EGERTON UNIVERSITY

TEGEMEO INSTITUTE OF AGRICULTURAL POLICY AND DEVELOPMENT

WPS 41/2011b

Food Security in Urban Households: An Analysis of the Prevalence and Depth of Hunger in Nairobi and its Relationship to Food Expenditure

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Tegemeo Institute

Tegemeo Institute of Agricultural Policy and Development is a Policy Research Institute under Egerton University with a mandate to undertake empirical research and analysis on contemporary economic and agricultural policy issues in Kenya. The institute is widely recognized as a centre of excellence in policy analysis on the topical agricultural issues of the day, and in its wide dissemination of findings to government and other key stakeholders with a view to influencing policy direction and the decision making process. Tegemeo's empirically based analytical work, and its objective stance in reporting and disseminating findings has over the past decade won the acceptance of government, the private sector, civil society, academia, and others interested in the performance of Kenya's agricultural sector.

Published 2011

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Tegemeo Institute acknowledges the resources support for its research programmes from key partners including the United States Agency for International Development (USAID), Michigan State University (MSU), and Egerton University, Njoro Kenya. Others include the World Bank and the International Development Research Centre (IDRC).

Abstract

Thirty percent (3 million) of the food insecure in Kenya are located in the urban and peri-urban centres making urban food insecurity and poverty a major concern. Because markets are the main source of food for the urban population, issues of food availability, affordability, adequacy and the ability of the market and public programmes to deliver food come to the fore. Up to date information on the proportion of food insecure and severity of hunger allow governments and development agencies to effectively plan, monitor and evaluate their interventions. Targeting and packaging of assistance need also to be informed to be effective.

Aggregate or country level estimates of food security are limited in their usefulness because they do not provide useful information for targeting specific areas or groups of people. Data on food acquired by households have been found useful in assessing food security status in households and are considered reliable in determining whether households acquired sufficient food in terms of quantity and quality. This study provides estimates of the prevalence and depth of food insecurity in households in Nairobi based on consumption and expenditure data that were collected directly from households in Nairobi, Kenya in November 2009. The indicators used for food insecurity are the proportion of the consuming inadequate dietary energy and the deficiency in energy intake.

The study shows that 44 percent of households residing in Nairobi are under-nourished with up to 20 percent being ultra hungry (i.e. daily per capita dietary energy intake is less than 1,600 kcal). Majority of the undernourished fall in the low income groups (quintiles 1 to 3) with a staggering 80, 60 and 40 percent of the households falling in the first, second and third quintiles respectively. Furthermore, 50, 20 and 17 percent of households in the lowest, second and third quintiles respectively were ultra hungry. The study also shows that a decrease in per capita expenditure on total food, staples, and all food groups except meats, signals increased food insecurity in urban households.

The study further shows that the cash transferred to poor and vulnerable households was adequate for bridging the energy deficit in all households when the energy deficit is met using the relatively cheaper 'posho' maize meal. The study also shows that a food subsidy programme covering households in the first, second and third quintiles reaches over 83 percent of the ultra hungry, 81 percent of the medial hungry and 69 percent of the subjacent hungry. The study however supports targeted food subsidies since the support needed varies with the income and hunger status of a household.

Key Words: consumption, dietary energy, hunger, depth, prevalence, Nairobi

Acknowledgements

Support for this research was provided by the Tegemeo Agricultural Policy Research and Analysis (TAPRA) Project between Tegemeo Institute/Egerton University and the Department of Agricultural Economics, Michigan State University. Financial support for the project was provided by the Kenya Mission of the United States Agency for International Development. We sincerely thank the Kenya national Bureau of Statistics (KNBS) for their support in sampling process and data collection. We also wish to express our gratitude to Dr. Melinda Smale for reviewing this paper and to Ms. Mercy Mutua for formatting it for publication.

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1. Introduction and Background

Food is categorised as a basic human right (FAO, 1996; Chapter 4 in Constitution of Kenya, 2010), yet, food and nutrition insecurity is a daily reality for millions of Kenyans living in both the rural and urban areas. According to projections made by FAO, the number of under-nourished in the world increased from 848 million in 2003-05 to 1,020 million in 2009 due to the economic downturn (food crises, financial crunch, economic recession). The impacts of this economic downturn and climate change are expected to be highest among the poor and hungry (IFPRI, 2010). Inadequate food consumption has serious implications for health, cognitive ability of children, labour productivity and often results to social ills like crime. Food security is therefore an essential element of overall human well-being and an important milestone on the path to complete poverty alleviation, a development priority.

A government's role is to institute plans and policies that ensure that all its people have adequate food at all times. Yet poverty and hunger[1] continue to be the most pervasive problem in Kenya today. About a half (46 percent) of Kenya's estimated 35.5 million people live below the poverty line, and some 7.5 million people live in extreme poverty. A recent IFPRI report (IFPRI, 2010) classified the status of hunger in Kenya as 'alarming', indicating that negligible progress was made between 1990 and 2009 in terms of the global hunger index (Kenya's hunger index was 20 in 1990 and 20.2 in 2009). Authors of this report estimated that 27 percent of Kenyans were ultra hungry with a daily dietary energy intake of less than 1,600 kcal per adult equivalent (ae). They attribute the alarming level of hunger to amongst others, a high number of people who cannot meet their calorie requirement. Their estimate is that about 50.6 percent of the population lacks access to adequate food and, even the little they are able to obtain is of poor nutritional value and quality. During periods of drought, heavy rains and/or floods, the number of people in need of relief food rises. The most recent crisis was experienced in early 2009, when 10 million Kenyans were declared food insecure.

[1] Goal number one of the millennium development goals is to eradicate extreme poverty and hunger. The target set is to halve, between 1990 and 2015, the proportion of people who suffer from hunger (Target 1.A: in MDG official list).

The population lacking access to adequate food included those who were unable to purchase food either due to lack of financial resources (3.5 million) or because the prevailing food prices were too high. The world prices for staple foods recorded dramatic increases between 2007 and 2008 and the food price index rose by a massive 23 per cent in 2007 (FAO, 2008). In Kenya, by the first quarter of 2009, the wholesale price of maize was 100 to 140 percent higher than those in January 2007 while beans were selling at prices 90 to 100 percent higher than the prices in January 2007. Although the surging prices appear to have softened during the second half of 2009, the prevailing prices for cereals and pulses remained well above their January 2007 levels by at least 80 to 100 percent. The severity of the effect of food prices and low affordability on food security cannot be overemphasized. For example, it is reported that urban slums which are home to 43 percent of total 'food poor[2] in Kenya are worst hit by the food crises (Oxfam, 2009). Ninety percent of these poor households in the slums reduced the size or/and frequency of their normal meals in order to cope with rising food prices. Sadly, like in many other countries, this food insecurity in urban areas remains largely invisible to policy makers (Maxwell, 1999).

Historically, food security in Kenya has been assured through policies and programmes that are aimed at enhancing economic growth, production and productivity and trade. Furthermore, food security in Kenya (and sub-Saharan Africa in general) has historically been viewed from mainly a supply or food availability perspective. The principal focus of government policies and development programmes has therefore been towards increasing food production through productivity enhancing technological breakthroughs, and provision of productivity enhancing inputs like improved seed and fertiliser. Other efforts have been directed at empowering farmers through provision of credit, information and improving access to markets for their output[3]. Such efforts which are geared towards increasing Kenya's food supply in isolation have not been successful in assuring food and nutrition security for all citizens. While low productivity in the agricultural sector is one of the main causes of food insecurity in SSA, it is increasingly recognised that food and nutrition insecurity is a consequence of poverty. Moreover, a large proportion of the poor and hungry live in urban or in arid and semi-arid areas where food

[2] Household unable to meet all its nutritional needs due to expenditure on basic non-food essentials like shelter, clothing, schooling and sanitation.

[3] policies and programmes such as the Agricultural Sector Development Strategy (ASDS), Njaa Marufuku Kenya, and the National Access to Agricultural Inputs Accelerated Programme (NAAIAP)

production may not be an option and hence rely on the market (and the government, when markets perform poorly) to provide them with affordable food.

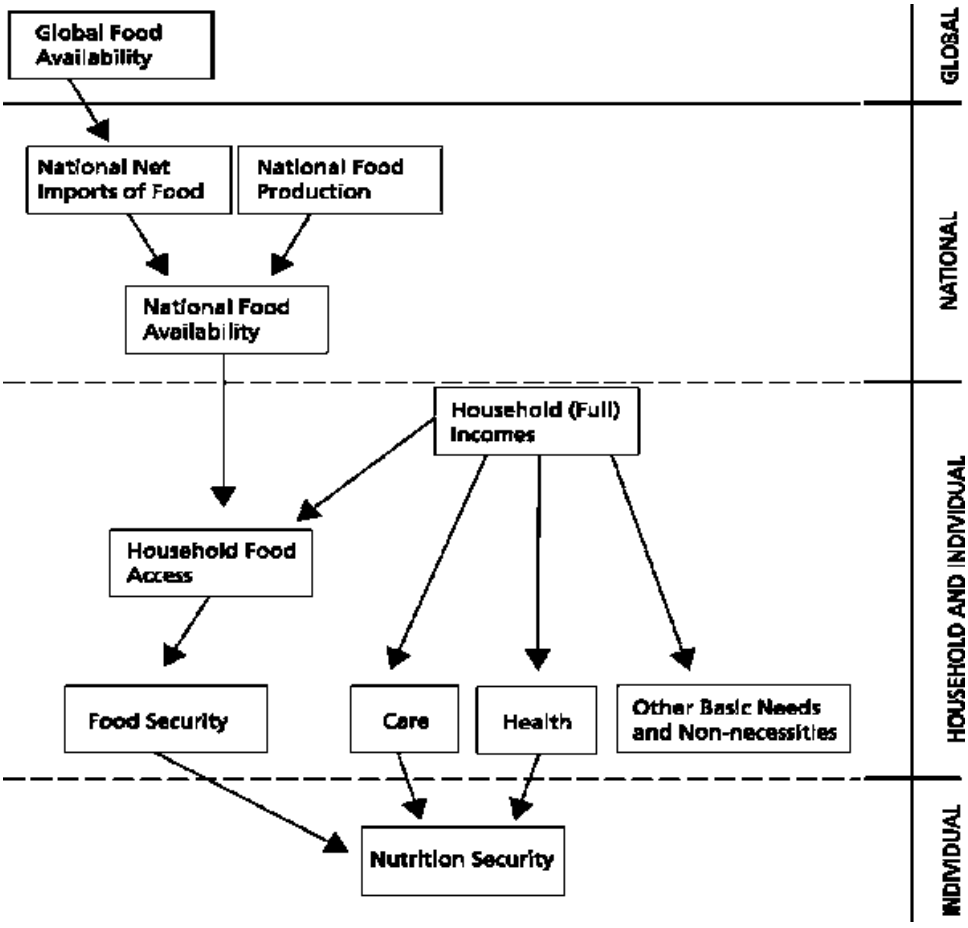
Through this realisation and after a series of hunger/starvation crises, the government, together with partners, is piloting programmes which are aimed at responding to food insecurity that is due to poverty, price-related food crises or emergencies (e.g. drought, floods). Through its National Food Security and Nutrition Policy[4] (Draft FSNP, 2009), the government expects to strengthen Kenya's food security and social protection programmes. The government also partners with development agencies in supplementary feeding programmes for breastfeeding mothers and school-going children. Programmes to monitor the food security situation in the country have been initiated although food distribution during drought/famine remains a major challenge.

