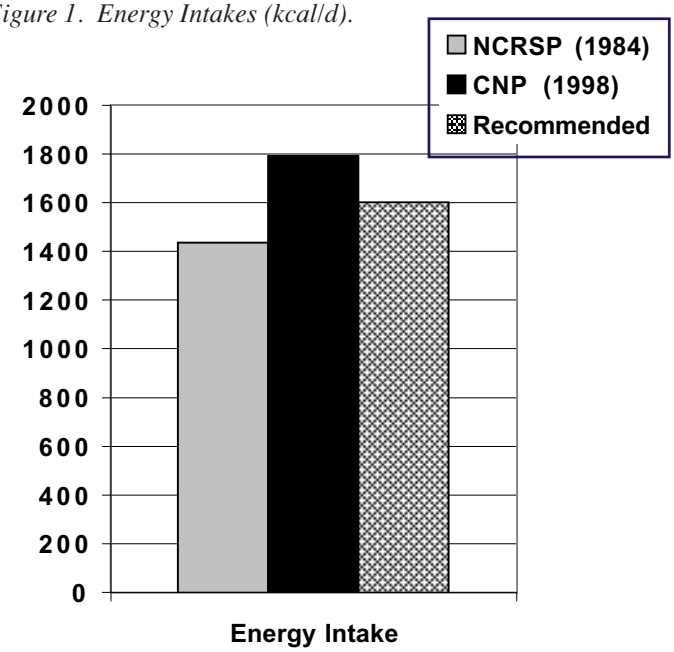
Intake data from the NCRSP were collected by enumerators who weighed foods as they were prepared, collected detailed information on the ingredients in mixed dishes, and measured the amount of food consumed by each member of the family, including the targeted schoolchild. The goal was to collect at least two days of intake data per month for each family, for at least 12 months. The intakes presented here are for children with at least 6 days of intake (N = 138, average age = 7.6 years). Energy and nutrient intakes were calculated using a food composition table developed specifically for the study (Murphy et al., 1991). More details on these procedures may be found in Murphy et al., 1995.

For the schoolchildren participating in the CNP, intake data were collected by enumerators who interviewed the child's mother to determine foods that the child ate on the previous day. Detailed information was collected on the types and amounts of foods consumed, as well as the ingredients in mixed dishes. Intakes were measured on three occasions before the start of the feeding program, and then periodically throughout the intervention period. Here we present the dietary data collected for the children during the first visit of the baseline period in the summer of 1998 (N = 507, average age = 7.6 years). The food composition table developed for the NCRSP was updated and extended, and used to calculate energy and nutrient intakes for each child.

## Major Findings

Average energy intake for schoolchildren increased

*Figure 1. Energy Intakes (kcal/d).*




substantially over the time between the two studies, from 1434 kcal/d, to 1791 kcal/d (Figure 1). For children between 7 and 10 years of age, the recommended daily energy intake is approximately 70 kcal/kg, while for children between 5 and 7 years, it is approximately 90 kcal/kg (FAO/WHO/UNU, 1985). We used the average of these two estimates, or 80 kcal/d, to derive an energy requirement of 1600 kcal/d for these schoolchildren weighing, on average, about 20 kilograms. Thus, we conclude that the average energy intake from the earlier study (NCRSP) was clearly inadequate, while the average from the more recent study (CNP) was closer to the recommendations.

One way to examine dietary quality is to calculate the percent of energy that comes from fat, protein, and animal protein. In developing countries, starchy staples like maize and rice provide the majority of the calories in a typical diet (Calloway et al., 1992). As resources permit, families usually add animal products and fats like margarine to improve the quality of the diet. There was a clear increase in the percent of energy from fat in the time between the two studies: from 11.2% to 16.0%. These fat intakes are still much lower than those in the U.S., which averaged about 33% of energy from fat for schoolchildren in 1994-96 (USDA, 2000). Protein intakes were between 11% and 12% of energy in both studies in Embu, and appear to have been adequate at both times. Animal protein intake was very low, averaging only 0.8% of calories in the earlier study, and 1.0% in the CNP.

Another measure of dietary quality is the adequacy of micronutrient intakes. Although the total intake of vitamins and minerals has increased over time, most intakes are still well below recommendations (Figures 2 and 3). Figure 2 shows zinc and iron intakes adjusted for bioavailability of these nutrients (Murphy et al., 1995). Although total intakes of these minerals may appear to be high, the bioavailablity is often low due to factors in the diet that inhibit absorption (such as phytate and dietary fiber). Thus, it is important to estimate the amount of iron and zinc *absorbed*, rather than the amount *eaten*. When this is done for the Embu children, intakes of both minerals remain well below the recommended levels as specified in FAO/WHO (1988) and FAO/WHO/IAEA (1996).