The paradigm shift in the world's view of food security is first credited to Sen (1981), who rightly categorized food insecurity as a demand concern (the access of poor people to food, based on their entitlements) rather than a supply concern affecting national availability[5] of food. Prior to Sen's work, indicators commonly used for food insecurity were those related to: a) failure in food supply (mainly national, domestic supply) such as price spikes and lack of adequate food in stores/grain reserves; b) global food balance and price effects of economic policies; and c) physiological manifestations of food deprivation (measured in terms of height and weight, infections and mortality). Since Sen, the ability of household to access food mainly from the market but also from other source to which they are entitled became a central concept. The concept brings to the forefront issues of adequacy and the ability of the market and other public programmes to deliver it. The market is the main source of food for the population in Nairobi which is principally a buyer of foodstuffs, rarely producing[6] its own food. Figure 1 shows how national food availability influences food security and ultimately the nutritional security of

[4] The FSNP and associated actions is framed in the context of basic human rights including the universal 'Right to Food' (GOK, 2009).
[5] Availability relates to production and distribution
[6] The proportion of urban households who produce food either for home consumption or for the market is said to be on the increase but the importance of such own production is low.

households[7], i.e. adequate nutritional status on a sustainable basis. In order for households to have access to food, it is necessary that sufficient food be available in a nation. Figure 1 demonstrates that availability at the national level is not sufficient to guarantee food access at the household level. Households must have the resources necessary to acquire food in addition to meeting other basic needs.

Figure 1: Conceptual framework for food security



Source: Smith et al., 2006. As Adapted from UNICEF (1990) and Frankenberger *et al.* (1997).

The key to successful interventions to improve food security lies in the information on which it is based. Country level estimates from FAOSTAT, which capture broad national level food

[7] Food security works through people's dietary intakes to influence their nutritional security. However, food security alone is not sufficient for households to achieve nutritional security. People also need adequate care and a healthy living environment to be able to absorb the nutrients in food and thus use it in their everyday lives (FAO).

availability based on cereal production and imports (mainly maize in Kenya), provide useful statistics and information on trends and for advocacy for reduction in hunger. However, these estimates may not be reliable for policy making and planning.

Efforts to improve food security estimates in Kenya have been directed at further disaggregation of information to reflect the prevailing situation in different areas. For example, at the district level, Food Security Steering Committees collate information on food security status and cascade to the cabinet through the minister in charge. This information normally describes food available in stores at the National Cereals and Produce Board (NCPB) and on farm as well as the projected food supply based on the status of the crop in fields. Aggregated estimates of food security have serious limitations in informing decision making. In particular, these do not allow identification of the food insecure households which is important for formulation of social protection policies.

Estimates that are based on household surveys are more reliable for decision making and programming (Smith, 2002). Household surveys can be used to assemble: anthropometric measures of height and weight which provide strong evidence of under nutrition; data to estimate poverty or income insecurity indicating the capacity of the household to satisfy basic needs; indicators of nutrition adequacy based on food intake or household perceptions. The principal challenge associated with these estimators is that they are influenced by factors other than food intake, such as the health status of family members. Anthropometric and food intake measurements in particular are also impracticable and costly.

Surveys of household expenditure are increasingly being used to assess food security status in households by providing estimates of food acquired by households. Such estimates are considered reliable in determining whether households acquired sufficient food in terms of quantity and quality. In Kenya, statistics on households' consumption are based on the 1997 Welfare Monitoring Survey (WMS-III) and later on the Kenya Integrated Household Budget Survey (KIHBS), 2005/6 which were carried out by the Kenya Bureau of Statistics in the Ministry of Planning. The latter survey provided updated statistics on rural and urban consumption of food and other goods and services. According to this survey, the urban poor spend 57 percent of their household budget on food while non-poor spend 45 percent and the poor spend on the food only a third of what the non-poor spend on food. The major share of

household budget is spent on cereals. The KIHBS also provided an indication of the food security status of households by providing information on the well-being of infants and children based on their feeding patterns as well as anthropometric measurements. The results showed that on average, a quarter of children from poor homes are stunted and that poor children are twice as likely to be stunted compared to non-poor children. Tegemeo Institute has also carried out consumption surveys in Nairobi in 2003 and 2010, mainly to inform agricultural policymakers concerning trends in demand for various foodstuffs.

Interventions that are not well informed through careful analysis and based on up-to-date knowledge on food expenditures and consumption of various foodstuffs are likely to be ineffective thereby complicating the drive towards elimination of hunger. Lack of crucial information such as the proportion of population that is food insecure and the severity of hunger often translates to ineffective planning, targeting and packaging of assistance and evaluation of interventions. Lack of up-to date knowledge suggests resource constraints for generating such evidence and hence the need for quick and effective ways of detecting food insecurity in households.

The objective of the study was to generate: knowledge/evidence on the food security status of households and quick indicators of household food insecurity from expenditure data. It also informs on adequacy of cash transfers to households that are poor. The information is crucial in formulation of policies and design of programmes that are aimed at improving access to adequate and quality food by households across different socio-economic groups in Nairobi. This paper is motivated by findings in a paper by Kamau et al (2011a), in which the status and trends in food expenditure and consumption in households in Nairobi are analysed. The authors concern about household food security given: decreasing real household income; large and increasing proportion of income spent on food; a high proportion of food budget allocated to staples and much less to high value foods; and high and increasing food prices are further explored. The estimates are based on the same dataset on consumption and expenditure collected by Tegemeo staff directly from households in May/June 2009.

The study explores the extent of food insecurity based on diet quality indicators. The two main indicators used are the proportion of households consuming inadequate dietary energy and the

depth of hunger, as measured by the extent to which food intake falls below the minimum level of dietary energy requirement. Finally, this information is used in estimating the effectiveness of a cash transfer scheme to poor households and to explore the association between food insecurity in urban households and food expenditure.

2. Methodology

2.1 Assessing Food Insecurity

A household's vulnerability to food deprivation in the future can be informed by the percentage of total household expenditure that is spent on food. Households that spend high proportions of income on food have limited reserve for meeting their food needs when they encounter shocks, for example when food prices rise (Maxwell & Franenberger, 1992). This is particularly relevant for urban households whose primary source of food is the market. Using household consumption data, one can also measure whether households acquired sufficient food to meet their energy requirements. The measure of energy deficiency evaluates whether household acquired food enough for its members to survive. This measure is based on energy requirement for light activity level where the correct energy levels depend on gender, age, body weight, state of health, genetic traits, pregnancy or lactation state and on activity level (Hoddinott, 2001; Sevdberg, 2000). The other indicator for monitoring food security is the proportion of the population below the minimum level of dietary energy consumption, also referred to as the prevalence of undernourishment. This is the proportion of the population that is undernourished or food deprived. The undernourished or food deprived are those individuals whose food intake falls below the minimum level of dietary energy requirements. In addition to these direct measures, the relationship between household expenditures and household characteristics and with food security can be assessed. Moreover, the evaluation of government interventions such as cash transfer schemes is possible.

2.2 Empirical Analysis

The households were categorized into five groups each containing 20 percent or a fifth of the total number of households in the sample. The quintiles are based on households' monthly expenditure per adult equivalent (Kamau et al., 2011a). Using household food expenditure and

consumption data, the following indicators of food security were generated: sufficiency of available dietary energy, coping mechanisms, association between food insecurity and food expenditures. This section describes the empirical approaches followed in assessing food security in households, the relationship between food insecurity and household characteristics and the adequacy of cash transfer schemes to poor and vulnerable households.

2.2.1 The Proportion of Expenditure on Food & Dietary Diversity

The total monthly expenditure on food was obtained by aggregating expenditure on all food items. The proportion spent on food was obtained by diving the household's food expenditure with its total monthly expenditure which includes: expenditure on consumables (food, non-food), housing, schooling, health, clothing, savings and payment of loans/credit.

The total monthly expenditure on each food group was obtained by aggregating expenditure on all food items within that group. Per capita expenditure on food and on each food group was obtained by dividing the expenditure by the adult equivalents in a household. In absence of a universally acceptable level of expenditures on various food groups, the dietary diversity was assessed by observing the wholeness or completeness in terms of food types that provide various types of nutrients.

2.2.2 Sufficiency of Available Energy

The daily energy available for each household was estimated and sufficiency of available energy to meet the dietary needs of household members assessed. This was done as follows:

- The physical quantities of each food item consumed by a household were converted to kilocalorie values using conversion tables (WHO, 1985).
- The kilocalorie values were summed-up and divided by the number of days in the reference period (in this case 30 days) to obtain kilocalorie per day.
- To obtain per capita energy intake, the number of kilocalories per day was divided by the adult-equivalent persons living in a household.

The depth of hunger, or food deficit, was measured by comparing the per capita energy intake of each household with the minimum amount of dietary energy needed to maintain average body

weight and undertake light activity. We used the recommended energy intake levels by WHO/FAO.

2.2.3 Household Coping Mechanisms

The importance of various channels used by urban households to access food namely, (1) purchases, including food purchased and consumed away from home; (2) receipts by household members as gifts or as payment for work; and (3) own production, were gauged by estimating the percentage of households accessing food through each channel.

2.2.4 Household Food Insecurity and Food Expenditure

With increasing food insecurity, we expect to see changes in household's expenditure on total food as well as in expenditures on specific food groups. In this section we wish to explain how urban households in Nairobi adjust their food expenditure levels and food budget allocation as food security increases by assessing the relationship or association between food security and household expenditure on food. The proxy used, for household food insecurity in this paper is the daily dietary energy deficit, that is, how short the estimated per capita energy intake falls from the recommended energy intake. The dietary energy deficit and the depth of hunger are interchangeably used in this paper.

A subset of the whole sample was drawn comprising of only the food insecure households. This subset was drawn on the basis of a household's ability to acquire enough/adequate food, that is, food to supply at the least, the minimum recommended daily per capita dietary energy. As indicated in previous sections, the minimum recommended daily dietary energy intake has been pegged at 2,200 kcal per person (IFPRI, 2010). The energy deficit was estimated for each household by subtracting its daily dietary energy intake from the minimum recommended (expressed as kcal/day/ae). These food insecure households were ordered along a continuum according to their deficiency in dietary energy intake to form a continuous variable of dietary deficiency or depth of hunger. This continuous variable allows for the exploration of the association between household characteristics and undernourishment and the association between expenditure on food and severity of food insecurity or hunger.

Sample Selection Correction

We may wish to explain y_i which we assume, follows a linear model and is randomly drawn from a population.

$$y_i = \beta_0 + x_i\beta + u_i, u_i | x_i, s_i \approx Normal(o, \sigma^2)$$

In this case, the error term has zero mean and is uncorrelated with the explanatory variables and the Ordinary Least Squares (OLS) estimators are consistent (Woodridge, 2003). This is the case in an uncensored estimation, i.e. where all observations are included in the estimation. However, in our analysis, rather than observe y_i, we only observe it when it is less than a censoring value s_i i.e.:

$w_i = \min(y_i, s_i)$, meaning that the sample has been censored from the right or from above.

A nonrandom sample is likely to be created when a sample has been censored below or above a certain threshold of the dependent variable, but have information about the missing variable i.e. whether above or below a certain threshold (Wooldridge, 2003). In addition, self selection is also likely to occur because poor households/individuals are likely to select into a food insecure group[8]. As such the sub-sample of food insecure households may not be randomly determined. In cases where we only observe the dependent variable *yi* if it is less or greater than a censored value s, then OLS produces inconsistent estimators of β_j. Moreover, if being food insecure is related to factors which are unobserved (and hence cannot be controlled) then, the error term is related to food insecurity and the OLS estimators of β_j would be biased. This implies that including only the food insecure households in our estimation would produce invalid estimators. To correct for the non-random sample selection, we followed the Heckman (1979) two-step estimation procedure in which sample selection bias[9] is treated as a form of omitted variable bias. In Heckman's two stage approach, a correction term (the inverse mills ratio (IMR)) is included in the OLS estimates while restricting the sample to the households that were categorized as food insecure.

[8] From Sen's assertion that food insecurity is an entitlement problem i.e. one related to resource ownership or means to acquire food.

[9] Distortion of statistics by the way the sample is selected (non-random). This leads to errors in estimated parameters.

In the first stage, the predicted probabilities used in the construction of the selection bias correction term λ_j, are obtained from a binary choice estimation. All N observations were used in a logit model estimating the odds or probability that a household would have a deficit in dietary energy intake (see model and results in the appendix Table A3). In the logit model specified as: $y^* = \beta_0 + \beta\, x + \varepsilon$, y^* is a latent variable depicting the food security status of a household. The statement below shows that the observed y takes the value of one if the statement in brackets is true, zero otherwise.

$$y = 1[y^* > 0],$$

ε is an error term assumed to be independent from x.

In the second stage, OLS estimates were obtained by restricting the sample to the households that had a deficit in their daily per capita dietary energy intake. In this regression, the daily per capita expenditure on total food was included as the dependent variable. The daily per capita dietary energy deficit or depth of hunger was included as an explanatory variable while other confounding factors, mainly individual and household characteristics were controlled for. A selectivity correction term (IMR) was included as an additional regressor. This second step estimation was replicated for each food group (staples, pulses, oils, fresh fruits and vegetables, meats and dairy products), by replacing the daily per capita expenditure on total food with the daily per capita expenditure on specific food groups while retaining all the other covariates.

The second stage model was estimated in its log-linear form and specified as follows:

$$\log E_{j_i} = \alpha + \delta_1 h_1 + \beta_i z_i + \varepsilon_i,\ j = 1, 2, ..., 8\ \ \&\ i = 1, 2, ..., n_1$$

Where:

E represents the expenditure on food

j 1 represents all food; while j 2, 3, ... represents specific food groups and there are seven food groups.

i represents the household

n_1 represents the sub-sample

h_1 represents the depth or severity of hunger

z_i represents individual and household characteristics

δ and β_i the coefficients to be estimated and

ε_i is the error term

The individual and household characteristics that are likely to influence the odds that a household will suffer from hunger were not expected to differ from those determining the food expenditure in food insecure households. Sudden and unexpected events that cause illness or loss of income are expected to increase the odds. Poor households are more affected because they are less able to protect themselves against such shocks. Ill health in a household means that household resources will be diverted away from food to medicines and health care. It also means loss of income where a key member of the household such as the household head succumbs to illness. Reported incidence of hunger (and poverty) is expected to be higher among the elderly due to their inability to work and in some cases reluctance to rely on others. The elderly are also likely to be excluded from employment. Moreover, family ties and social networks which support the elderly particularly in the African setting are less common in an urban setting. Education, particularly of the head improves the welfare of a household because the more educated are likely to secure better paying and more productive jobs. Female headed households are likely to be poorer than male headed households because they are likely to be less educated, own lower productive assets, and more likely to be discriminated in the job market. The household and individual characteristics included in the first and the second step estimation are:

i) dummy variable for gender of head, 1 if male
ii) log of age of head
iii) log of education level of head
iv) dummy variable for marital status, 1 if married
v) dummy variable for salaried head, 1 if in salaried employment
vi) dummy variable for business employment of head, 1 if in business
vii) dummy variable for shocks like illness or death in the household, 1 if death or illness occurred

viii) dummy variable for whether household owns the house they live in, 1 if they own house

ix) log of access to amenities like electricity

x) log of access to modern plumbing

xi) log of household size

xii) household composition:

a. number of infants (< 5 years old)

b. number of children (5 to 14 years old)

c. number of dependant adults (15 to 23 years old)

d. number of independent adults (24 to 65 years old)

e. number of senior citizens (> 65 years old)

xiii) dummy variables representing the expenditure quintile of a household, with the highest quintile (5) being the comparison group.

2.2.5 Adequacy of Cash Transferred to Subsidize Food Expenditure

One of the key government commitments is to ensure that households, including the poor and vulnerable have access to adequate and quality food. The government of Kenya together with its development partners has been piloting social protection programmes intended to boost food security at the household level. These include cash transfers[10] and supplementary feeding for children, pregnant women and breastfeeding mothers from poor and vulnerable households. These are aimed at cushioning poor and vulnerable households against hunger by supplementing their food budget. In this section we use the results obtained in preceding sections to: one, estimate the cost of subsidizing the dietary energy intake in food insecure urban households and two, assess the effectiveness of cash transfer schemes that are being implemented by the government and its development partners in line with the social protection policies. The guiding questions for this analysis are:

i. By how much would households need to be subsidized in order to meet shortfall in energy intake? How much more maize grain or maize meal needs to be

[10] Such cash transfer schemes have been in place in Egypt, South Africa and Mozambique.

consumed to meet the shortfall in energy intake? What is the cost of achieving this?

ii. How does the estimated cost of supplementing household's dietary energy intake compare with the cash transferred to poor and vulnerable households in Nairobi?

iii. Which is the cheaper option for meeting dietary energy deficit? Maize **grain** or maize **meal**?

For each quintile group, the amount (kg) and cost (KES) of maize (grain or sifted flour) required to meet the shortfall[11] in energy intake was estimated. In estimating the quantity of maize and maize flour needed to meet the shortfall in energy intake for each level of hunger by quintile, we used the average energy intake by level of hunger and quintile (see intake levels in Table 2). The number of adult equivalents in a household (to assess household energy needs) is based on the computed statistics in Kamau et al., 2011a. The costs are based on retail prices prevailing in November 2009 for maize grain and maize meal (sifted). The estimated cost of meeting the energy deficit is compared with the cash transferred.

2.3 Description of Data

Data used were from a cross-sectional survey of households in Nairobi and its environs. A random sample of 821 households drawn from the NASSEP IV[12] frame and the households were interviewed between May and June 2009. Results from this survey were compared with results from an earlier survey conducted in 2003 in which a random sample of 542 households was similarly drawn from the NASSEP IV frame. The samples were stratified according to household income to reflect the socio-economic diversity in Nairobi (see Table 1 below).

[11] Difference between the average energy intake and the recommended intake
[12] In collaboration with the Kenya National Bureau of Statistics

Table 1: Sample in Tegemeo urban survey 2009

Income category	No. of clusters covered in 2009	No. of clusters covered in 2003	No. of households interviewed in 2009[a]	No. of households interviewed as % of total
Upper	8	8	83	10
Lower Upper	7	3	94	11
Middle	10	5	180	22
Lower Middle	13	10	237	29
Lower	12	4	227	28
Total	50	30	821	100

[a] In 2009 our target was 1000 households. In 2003, the target was 600 households however due to non-responses the sample is of 542 households.

Data were collected on food obtained from three sources: (1) food purchases, including food purchased and consumed away from home; (2) food given to a household member as a gift or as payment for work; and (3) food consumed from home production. Secondary data on retail prices of various foods over the period (2003 to 2009) were also collected.

Details on the Sampling and weighting procedures are in the annex.

Sample Size: Target, actual and response rates

Although the actual sample for the 2009 survey was 20 households in each of the clusters (50 clusters), 22 households were sampled for each cluster to cater for potential misses. The total target was therefore 1100 households. The response rate was 74.6 percent resulting to an actual sample size of 821 households. Most of the non-responses were in the high income areas. One of the reasons was that the houses had been converted into offices or in the process of conversion to flats or offices. Refusal was the main reason for misses in high income areas.

3. Results and Discussions

3.1 Characteristics of Households in Nairobi and its Environs

3.1.1 Socio-economic Characteristics and Living Standards

Households included in Tegemeo's 2009 urban survey were divided into five quintiles based on their expenditure levels, with the first quintile having the lowest expenditure whilst the fifth quintile had the highest expenditure. The poor households or households falling in the lower

quintiles are characterized by: a larger household size with three or more children, being headed by persons with little or no education, living in houses made of earthen floor, iron sheet roofing, mud/wood or iron sheet walls, living in houses without electricity and modern plumbing and paying the lowest rent. Moreover, assets owned by these households have the lowest value.

3.1.2 Strategies for Accessing Food

Households in Nairobi acquire food from three sources, namely: (1) food purchases, including food purchased and consumed away from home; (2) food received by a household member as a gift or as payment for work; and (3) food consumed from own production. Previous studies by Tegemeo Institute (Muyanga et al., 2005) established that households in Nairobi mainly acquire their food through purchases. A recent study by the Institute (Kamau et al., 2011a) also indicates that households in Nairobi still access food mainly through purchases and that own production and gifts play a minor role (Table A4). This is the case in households across all expenditure quintiles. The proportion of households relying on purchases for different food groups consumed is as follows: 95 percent purchased staples; 96 to 98 percent purchased fruits and vegetables; 88 percent purchased legumes (with the rest mainly relying on gifts); 98 to 99 percent purchased dairy products and 94 to 99 percent purchased meats and eggs. Among the staple foods, 88 to 95 percent reported that they purchased the maize products and 5 to 9 percent reported having received them as gifts; 99 to 100 percent purchased wheat and rice; 92 to 96 percent purchased Irish potatoes; 77 to 89 percent purchased the bananas (this is the lowest) with 8 to 17 percent receiving bananas as gifts while 3 to 6 percent was from own production. It is important to note that among the low and middle quintiles (1 upto 3), 93 to 95 percent purchased maize & maize products consumed and only 5 percent was received as gifts. The exchange of gifts is more common for staples in the following order: bananas, Irish potatoes and maize products.

Very few households engage in own production as a coping strategy. Only 16 percent of households are involved in urban farming and is less practiced by households in the lower quintiles (25 percent). A large majority of households (87 percent) practicing urban farming are male headed. The main reasons for not practicing are that households cannot acquire plots or that available plots are too far (70 percent), while the rest are either not interested in urban farming or find it unprofitable.

3.2 Trends in Household Expenditure and Food Consumption and its Implications on Food Security

In a paper closely related to this study (Kamau et al., 2011a), total expenditure, food consumption and expenditure by households in Nairobi in 2009 were examined and compared to those in 2003. This section highlights and discusses the findings in this paper which have a bearing on household food security.

The first finding of significance is that household income (as measured by total expenditure) declined for all but the highest quintile. The greatest decline (55 percent) was recorded in the first quintile while that for the second, third and four quintile declined by five, six and three percent respectively. This decline in households' expenditure (income) means that little progress has been made in improving the welfare of most households in Nairobi particularly the poorest. Significant progress appears to have been made only in the high income group where the change in income was 16 percent. The findings underline the difficulty in reaching the poorest in society using the current policies and programmes.

The second finding that is of significance was that households spent a high (30 percent) and increasing proportion of their total budget on food. The proportion of household's budget spent on food was, as expected, inversely proportional to income, with the first and second quintiles spending the highest proportion (49 and 44 percent respectively) of household budget on food. Compared with 2003, the proportion of total household budget spent on food is shown to have increased for all income groups except for the highest quintile. The first and second quintiles experienced the greatest increase of 24 and 11 percentage points respectively. Furthermore, compared with 2003, households' expenditure (KES) on food increased for all but the highest income group. It increased by 21 and 22 percent for the first and second quintiles respectively, the highest recorded.

The decline in households' real income accompanied by increased spending on food implies that households in Nairobi are relatively worse off than they were in 2003. This has resulted to greater poverty and vulnerability to food insecurity.

The third finding of significance is that households in low income groups (first three quintiles) spent less than the sample average on all food groups. Households in the lowest quintile spent

the greatest proportion of their food budget on staples (32 percent), which was the highest across all the quintiles. Spending on meats and eggs and dairy products by this group is also the lowest in the sample. A similar picture is observed for the second and third quintiles although the actual figures vary. Low spending on high value foods (meats & dairy products) signals a low quality diet in low income households particularly the poorest. It may be argued that these households may be compensating the expensive animal-based high value foods with the relatively cheaper foods like pulses. However, compared with all food groups, their budget on pulses was lowest.