A similar situation was found for vitamin A, where intakes in mg of retinol activity equivalents (RAE) have improved, but are still below recommendations (Figure 3). Note that this newer method of measuring vitamin A activity reduces the availability of pro-vitamin A carotenoids compared to the previously used retinol equivalent (IOM, 2001). Calcium intakes have also improved, but only slightly (from 228 mg/d to 297 mg/d) and are less than half of the recommended 800 mg/d for children of this age (IOM, 1997). Intakes of vitamin $B_{12}$ are also of concern because there are so few animal products in the children's diets, and this vitamin is not found in plant foods.

*Figure 2. Mineral Intakes (available mg/d).*

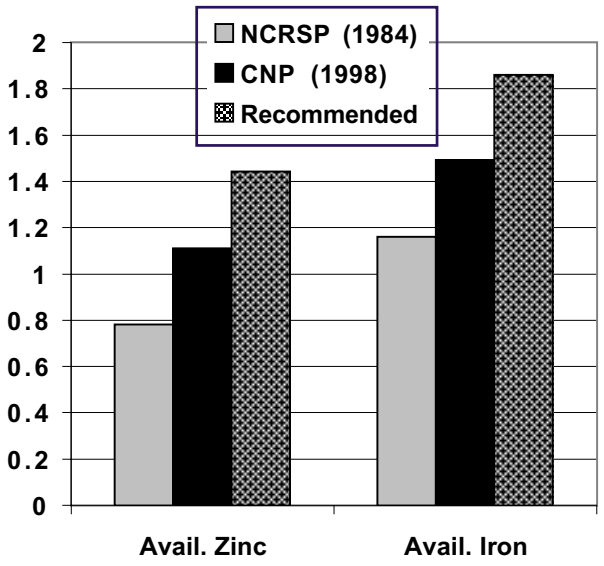
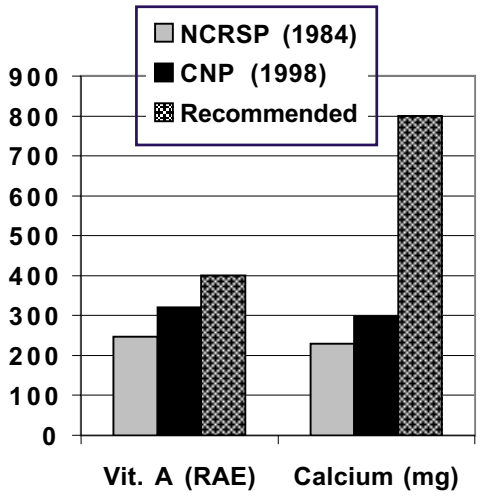


*Figure 3. Vitamin A and Calcium Intakes.*




## Practical Implications

Although the quantity of food consumed by schoolchildren in Embu appears to have increased since 1984-85, the quality of the diet remains low. Nutrients of particular concern are calcium, iron, zinc, vitamin A, and vitamin $B_{12}$. We would expect to find a substantial proportion of the children with inadequate intakes of these nutrients, leading to health problems such as anemia (both microcytic and macrocytic), rickets, and night blindness.

Differences between 1984-85 and 1998 may be exaggerated by the presence of a drought in Embu in 1984. The drought reduced food availability substantially for most families, and thus contributed to particularly low intakes during the NCRSP (Neumann et al., 1992). However, periodic food shortages are the norm in this district, and while intakes may have been lower than usual in 1984, the average across 1984 and 1985 may accurately reflect usual food availability in the 1980's. A drought also occurred in 1999-2000 in this district, but was after the period reflected by the data presented here (for mid-1998). The use of different methods for measuring intake (having observers measure all foods in the NCRSP vs. having the mothers recall the previous day's intake in the CNP) may also have artificially increased the differences in intake estimates between the two studies.

One easily measured outcome of poor dietary quality is a child's size. Many children in Embu are stunted (with a low height for their age) or malnourished (with a low weight for their height). In spite of apparent improvements in the diets across a fifteen year timespan, the percent of the children who are stunted has decreased only marginally (from 20.5% to 19.4%). The percent malnourished has decreased from 37.2% to 30.4%, but is still unacceptably high. Poor diets, intestinal parasites, malaria, and infectious diseases all play a role in poor growth for children in Embu, and all must be addressed before these children can achieve optimal health.

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## Further Reading


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The GL-CRSP Child Nutrition Project (CNP) was established in 1997 and is built on a decade of research conducted by the Nutrition CRSP (USAID) in the 1980s. The Child Nutrition Project research addresses food-based approaches to micronutrient deficiencies, particularly of children with respect to both the quantity and quality of food intake. The study is centered on a controlled intervention feeding trial of school children in Embu, Kenya. The project is directed by Dr. Charlotte Neumann and Professor Nimrod Bwibo as Principal Investigators and Suzanne Murphy, Marion Sigman, Shannon Whaley, and Lindsay Allen as Co-Investigators. Email contact for Dr. C. Neumann is: cneumann@ucla.edu.

The Global Livestock CRSP is comprised of multidisciplinary, collaborative projects focused on human nutrition, economic growth, environment and policy related to animal agriculture and linked by a global theme of risk in a changing environment. The program is active in East Africa, Central Asia and Latin America.


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