3.3 Sufficiency in Energy Intake

In this section the sufficiency in energy intake is assessed. This assessment is based on the new recommended daily dietary energy intake of 2,200 kcal per adult equivalent (IFPRI, 2010), which is the minimum consumption level that is acceptable given the body weight, age, gender and activity level. The dietary energy deficit of the undernourished is expressed as a percentage and was estimated by subtracting the average dietary energy intake of undernourished people from the minimum energy requirement. The deficit is the figure in brackets.

Table 2: Average energy intake (kcal per adult equivalent per day) in 2009

	kcal per adult equivalent per day (by Quintile) & deviation (%) from recommended energy intake					
Category of Hunger	**1**	**2**	**3**	**4**	**5**	**Sample Average**
Ultra hungry	1,196 (46)	1,316 (40)	1,312 (40)	1,192 (46)	1,078 (51)	1,228 (44)
Medial hungry	1,696 (23)	1,689 (23)	1,735 (21)	1,719 (22)	1,725 (22)	1,708 (22)
Subjacent hungry	1,971 (10)	1,963 (11)	1,956 (11)	2,017 (8)	2,008 (9)	1,978 (10)
Food Secure	2,628 19	2,918 33	2,956 34	3,212 46	3,803 73	3,228 47
Average	1,676 (24)	2,192 (0)	2,437 11	2,816 28	3,275 49	2,478 13

From Table 2 we note that on the average, households in Nairobi have a daily per capita dietary energy intake of 2,478, which is slightly above (13 percent) the recommended intake for a sedentary lifestyle. Differentiating the households by expenditure quintile reveals that calorie intake by the lowest income group (quintile 1) is inadequate by 24 percent (a deficit of 524 kcal per day per adult equivalent). By further dis-aggregating the households into levels of hunger we find that the ultra hungry have an intake of only 1,228, which is a deficit of approximately 1,000 kcal per day per adult equivalent, the medial hungry have a daily intake of 1,708 kcal per adult equivalent and subjacent hungry have an intake of 1,978 which is a deficit of only 10 percent. Generally the calorie intake increases with income.

The proportion of the sample households with a deficit in energy intake is indicated in Figure 2. On average, over 56 percent of the households in Nairobi meet the minimum recommended daily energy intake while 44 percent of the households have a deficit in their daily dietary energy intake. Twenty percent of the households are in the ultra hungry category, having a daily intake of less than 1,600 kcal per adult equivalent, while 16 and 8 percent are in the medial and subjacent hunger categories respectively.

Figure 2: Proportion (%) of households with adequate or inadequate dietary energy intake (Energy requirement for Sedentary Lifestyle = 2,200 kcal per day per adult equivalent)

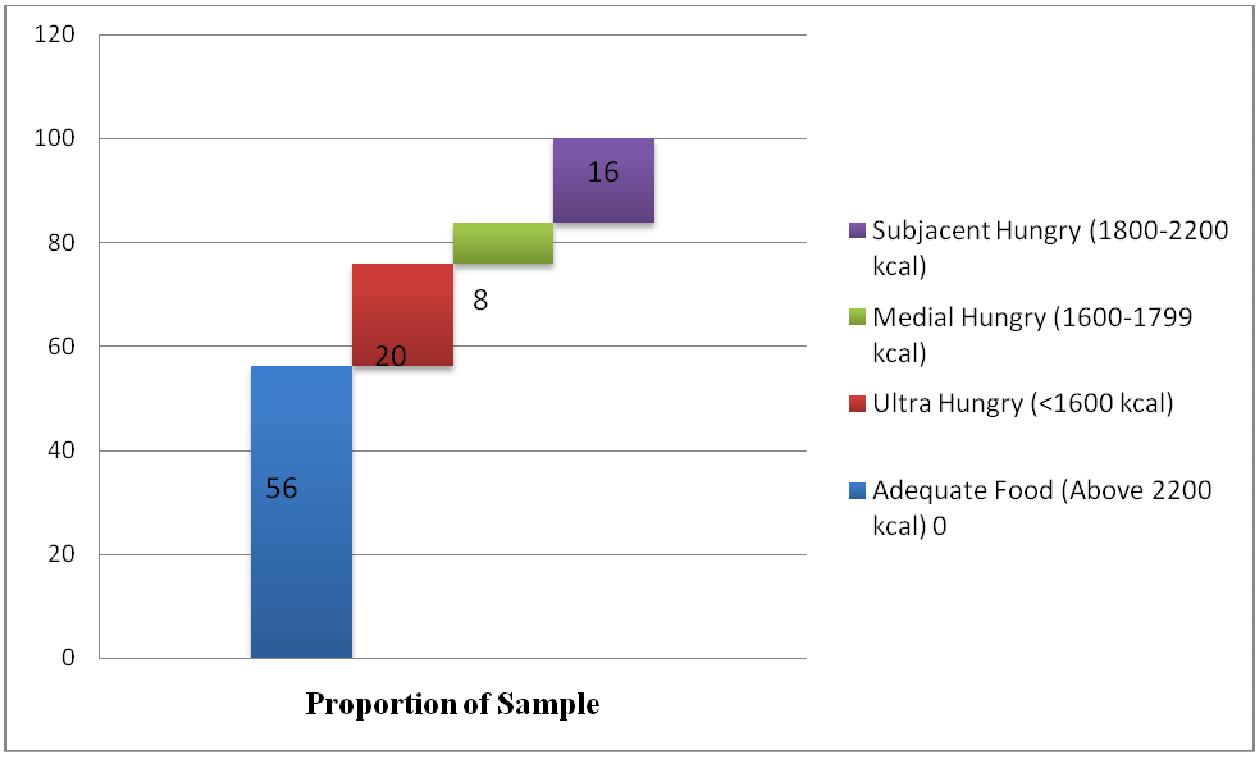
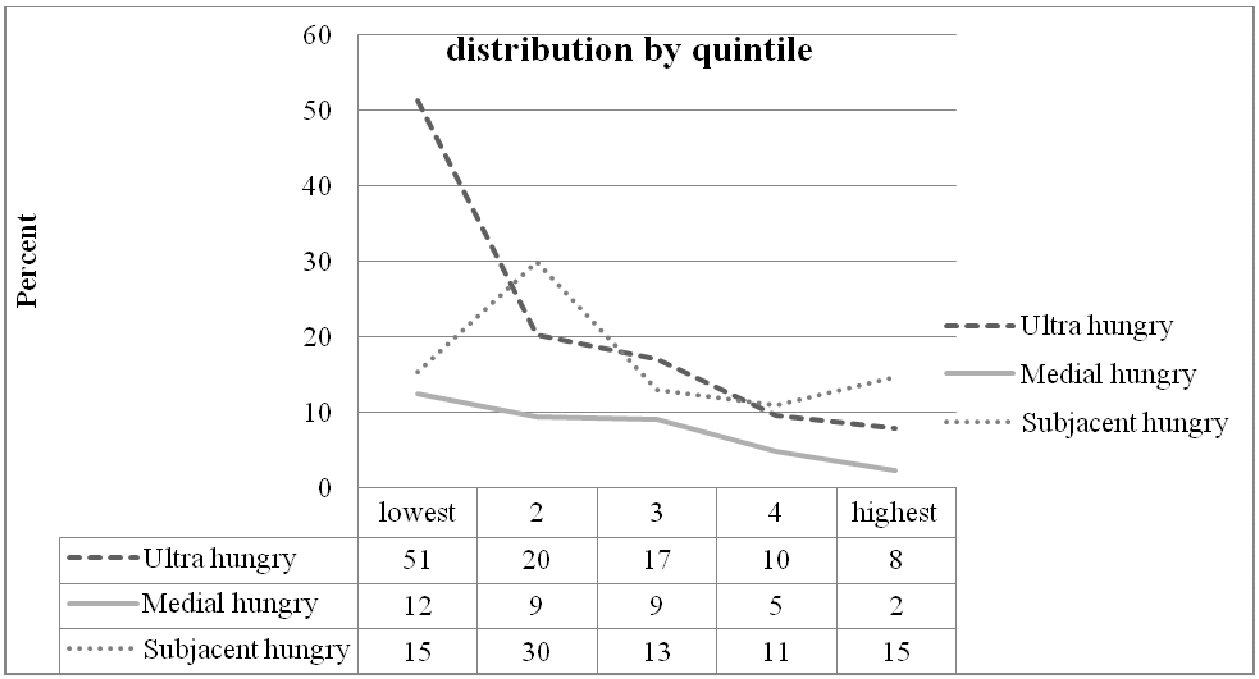


Figure 3: Distribution (%) of households falling in each hunger category within each quintile

According to Figure 3, majority of households with an energy deficit fall in the first and second quintiles. Seventy percent (70%) of the ultra hungry fall in these two quintiles. Only 21 and 40 percent of households in the first and second quintiles respectively have attained the recommended dietary energy intake and the proportion of households with adequate intake increases with income. A surprising finding was that some households (25%) in the high quintiles (4 & 5) also have a deficit in energy intake with some falling in the ultra hungry category.



	lowest	2	3	4	highest
Ultra hungry	51	20	17	10	8
Medial hungry	12	9	9	5	2
Subjacent hungry	15	30	13	11	15

3.4 Association between Household Food Insecurity and Food Expenditure

As indicated in the methodology (section 2), the relationship or association between food security and household expenditure on food was explored by regressing per capita expenditure on total food or on specific food group against the dietary energy deficit (expressed as kcal per day per adult equivalent), the proxy used for severity in household food insecurity. The descriptive statistics of variables included in the linear regression are provided in Table 3.

The daily dietary energy intake for households with an energy deficit averages at 1,648 kcal per adult equivalent while it averages at 4,072 kcal per adult equivalent for households without a deficit. Households falling in the two groups differ mainly in: 1) characteristics of head of household (households with an energy deficit have more male heads, have a lower education level, more heads that are married, and fewer salaried heads); 2) the socio-economic status of household (households with an energy deficit have fewer households with a connection to electricity supply or modern plumbing, more households in the lower quintiles & fewer in the higher quintiles (4 & 5), have larger family sizes and more members in each age category)

Table 3: Comparison of characteristics of households with and without a deficit in energy intake

Variable Label	Households Without Deficit in Energy Intake		Households With Deficit in Energy Intake		t-test
	N	Mean	N	Mean	p-value
Daily per capita consumption (food) expenditure (**KES**)	560	4,072	255	1,648	0.000***
Gender of household head (**1 = male**)	568	0.80	255	0.89	0.003***
Age of household head (**years**)	564	38.90	254	39.56	0.476
Education level of household head	566	13.76	255	11.92	0.000***
Marital status of head (**1 = married**)	567	0.73	255	0.81	0.014**
If head is in salaried employment (**1 = salaried**)	567	0.55	255	0.47	0.043**
If head is engaged in business activity (**1 = in business**)	568	0.52	255	0.53	0.711
If head was chronically ill for at least three months (**1 = ill**)	567	0.02	255	0.02	0.702
If there was any occurrence of death in household (**1 = death in household**)	568	0.03	255	0.04	0.205
If household owns the house they live in (**1 = own house**)	568	0.18	255	0.20	0.567
If main house has electricity (**1 = has electricity**)	568	0.84	255	0.76	0.010**
If main house has modern plumbing (**1 = modern plumbing**)	568	0.40	255	0.27	0.001***
If household is in first quintile (**1 = yes**)	568	0.18	255	0.24	0.035**
If household is in second quintile (**1 = yes**)	568	0.17	255	0.28	0.000***
If household is in third quintile (**1 = yes**)	568	0.20	255	0.21	0.724
If household is in fourth quintile (**1 = yes**)	568	0.22	255	0.15	0.022**
Farm size owned by household (**acres)**	564	3.87	255	5.00	0.000***
Number of infants (**0 to 5 years**)	564	0.51	255	0.64	0.030**
Number of children (**6 to 14 years**)	564	0.54	255	1.06	0.000***
Number of dependant adult children (**15 - 23 years**)	564	0.82	255	1.10	0.001***
Number of independent adults (**24 - 55 years**)	564	1.81	255	2.06	0.004***
Number of senior adults (**> 55 years**)	564	0.20	255	0.15	0.245

Results of the linear regression model are shown in Table 4 while results of the logistic regression model used to estimate a selectivity correction term (IMR) and to identify the determinants of whether a household is energy deficit are provided in Table A3 in the appendix. From the regressions, we used the usual statistical test as a test of the null hypothesis H_0: $p = 0$ i.e. that there is no selection problem (Wooldridge, 2003). The mills ratio was found not to be

significant in any of the estimated functions. This suggests that there is no selection problem and that OLS estimates would be consistent. The results discussed below are therefore OLS estimates without a correction term.

Table 4: Results of an OLS estimation of the association between per capita expenditure on food and depth of hunger

Independent Variables	Dependent Variables: Log Daily Per Capita Consumption Expenditures						
	Food (total)	Staples	Meat & Eggs	Fresh Fruits & Vegetables	Pulses	Dairy	Oils
Log of depth of hunger	-0.13***	-0.21***	-0.06	-0.12***	-0.25***	-0.19***	-0.17***
Gender of household head	0.03	0.31**	-0.51*	-0.36*	0.11	0.10	-0.05
Log age of head	-0.17	0.01	-0.25	-0.27	0.51	-0.26	-0.28
Log of education level of head	0.05	0.00	0.30*	-0.04	-0.03	0.21	0.01
Marital status of head	0.09	-0.11	0.54**	0.29*	0.07	0.00	0.27*
Head in salaried employment	-0.17**	-0.08	-0.11	-0.20	-0.06	-0.08	-0.08
Head in business	-0.14*	-0.03	-0.03	-0.21	-0.06	0.10	-0.06
Illness of head	-0.16	-0.14	-0.65	-0.44	0.50	0.09	-0.14
Occurrence of death	0.13	-0.12	0.61*	0.04	-0.52	-0.39	-0.12
Own house	0.19***	0.09	0.33*	0.20*	0.25	0.09	0.27**
Electricity	-0.04	0.03	-0.06	-0.15	-0.07	0.14	0.17*
Modern plumbing	0.02	0.15	-0.01	-0.11	0.35*	0.39*	-0.01
First quintile	-0.84***	-0.24	-1.57***	-1.02***	0.37	-0.66**	-0.36
Second quintile	-0.60***	-0.15	-1.11***	-0.75***	0.05	-0.40	-0.40**
Third quintile	-0.43***	-0.08	-0.95***	-0.68***	0.40	-0.09	-0.21
Fourth quintile	-0.25**	-0.09	-0.66**	-0.30*	-0.02	-0.16	-0.22
Log of household size	-0.33***	0.33**	-0.84**	0.15	-0.30	-0.72**	-0.13
Infants (0-5yr)	0.03	-0.03	0.09	-0.14**	-0.11	0.23**	-0.02
Children (6 – 14)	0.00	-0.04	0.08	-0.11*	0.01	-0.01	0.00
Dependent adults (15- 23)	-0.07**	-0.10**	0.01	-0.19***	-0.04	0.01	-0.09
Independent adults (24 - 65)	-0.02	-0.07	0.02	-0.13**	0.09	-0.01	-0.01
Seniors (> 65)	0.00	-0.05	0.03	-0.16	-0.15	0.29	0.14
Constant	8.88***	3.50***	4.52***	5.60***	0.02	4.21***	3.06***
N	244	240	221	242	177	236	236

Key: * p<.1; ** p<.05; *** p<.01

Results of the logistic regression model show that: dietary energy deficiency is mainly determined by the economic status of a household, family size and gender of head. Households in the 1st, 2nd and 3rd quintiles are 3, 2.4 and 2 times respectively, more likely to have a dietary energy deficit compared with households in the highest quintile. Male headed households and larger households are also more likely to have an energy deficit. An increase in household size by one increases the odds that a household will suffer deficiency in energy intake by 180 percent but the odds is lower when the family size increase is due to an increase in the number of infants. A household with a male head is 138 percent more likely than a female headed household to have a deficit in dietary energy intake. The other determinant is the marital status of the household head. Households with both father and mother are 67 percent less likely than single parent households to have a deficit in dietary energy intake. According to the OLS estimates:

Depth of Hunger and Food Expenditure: A 1 percent increase in food insecurity is associated with a reduction in per capita expenditure on all foods in the following proportions: 0.13 percent reduction on total food, 0.21 percent reduction on staples, 0.25 percent reduction on pulses, 17 percent reduction on oils, 0.19 percent reduction on dairy products and a 0.12 percent reduction on fresh fruits and vegetables. This implies that a reduction in total per capita expenditure on foods (all food) or of specific foods is a reliable indicator of increased food insecurity in households in urban areas like Nairobi.

Expenditure quintiles: Not only are households in the lower quintiles more likely than households in the highest quintile to be undernourished (see results from logistic model), they are also associated with lower per capita expenditure on total food and especially high value food groups such as meats, fresh fruits and vegetables. The per capita expenditure on meat by lowest quintile is 157 percent lower than that of the highest quintile and its per capita expenditure on fruits and vegetables is 102 percent lower. They also have lower expenditure oils and dairy products. Expenditure on each of these foods declines with income (quintile) which implies that decreases the depth of hunger increases and the quality of diet deteriorates down the income ladder.

Family size and composition: The logistic model shows that households with larger families are highly likely to be energy deficient a one percent increase in the size of households is associated

with 1.8 percent increase in the odds that a household will suffer deficiency in energy intake. OLS estimates show that a one percent increase in family size is associated with an increase in per capita expenditure on staples of 0.33 percent but a reduction in total per capita expenditure on total food (0.33 percent) and all other foods especially meats and dairy products. The per capita expenditure on fresh fruits and vegetables increases, (although not significant) with the family size. The implication of these results is that larger families suffer more hunger and have poorer quality diets.

The household composition also matters with households with infants are less likely to be undernourished. A higher number of dependant adults (15 – 23yrs) in a household is associated with decreased per capita expenditure on total food, staples (0.1 percent), oils (0.12 percent) and fresh fruits and vegetables (0.19 percent). Households with infants are less likely to be undernourished (logistic model) and their per capita expenditure on dairy products increases by 0.23% with a 1 % increase in hunger. This implies that feeding programmes for children under five years is yielding positive results in Nairobi.

Ownership of house: Although ownership of dwelling does not reduce the odds that a household will be energy deficient, it is associated with 19 percent higher per capita expenditure on total food and higher per capita expenditure on meats (33 percent), oils (27 per cent) and on fresh fruits and vegetables (20 percent). This suggests that home ownership is critical for improved food security of urban households. Modern plumbing in house is associated with greater per capita expenditure on pulses (35 percent) and dairy products (39 percent) suggesting that modern amenities in home are a sign of improved food security.

Employment: Although not significant, the logistic model shows that households with a head who is engaged in salaried or business employment are less likely to have deficiency in energy intake. Surprisingly, employment is associated with lower expenditure on total food (17 & 14 percent respectively) suggesting that the income from employment or business which energy deficient household members are engaged does not adequately cater for their food needs.

Gender: It is not clear why male headed households are more likely to be undernourished (up-to 44 percent of male headed households and 36 percent of female headed households do not meet the recommended daily energy intake. However, among the households with inadequate energy

intake, the male headed households have a higher expenditure on staples (31 percent) but lower per capita expenditure on meats (51 per cent), fresh fruits and vegetables (36 per cent).

Marital Status: Households with both husband and wife are less likely (67 percent) to be energy deficient compared to households with a single parent which is probably due to the effect of combined income compared with single income. Such households are have a higher per capita intake of high value foods especially meats and eggs (54 percent), oils (27 percent), fresh fruits and vegetables (29 per cent) and hence associated with lower food insecurity.

Shocks: The positive association between expenditure on meats and shock of death in a household was not expected and may be related to cultural practices when a death occurs.

3.5 Comparison of the Estimated Cost of Supplementing Energy Intake of Undernourished Households with Cash Transferred

Under a government cash transfer scheme which was announced in November 2009, needy/poor households in Nairobi received a boost of KES 1,500 every month as a food subsidy. In addition to this scheme, there are other cash transfer schemes that are being implemented by non-profit organizations. For example, in a scheme implemented by Concern Worldwide, Oxfam and Care International households in Nairobi slums (Kibera) receive KES 2,200 every month. The Ministry of Northern Kenya and Arid Lands (MONKAL) with support from DFID transfers KES 2,150 every month to households in Northern Kenya.

Results provided in Table 5 show that on average, it costs KES 1,528 and KES 865 to subsidize households in first and second quintiles with sifted maize while it costs much less, that is, KES 915 and KES 518, when energy is from maize grain. The results also show that the cost of supplementing households increases with the level of hunger. For example, it costs KES 1,814 and KES 1,086 to supplement an ultra hungry household while it costs KES 866 and KES 519 to supplement a household that has medial hunger using maize meal and maize grain respectively.

Generally, the cash transferred to poor and vulnerable households is adequate for meeting the energy deficit in all households except for the ultra hungry households in the lowest income group. Such households (poorest and ultra hungry) require KES 2,122 to meet its energy deficit using maize meal and so the cash received by these households is 41 percent lower than the

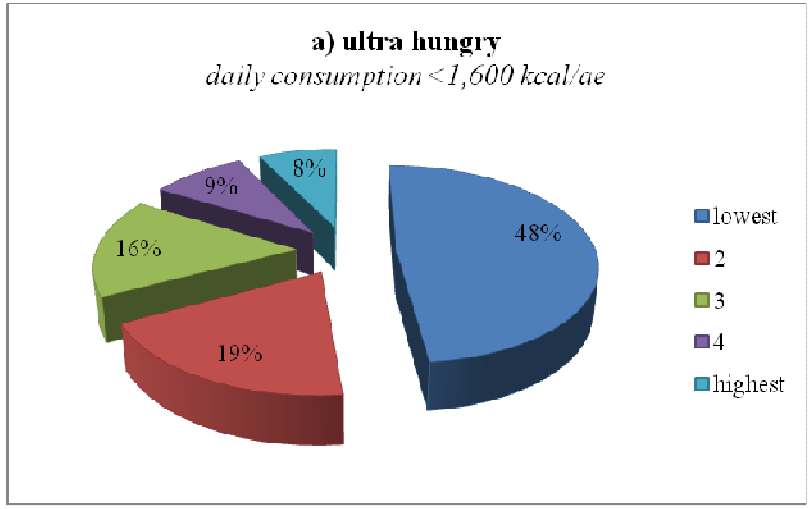
estimated cost. The cash transferred may however meet the energy deficit when used to purchase the cheaper maize meal (posho).

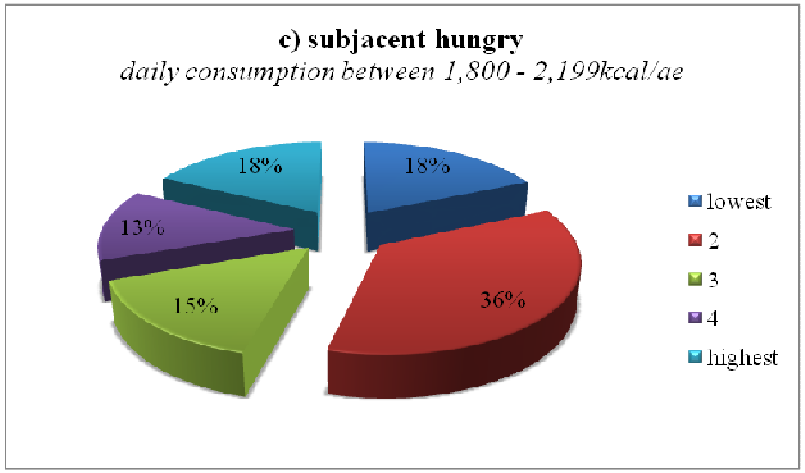
The estimates also show the huge savings that food subsidy programmes would make with improved targeting of households (in this case by income category and level of hunger) and by meeting dietary energy requirements from the relatively cheaper foods. Figures 4 a - d show the distribution of food insecure households across quintiles and by severity of hunger (or the extent of undernourishment). The Figures show that: the food secure category comprises 54 percent from highest income groups (fourth and fifth quintiles) and only 8 and 15 percent from the first and second quintiles; the ultra hungry category comprises 67 percent from the lowest two quintiles and 83 percent from the first three quintiles; the medial hungry category comprises 57 percent from the lowest two quintiles or 81 percent from the first three quintiles; and the subjacent hungry category comprises 54 percent from the lowest two quintiles or 69 percent from the first three quintiles. For a comprehensive coverage, a social protection programme must reach households in the first, second and third quintiles. This would ensure that over 83 percent of the ultra hungry, 81 percent of the medial hungry and 69 percent of the subjacent hungry are reached.

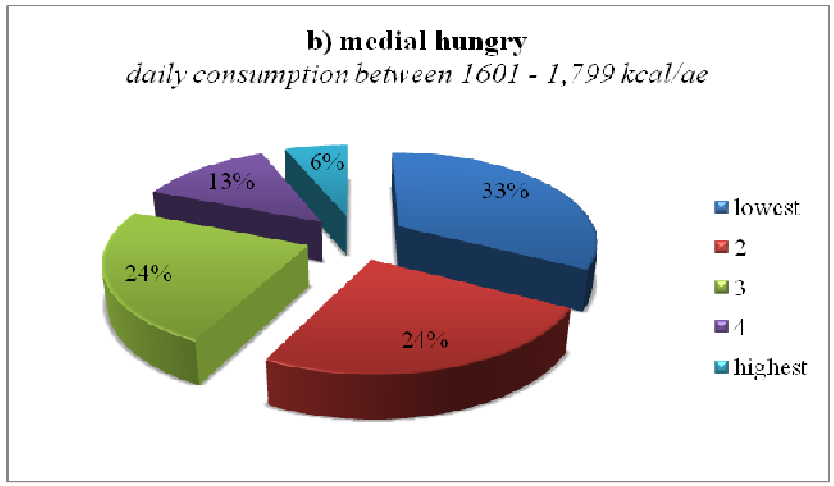
According to the results, the depth of hunger (energy deficiency) and the proportion of households with deficient energy intake decreases as the household income increases. The subsidy level needed therefore decreases with the quintile. Governments frequently opt for blanket food subsidy schemes (for example the subsidy on maize grain in November 2009) due to the challenges associated with targeting of food subsidies. But this approach may not be feasible to support all[13] the poor and vulnerable households. This paper shows how food expenditure surveys may be used to target the needy households and to assess their level of need.

[13] Such a scheme may be limited by available resources.

Figure 4: Distribution of households with a deficiency in daily energy intake across the five income groups







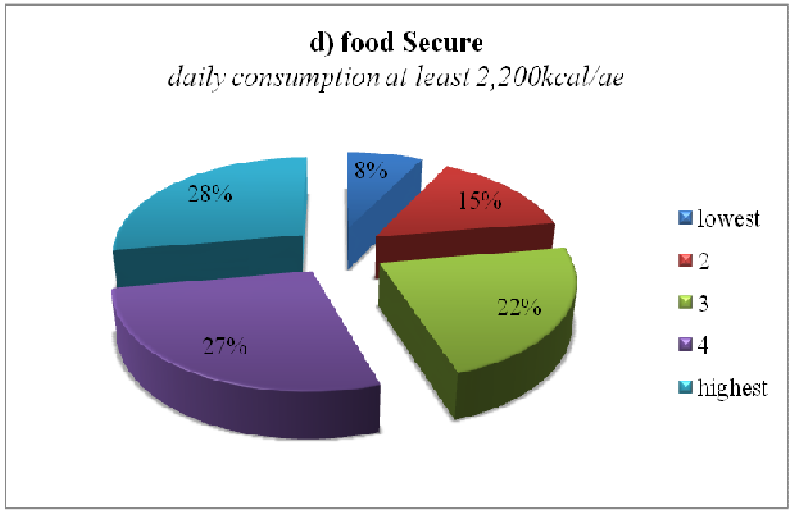


Table 5: Cost (KES/month) of supplementing household's dietary energy deficit & adequacy (%) of GOK cash transfer scheme

	Source of Supplementary Dietary Energy	Lowest	2	3	4	Highest	Average
Sample Average	maize meal	**1,528**	865	893	950	608	1,119
	adequacy of GOK cash transfer	***(2)***	*42*	*40*	*37*	*59*	*25*
	maize grain	915	518	535	569	364	670
	adequacy of GOK cash transfer	*39*	*65*	*64*	*62*	*76*	*55*
By Level of Hunger							
Ultra Hungry	maize meal	**2,122**	1,497	1,414	**1,997**	1,044	1,814
	adequacy of GOK cash transfer	***(41)***	*0*	*6*	***(33)***	*30*	*(21)*
	maize grain	1,270	896	847	1,195	625	1,086
	adequacy of GOK cash transfer	*15*	*40*	*44*	*20*	*58*	*28*
Medial Hungry	maize meal	837	815	857	1,045	1,124	866
	adequacy of GOK cash transfer	*44*	*46*	*43*	*30*	*25*	*42*
	maize grain	501	488	513	625	673	518
	adequacy of GOK cash transfer	*67*	*67*	*66*	*58*	*55*	*65*
Subjacent Hungry	maize meal	440	368	266	336	255	355
	adequacy of GOK cash transfer	*71*	*75*	*82*	*78*	*83*	*76*
	maize grain	263	221	159	201	153	212
	adequacy of GOK cash transfer	*82*	*85*	*89*	*87*	*90*	*86*

4. Conclusions

Our results show that forty four percent (44%) of households in Nairobi are under-nourished with upto 20 percent being ultra hungry (i.e. their daily per capita dietary energy intake is less than 1,600 kcal). A majority of the undernourished are in the low income groups (quintile 1 to 3). A staggering 80 percent of the households in the lowest quintile do not meet the minimum daily requirement for energy, while 60 percent and 40 percent of households in second and third quintiles respectively also do not meet minimum energy intake. Fifty percent of households in the lowest income group and 20 and 17 percent in second and third quintiles respectively are ultra hungry. This group of ultra hungry is classified as those that are likely to die of hunger (IFPRI, 2010).

The prevalence of deficient energy intake or undernourishment increases as the household income decreases. The study has therefore shown that a decrease in per capita expenditure on total food, staples and other food groups in urban households signal increased severity in food insecurity. A decrease in per capita expenditure in the various food groups is an indication of low diversity in the diet of the food insecure. It is also a reflection of low quality diets as is also suggested by lower intake in foods rich in proteins, vitamins and minerals in the diet of the food insecure. The findings of this study are in line with earlier observations that where there is a deficit in the average kilocalorie intake, many people's diets are deficient in everything (FAO, 2000) and where the deficit is moderate, people get enough of staple foods but often lack other foods that provide protein, fat and micronutrients as well as energy, namely: legumes, meat, fish, oils, dairy products, vegetables and fruit. Similar findings were found for Mexico, Bolivia, Philippines and Burkina Faso where food insecurity was found to be associated with reduction in the food budget. Furthermore, households faced with food insecurity, even at moderate levels, had reduced expenditure on food items that are higher quality and such as foods sourced from livestock and had low intake of micro-nutrient rich foods (Melgar-Quinonze et al., 2006).

Households that are more likely to be undernourished are those in low income groups, those with larger family sizes and those headed by a male. Households that are less likely to be undernourished are those with both parents (father and mother), those with more infants. Among the households with a deficit in dietary energy, characteristics of the head, such as the gender,

education level, and employment seem not to improve the food insecurity situation. For example, salaried employment seems not to be an advantage in an undernourished household maybe because they hold low paying jobs that cannot adequately nourish the household. Ownership of a home however, alleviates the problem of food insecurity since such households have higher food expenditure.

Households, across all expenditure quintiles were found to access their food mainly from the market (purchasing) and rarely produced their own food or receive gifts. Markets are therefore critical in ensuring food security for urban households.

Under a government cash transfer scheme which was announced in November 2009, needy/poor households in Nairobi received a cash transfer of KES 1,500 every month. In addition to this scheme, there are other cash transfer schemes that are being implemented by non-profit organizations. Using the retail prices prevailing in November 2009 for maize grain and maize meal (sifted), the study shows that it costs an average of KES 1,528 and KES 865 to subsidize households in first and second quintiles with sifted maize while it costs much less i.e. KES 915 and KES 518 when the supplement is in form of maize grain. The cost of supplementing households increases with the level of hunger. For example, it costs KES 1,814 and KES 1,086 to supplement an ultra hungry household and only KES 866 and KES 519 to supplement a household with medial hunger using maize meal and maize grain respectively.

Generally, the cash transferred is adequate for meeting the energy deficit in all households except for the ultra hungry households in the lowest income group. This group requires KES 2,122 to meet the energy deficit using maize meal and so the cash received by these households is 41 percent lower than the estimated cost. The cash transferred would however meet the energy deficit for this group if the supplement was the relatively cheaper maize meal (posho).

The results also suggest that for a comprehensive coverage, the food subsidy programme must target households in the first, second and third quintiles. This would ensure that over 83 percent of the ultra hungry, 81 percent of the medial hungry and 69 percent of the subjacent hungry are reached.

According to this study, the depth of hunger (energy deficiency) and the proportion of households with deficient energy intake decreases as household income increases. The study therefore supports targeted food subsidies since the support needed varies with household income and level of hunger. The study further shows how food consumption and expenditure surveys may be used to target needy households and to assess their level of food need.

The cash transfer is more than adequate when the undernourished are supplemented with grain as opposed to sifted maize meal. This means that the government may be able to stretch current resources[14] to adequately supplement the energy intake of more households through better targeting and using cheaper food options. Beneficiary households may use the surplus cash transferred to them to purchase more food or to engage in various income generating activities.

5. Policy Implications

Our results show that, a significant proportion (44%) of households in Nairobi are under-nourished. Urban food insecurity continues to be a major problem partly because like many other countries, urban food insecurity has mainly been invisible to policy makers (Maxwell, 1999) and partly because of the ineffectiveness in policies addressing this problem (Musyoka et al., 2010). Hunger or food insecurity still remains a household's or individual's problem and only comes to the fore when there is a major problem in food supply or a sudden increase in food prices affecting a large number in the population. Thereafter the problem is quickly forgotten and not dealt with the seriousness it deserves. Our findings lead us to recommend the following:

i) With regard to food markets;

Increased efforts towards building food markets that are reliable and efficient and which can deliver affordable and nutritious food at all times particularly to urban households. Hunger in these urban households is a signal that households particularly the poor have problems in accessing adequate food from the market. So in addition to efficient and reliable markets and food system, the results also support the establishment of safety nets for the urban poor and vulnerable groups who cannot access sufficient food from the market.

[14] In 2009 the government allocated KES 600 million (less administrative costs) to food subsidy through cash transfers

ii) With regard to food security;

Strengthen food safety nets for poor and vulnerable groups in urban areas especially those in Nairobi and reduce the depth of hunger through: feeding programmes for the severely undernourished households; supplementing energy intake of undernourished in the first and second quintiles and if possible those in the third quintile through cash transfer schemes; and increasing the food security of the low income households by creating employment opportunities with higher returns.

Posho meal, directly hulled from maize grain is a cheaper option for supplementing energy intake in low income households. This recommendation is supported by findings in this paper as well as earlier studies (Muyanga et al., 2005) that poor households prefer posho meal rather than sifted maize meal. There are however challenges in delivery of posho 'maize' meal (particularly low shelf life & use of the voucher system in the informal sector) that would need to be dealt with.

Due to the challenges associated with targeting food subsidies, governments frequently opt for blanket food subsidy schemes for comprehensive coverage. This paper however shows that it is not necessary to provide equal support (to the same extent) to all[15] the food insecure households. The paper therefore supports targeting in food subsidy schemes and demonstrates how consumption and food expenditure surveys may be used in targeting the needy households and in assessing their level of need.

iii) *With regard to monitoring and evaluation*;

The paper provides data or evidence crucial for benchmarking and assessing the progress made towards the attainment of millennium development goal (MDG) number 1 in urban areas like Nairobi. The paper estimates the depth of hunger, in terms of deficit in dietary energy, and orders households along a continuum which is useful for planners and managers in prioritizing and targeting interventions. Further, the paper determines the difference between the food security status of households which is crucial for monitoring and evaluation of interventions. It shows

[15] Such a scheme may be limited by available resources.

that household food expenditures are strongly associated to severity of hunger (while holding other factors constant) and can proxy for households' food security.

iv) With regard to government policy and strategy;

- Fast track the Food Security and Nutrition (FSN) Draft Policy.
- Harmonize and look for synergies in steering and coordination committees charged with food and nutrition security. For example, the functions of working groups (WGs) in the Kenya Food Security and Steering Group (KFSSG) on Agriculture & Livestock; Health and Nutrition and ASCU's Thematic Working Group (TWG) on Food Security and Nutrition (FSN).
- Harmonize, institutions and programmes involved in implementation of the food security and nutrition strategy and seal gaps and minimize overlaps or grey areas in strategy.

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Appendices

A1 FAO's Method of calculating food energy requirements

How much people need to eat each day - their daily dietary energy requirement - depends on their weight, height, age, sex and activity level.

The table **(INSERT)** gives examples of light, moderate and heavy activity levels and the amount of food energy required for such activities by men and women of differing body weight. The energy requirements for elderly people are somewhat less, and those for children are much less.

The prevalence and depth of hunger are calculated using the minimum daily energy requirements of the different sex and age groups in a population. The minimum requirement for each group is based on the lowest acceptable weight for the typical height of the group in a country and the light activity norm.

A2 Description of the method FAO uses to estimate the prevalence and depth of undernourishment:

- Calculate the total number of calories available from local food production, trade and stocks.
- Calculate an average minimum calorie requirement for the population, based on the number of calories needed by different age and gender groups and the proportion of the population represented by each group.
- Divide the total number of calories available by the number of people in the country.
- Factor in a coefficient for distribution to take account of inequality in access to food.
- Combine the above information to construct the distribution of the food supply within the country and determine the percentage of the population whose food intake falls below the minimum requirement. This is the prevalence of undernourishment.
- Multiply this percentage by the size of the population to obtain the number of undernourished people.
- Divide the total calories available to the undernourished by the number of undernourished to obtain the average dietary energy intake per undernourished person.

- Subtract the average dietary energy intake of undernourished people from their minimum energy requirement (expressed in kilocalories per person per day) to get the average dietary energy deficit of the undernourished. This is the depth of hunger.

A3 Survey Sample Design

Sample design

The sample design for Urban Consumption Survey (UCS), 2009 by the Tegemeo Institute utilized a two stage cluster sampling methodology. The first stage involved sampling of Enumeration Areas (EAs), which were the primary sampling units (PSUs) for the survey, from a master sampling frame, while the second stage involved selection of households.

Sampling Frame

The sample for the (UCS), 2009 was drawn from the National Sample Survey and Evaluation (NASSEP) IV sampling frame, which was developed in 2002 based on the 1999 Population and Housing Census. The sampling frame is multi-purpose in nature and was designed to provide estimates for various surveys. The frame is continuously updated.

Nairobi is one of the 8 provinces in the administrative structure of the country. The administrative hierarchy starts from the provinces then districts, divisions, locations and finally sub locations. During the 1999 census, Nairobi was both a province, a district and entirely urban. Prior to 1999 population census, each sub-location was subdivided into small units called Enumeration Areas (EAs) for the purpose of the census. Nairobi province had 4,776 EAs covering all the socio-economic classes.

The NASSEP IV frame followed a multi stage cluster sampling format with first level stratification being the district or sub strata by socio economic categories. The first stage involved selection of Primary Sampling Units (PSUs), which were the EAs, using probability proportional to size (PPS) method. The second stage involves the selection of households for various surveys. EAs were selected on the basis of one measure of size (MOS), defined as the ultimate cluster with an average of 100 households, with a minimum of 50 and maximum of 149 households. Nairobi has a total of 108 clusters of which 2 are non-operational.

During the creation of NASSEP IV master sample, it was observed that six major urban areas, viz. Nairobi, Mombasa, Nakuru, Eldoret, Kisumu and Thika had a lot of variation across their populations. As a result, the areas were stratified to control for the apparent variation. The stratification was based on socio-economic characteristics of the population. The following five strata thus resulted:

(1) Upper

(2) Second Upper

(3) Middle

(4) Lower Middle

(5) Lower socio-economic categories.

The UCS 2009 sample was drawn from the five socio economic strata in Nairobi in order to capture all the important variables for the study.

Sample size , survey domains and sample selection

Sample size and survey domain

The UCS 2009 was aimed at providing the estimates for Nairobi district/province. Therefore, the domain of the study is Nairobi province. A sample size of 1,000 households was pre-determined in order to provide estimates for Nairobi as an urban area. The power allocation method was used to distribute the sample across the five socio-economic strata. The method was adopted instead of a proportional allocation so as to have adequate sample in the smaller strata. The design of the study was to have a uniform sample of 20 households per cluster, resulting into a total of 50 clusters. The distribution of the sample is shown in Table 1.

Table A6 : Sample distribution

Serial number	Stratum	Estimated total No. of households (1999)	No. of clusters	No. of selected households
1	Upper	26,956	8	160
2	Lower Upper	17,800	7	140
3	Middle	73,116	10	200
4	Lower Middle	313,215	13	260
5	Lower	208,395	12	240
Total		**639,482**	**50**	**1,000**

Sample Selection

1. **Selection of clusters**

The selection of the clusters was done systematically using the Equal Probability Selection method (EPSEM). Since NASSEP IV was developed using PPS method, the resulting sample of clusters was expected to retain its properties. The selection of the clusters was done independently within each stratum.

2. **Selection of Households**

From each of the selected cluster, 20 households were selected systematically, with a random start. Selection of the households was accomplished using the following procedure.

Let L be the total number of households listed in the cluster; let R be a random number between (0, 1) [Random numbers are different and independent from cluster to cluster]; let n be the number of households to be selected in the cluster; let I = L/n be the sampling interval.

(1) The first selected sample household is k (k is the serial number of the household in the listing) if and only if $(k-1)/L < R \leq k/L$

(2) The subsequent selected households are those having serial numbers:

$k + (j-1)*I$, *(rounded to integers)*

for $j = 2, 3, \ldots n;$

The systematic sampling method was adopted as it enables the distribution of the sample across the cluster evenly and yields good estimates for the population parameters. Selection of the households was done at the office and assigned to the field teams.

3. Selection of the respondents

The UCS survey targeted the head of the household or, in absence of the head, the most knowledgeable person within the household.

Estimation Procedures

Weighting the Sample Data

The resulting sample was not self weighting owing to the unproportional allocation of the sample within the strata. Weighting was therefore necessary to take account of the selection probabilities.. The weights were developed using the design weights of the clusters, the response levels and the number of clusters in the study. In the computation process, adjustment were made for cluster and household non-response. The mathematical relation is given as follows:

$$W_{hi} = D_{hi} \times \frac{S_{hi}}{l_{hi}} \times \frac{C_h}{c_h}$$

where,

W_{hi} = Overall cluster weight for the i-th cluster in the h-th stratum

D_{hi} = Sample cluster design weight obtained from cluster selection probabilities for the i-th cluster in the h-th stratum

S_{hi} = Number of listed households in the i-th cluster in the h-th stratum

l_{hi} = Number of responding households in i-th cluster in the h-th stratum

C_h = Number of operating clusters in h-th stratum

c_h = Number of selected clusters in the h-th stratum

The weights were applied to each individual item to obtain estimates on any given variable in a specified domain or category.

Weights were first developed for households per cluster and then the same weights were applied to individuals within the cluster. These provided the aggregate weights and used for estimation of totals.

Normalizing weights:

Normalization of weights was done independently for households and individuals. The aggregate weights were normalized for the whole sample so that the total number of weighted cases is equal to the number of un-weighted cases.

Normalized weights have a mean of 1.0 and are used to avoid generating incorrect standard errors and confidence intervals and are valid for estimation of proportions and means at any aggregation level. However, they are not valid for estimation of totals.

Estimation of the Population Parameters

The estimates for the population indicators may be proportions, ratios (means) or totals. The estimation process involves multiplication of the weighting factor with the sample value and summing up the products.

The estimates could include totals and ratios. In the estimation of totals, sample weights were applied to obtain national and domain totals using the expression:

$$\hat{Y} = \sum W_{hi} Y_{hij}$$

where

$\hat{Y}$ = estimate of the total of the variable Y;

W_{hi} = weight of the i-th cluster in the h-th domain.

Y_{hij} = observed value of the variable Y in the h-th domain in the i-th cluster on the j-th individual or household

For a ratio estimate, the estimates for Y and X will be weighted before the estimation of the ratio using the expression:

$$R = \frac{\hat{Y}}{\hat{X}}$$

Estimation of Sampling Errors

Estimates from the sample are subject to sampling and non-sampling errors. Sampling errors are usually controlled through the sample design while the latter are not easy to control since they arise from sources on which the sampling process has no control. These include failure of the enumerator to locate a respondent for interview, mistakes in recording the response from a respondent, mistakes during the data entry process and other causes which are unrelated to the design. However, the sample selected for the survey is one of the many possible samples that would come up in separate sample selection processes from the population. Estimates based on different samples from the population would have differences associated with the selections. The variation observed in different independent selections of samples amount to sampling errors. As a measure of these errors, the square root of the standard deviation of the estimates from the survey provides a measure of the sampling errors of the sample design.

Since the sampling design is not of simple random in nature, variance estimation tends to be complicated due to the need to take care of the complexity of the design. In the estimation of the standard errors of the population parameters, the ultimate cluster method of variance estimation is to be used. This is considered applicable because the variability of weights within the strata is not significant.

Table A2: Comparison between minimum wage in Nairobi and the retail price for maize (Grain & Flour)

Gazetted Averange Monthly* Basic Minimum Wages: Urban Areas (Nairobi)
*Excluding House Allowance Annual Average prices

Year	Wage (KES)	Price of 2 Kg Maize Flour (KES)	Price of 2kg Maize Grain (KES)
1998	4241	48	36
1999	4538	48	37
2000	4809	53	42
2001	5172	48	36
2002	5534	38	27
2003	6142	48	36
2004	6818	55	42
2005	7295	54	41
2006	8171	54	42
2007	8171	48	38
2008	8171	69	52

Table A3: Determinants of whether household will have a deficit in energy intake

Logistic regression Model (if energy deficit 1 = yes; 0 = no)

	Coef.	Std. Err.	z	P>z
Gender of household head (1 = male)	1.383	0.382	3.62	0.000
Log of age of household head (years)	0.014	0.452	0.03	0.976
Log of education level of household head	-0.319	0.264	-1.21	0.227
Marital status of head (1 = married)	-0.666	0.340	-1.95	0.051
If head is in salaried employment (1 = salaried)	-0.337	0.303	-1.11	0.267
If head is engaged in business activity (1 = in business)	-0.208	0.296	-0.7	0.482
If head was chronically ill for at least three months (1 = ill)	0.577	0.685	0.84	0.400
If there was any occurrence of death in household (1 = death in household)	-0.008	0.550	-0.01	0.989
Log of family size (count)	1.808	0.462	3.91	0.000
Number of infants (0 to 5 years)	-0.426	0.166	-2.57	0.010
Number of children (6 to 14 years)	0.194	0.130	1.5	0.134
Number of dependant adult children (15 - 23 years)	0.066	0.119	0.55	0.581
Number of independent adults (24 - 55 years)	0.104	0.128	0.81	0.416
Number of senior adults (> 55 years)	-0.301	0.249	-1.21	0.227
If main house has electricity (1 = has electricity)	0.230	0.247	0.93	0.351
If main house has modern plumbing (1 = modern plumbing)	0.230	0.306	0.75	0.451
If household owns the house they live in (1 = own house)	0.298	0.262	1.14	0.256
If household is in first quintile (1 = yes)	2.952	0.488	6.05	0.000
If household is in second quintile (1 = yes)	2.431	0.439	5.53	0.000
If household is in third quintile (1 = yes)	1.989	0.407	4.89	0.000
If household is in fourth quintile (1 = yes)	0.710	0.335	2.12	0.034
Constant	-5.022	1.957	-2.57	0.010
	Number of obs		799	
	LR chi2(21)		179	
	Prob > chi2		0.00	
	Pseudo R2		0.18	
	Log likelihood = -402.20025			

Strategies for Accessing Food by Urban Households (Nairobi)

Table A4.1: All foods

Food category	Exp Quintiles	Stats	Kgs Consumed				Source as a Proportion of Total Consumed		
			Total Consumed	Purchased	Produced	Gifts	Purchased	Produced	Gifts
Staples	Lowest	Mean	8.1	7.6	3.7	1.9	0.95	0.01	0.04
		N	180	178	8	31	178	8	31
	2	Mean	7.7	7.4	2.0	1.3	0.96	0.00	0.04
		N	194	194	5	36	194	5	36
	3	Mean	7.3	7.0	2.4	1.2	0.96	0.00	0.04
		N	196	196	4	42	196	4	42
	4	Mean	7.4	6.9	1.8	1.6	0.94	0.01	0.06
		N	148	148	6	40	148	6	40
	Highest	Mean	7.1	6.3	2.1	2.6	0.95	0.01	0.04
		N	95	95	7	24	95	7	24
	Total Staples	Mean	7.6	7.1	2.5	1.6	0.95	0.01	0.04
		N	814	812	30	174	812	30	174
Fruits & Vegetables	Lowest	Mean	5.6	5.2	5.6	1.0	0.96	0.01	0.03
		N	178	178	7	25	178	7	25
	2	Mean	6.2	6.0	2.0	0.6	0.98	0.01	0.01
		N	192	192	12	18	192	12	18
	3	Mean	5.5	5.3	2.0	1.3	0.98	0.00	0.02
		N	196	196	4	24	196	4	24
	4	Mean	5.3	4.9	1.5	1.3	0.96	0.01	0.03
		N	151	151	10	32	151	10	32
	Highest	Mean	5.7	5.4	1.6	0.6	0.96	0.01	0.03
		N	95	95	7	19	95	7	19
	Total F n V	Mean	5.6	5.4	2.5	1.0	0.97	0.01	0.02
		N	812	812	39	119	812	39	119
Pulses	Lowest	Mean	2.3	2.3	3.1	1.5	0.88	0.00	0.11
		N	143	130	1	20	130	1	20
	2	Mean	2.4	2.3	6.2	1.3	0.88	0.02	0.11
		N	155	144	3	23	144	3	23
	3	Mean	2.2	2.0	1.4	1.4	0.92	0.01	0.08
		N	150	144	2	18	144	2	18
	4	Mean	2.5	2.3	1.7	1.7	0.88	0.01	0.11
		N	128	119	5	22	119	5	22
	Highest	Mean	2.3	2.1	1.7	2.0	0.94	0.01	0.05
		N	78	76	2	6	76	2	6
	Total Pulses	Mean	2.3	2.2	2.9	1.5	0.90	0.01	0.09
		N	653	612	12	89	612	12	89
Dairy Products	Lowest	Mean	12.9	12.9	15.0	8.4	0.99	0.00	0.01
		N	177	177	0	2	177	0	2
	2	Mean	13.8	13.5	21.7	6.8	0.98	0.01	0.01
		N	191	189	2	5	189	2	5
	3	Mean	13.4	13.1	39.6	51.1	0.99	0.00	0.00
		N	195	194	0	1	194	0	1
	4	Mean	15.0	15.0	23.6	1.2	0.99	0.00	0.00
		N	147	146	1	1	146	1	1
	Highest	Mean	18.0	17.4	44.8	4.6	0.96	0.01	0.03
		N	94	92	1	9	92	1	9
	Total Dairy	Mean	14.2	14.0	30.1	7.7	0.99	0.00	0.01
		N	803	798	4	17	798	4	17
Meats & Eggs	Lowest	Mean	2.4	2.3	1.1	0.7	0.94	0.02	0.04
		N	173	171	6	24	171	6	24
	2	Mean	2.4	2.3	0.7	1.3	0.96	0.01	0.04
		N	187	187	3	22	187	3	22
	3	Mean	2.9	2.8	0.6	0.6	0.95	0.01	0.04
		N	191	191	4	26	191	4	26
	4	Mean	3.6	3.6	1.7	0.5	0.97	0.00	0.03
		N	147	146	1	16	146	1	16
	Highest	Mean	3.6	3.6	1.4	2.2	0.99	0.00	0.01
		N	92	92	1	2	92	1	2
	Total Meats	Mean	2.9	2.8	0.9	0.8	0.96	0.01	0.03
		N	790	787	14	90	787	14	90

Table A4.2: Staples

			Quantity of Staple Consumed (mean)				As a Proportion of Total Quanatity		
Staples	**Expenditure Quintiles**	**Stats**	**Total**	**Purchased**	**Produced**	**Gifts**	**Purchased**	**Produced**	**Gifts**
Maize products	Lowest	Mean	14.3	14.0	18.7	6.0	0.93	0.02	0.05
		N	178	169	5	16	169	5	16
	2	Mean	11.9	11.7	2.5	3.3	0.95	0.01	0.05
		N	190	187	3	16	187	3	16
	3	Mean	8.9	8.7	6.5	3.9	0.95	0.00	0.05
		N	192	190	1	17	190	1	17
	4	Mean	8.0	7.8	6.0	2.7	0.91	0.00	0.09
		N	145	140	0	26	140	0	26
	Highest	Mean	6.7	6.3	6.5	4.9	0.88	0.05	0.07
		N	90	82	5	9	82	5	9
	Maize Avg	Mean	10.4	10.2	10.2	3.9	0.93	0.01	0.06
		N	794	768	14	84	768	14	84
Wheat products	Lowest	Mean	5.3	5.3		2.6	0.98	0.00	0.02
		N	154	151		5	151		5
	2	Mean	4.8	4.8		1.6	0.99	0.00	0.01
		N	180	180		6	180		6
	3	Mean	6.3	6.3	0.7	0.6	0.99	0.00	0.01
		N	186	185	0	6	185	0	6
	4	Mean	5.1	5.1		0.2	1.00	0.00	0.00
		N	142	142		1	142		1
	Highest	Mean	6.0	6.0		1.8	1.00	0.00	0.00
		N	93	93		1	93		1
	Wheat Avg	Mean	5.5	5.5	0.7	1.5	0.99	0.00	0.01
		N	754	751	0	20	751	0	20
Rice	Lowest	Mean	5.0	5.0		1.0	1.00	0.00	0.00
		N	161	161		2	161		2
	2	Mean	5.0	4.9		10.0	0.99	0.00	0.01
		N	179	178		1	178		1
	3	Mean	5.8	5.9		3.6	0.98	0.00	0.02
		N	179	176		3	176		3
	4	Mean	6.0	6.0	8.0	2.5	0.96	0.02	0.03
		N	143	137	2	5	137	2	5
	Highest	Mean	5.9	5.9		11.9	0.99	0.00	0.01
		N	88	87		1	87		1
	Rice Avg	Mean	5.5	5.5	8.0	4.2	0.98	0.00	0.01
		N	750	739	2	12	739	2	12
Cooking bananas	Lowest	Mean	8.7	6.7	14.2	18.5	0.82	0.03	0.14
		N	53	44	2	8	44	2	8
	2	Mean	10.4	9.2	15.8	21.6	0.89	0.03	0.08
		N	83	74	3	7	74	3	7
	3	Mean	11.0	10.0	21.7	12.8	0.83	0.02	0.15
		N	88	73	3	14	73	3	14
	4	Mean	12.7	12.0	16.0	14.6	0.78	0.04	0.18
		N	77	60	3	14	60	3	14
	Highest	Mean	13.7	9.2	22.9	22.8	0.77	0.06	0.17
		N	48	39	3	10	39	3	10
	Banana Avg	Mean	11.2	9.6	18.4	17.2	0.82	0.04	0.14
		N	350	289	13	53	289	13	53
Irish /sweet potatoes	Lowest	Mean	9.0	9.0	6.5	4.7	0.96	0.02	0.02
		N	147	144	3	4	144	3	4
	2	Mean	11.5	11.4	13.1	5.3	0.96	0.01	0.03
		N	152	148	3	5	148	3	5
	3	Mean	9.8	9.7		5.9	0.98	0.00	0.02
		N	167	165		5	165		5
	4	Mean	11.5	11.0	11.4	8.3	0.92	0.01	0.06
		N	125	120	2	12	120	2	12
	Highest	Mean	11.8	10.8	24.6	12.3	0.92	0.01	0.07
		N	90	85	1	11	85	1	11
	I pot Avg	Mean	10.6	10.3	11.7	8.3	0.95	0.01	0.04
		N	682	661	8	37	661	8	37
Cassava products	Lowest	Mean	3.7	2.3		6.1	0.78	0.00	0.22
		N	13	11		4	11		4
	2	Mean	9.8	8.3		49.5	0.96	0.00	0.04
		N	10	9		0	9		0
	3	Mean	2.5	1.0		2.6	0.05	0.00	0.95
		N	5	0		4	0		4
	4	Mean	1.3	1.3		1.0	0.97	0.00	0.03
		N	10	10		0	10		0
	Highest	Mean	5.9	6.2		0.6	0.96	0.00	0.04
		N	9	9		0	9		0
	Casava Avg	Mean	4.7	4.3		5.6	0.82	0.00	0.18
		N	46	38		9	38		9
Millet /sorghum	Lowest	Mean	1.9	1.7	4.1	3.2	0.91	0.03	0.06
		N	58	53	2	3	53	2	3
	2	Mean	2.3	2.4		1.7	0.86	0.00	0.14
		N	66	56		9	56		9