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Full Length Research Paper

Assessment of food and nutrient intake of beneficiary and non-beneficiary households in a dairy development project of Vihiga District, Kenya

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A cross sectional design using a three-consecutive day 24 h diet recalls survey was adopted using interview schedules to estimate the nutrient consumption in 60 households of which 30 households were beneficiary and 30 were non-beneficiary households of a dairy development project in Vihiga, Kenya. Variation was observed in the consumption of meat and meat products, cereals and vegetables between days for households. Variation in the consumption of meat and meat products cereals, vegetables, and, milk and milk products between days for women was observed. Variations in nutrient intake were significant between days for energy, protein, calcium, thiamine and niacin in households and by women. Variations between households and between days with regard to food and nutrient intake observed indicate that a one-day twenty-four-hour diet recall method may not bring out the true pattern of food and nutrient intake of households and individuals. The twenty-four-hour recall diet survey method conducted for a period of days could show food and nutrient consumption pattern clearly from which average requirements for the population can be derived.

Key words: Dairy, beneficiary, non-beneficiary, nutrient consumption, Vihiga, Kenya.

INTRODUCTION

Various diet survey methods have been used to gather food and nutrient information of individuals from which conclusions of adequacy of intake are made, and sometimes population recommended allowances generated. Food and nutrient estimates of individuals or populations help in aetiological studies of health and nutrition status of populations. Different dietary assessment methods have limitations in obtaining accurate estimation of food and nutrient intakes of populations. The weighing method, for example, has been considered the most reliable diet survey method for determining dietary intakes of populations (Abramson, 1963; Armar-Klemesu et al., 1995; Combs and Wolfe, 1960; FAO, 1987; FAO, 1964). This method involves a great deal of time and energy expenditure, besides inconveniencing indexes households and individuals. Individuals can also make adjustments in the food intake during the survey period, giving a false picture of the food consumption pattern. Even then, researchers have seen the need to conduct diet weighment for a period of time even up to seven days to get the mean food intakes that reflect the true pattern of food and nutrient intake of individuals and populations (ICMR, 1989). However, because of the heavy requirements of the weighment method, one-day twenty-four-hour diet recall survey has been commonly used to estimate the food and nutrient intakes of populations. Such a survey fails to capture the day-to-day variations in the food and nutrient intake for households and individuals. This yields a wrong pattern

Abbreviations: DRI, Dietary reference intakes; **UML,** Upper Midland; **LML,** Lower midland; **ICMR,** Indian Council of Medical Research; **RDI**, recommended daily intake**; RDA,** recommended dietary allowances**; FAO,** Food and Agriculture Organization.

of the food and nutrient intake of population leading to flawed policy decisions regarding adequacy of food and nutrient intake.

Overconsumption and under-consumption of foods and nutrients have poor nutrition and health implications for individuals and populations, and for the health service sector. Day-to-day variations in food intake could emanate from various factors like income availability, indisposition, changes in daily work patterns and seasonal labour demands, household size and composition amongst others. Therefore a one-day twenty-four hour [24 h] diet recall is not adequate to estimate an individual's dietary intake and nutrition estimates and conclusions based on such surveys are flawed. Frequent recalls per subject can provide a reliable estimate of an individual's usual intake (Institute of Medicine, 2000). There is no systematic analysis of the quality of twenty-four hour diet recall, and little work has been done to consider ways to improve these dietary assessment methods. Variations in food intake and eating patterns within households appear to be changing with changing economic status and food scarcity. The focus of most food policies is more on food security needs and on health-related needs of selected age and gender, making individual dietary intake more valuable.

The goal of assessing the intake of an individual is to determine the probability that the person's usual diet is meeting his or her nutrient needs and whether the person is potentially at risk for adverse effects from excessive intakes (Barr et al., 2002). Dietary Reference intakes [DRIs] are available for energy, macronutrients, vitamins, minerals, and fibre [Murphy and Vorster, 2007; Barr, Murphy, Agurs-Collins and Poos, 2003; Murphy, Barr, Poos, 2003]. It is difficult to know if an individual's nutrient intake is adequate because the person's nutrient requirements are usually unknown, and an accurate measure of the person's usual long-term nutrient intake is almost unavailable (Kaiser and Dewey, 1991). It is necessary to observe a person's diet over many days because of the day-to-day variations. How many days are appropriate for this estimation is a question researchers need to answer. This study was established to assess the three-day variations in usual food and nutrient intake for women in Dairy Development Project area in Vihiga District.

MATERIALS AND METHODS

The study was conducted in Sabatia division of Vihiga district, Kenya, in beneficiary and non-beneficiary households of a Dairy Development Project. The Dairy Development Project was initiated to improve household food security socially, and economically empower women in decision-making in the households and the wider community. Dairy interventions have been initiated in this area in view of the manifestation of negative developmental characteristics, including high levels of poverty. The district is divided into two main agro-ecological zones: the upper midland (UML) and the lower midland (LML) zone. The upper midland zone has fertile, well drained, dark red soils which support the growing of tea, coffee, finger millet, maize, beans, fruits and cassava. The lower midland zone has red loamy soils derived from sediments and basement rocks, supporting the growing of sugarcane, maize, coffee, beans, finger millet and sorghum. The permission to conduct the research was granted by the office of the President and the Maseno University Institute of Research and Postgraduate Studies. To access households and schools, permission was sought from the District Education Office and the District Officer in charge of Administration as is the procedure in Kenya for research where individuals are interviewed. The District Officer introduced the research team to all his constituents in a general meeting where the purpose of the study was expounded. Permission was sought from individual respondents. The purpose of the study was further explained to all respondent women for them to make an informed decision on participation in the study

Women from beneficiary households and non-beneficiary households of a Dairy Development Project were respondents who provided information on the food intake of households and also their own intakes. Women beneficiary were the cases while the women non-beneficiary of the Dairy Project were the controls. For a woman from the beneficiary household to qualify for the study, she must have been a member of the Dairy Project for at least three years. This was assumed to be the least period for one to notice perceived nutritional and health benefits of the project.

The study was carried out using a cross-sectional design with a case-control model. Households were randomly selected for participation in the diet survey. A total of 30 households were randomly selected from a list of beneficiary households in a Dairy Development Programme, and were matched with 30 non-beneficiary households in the Dairy Development Project. Beneficiary households were identified from a list at the project office and were matched for education, age, income and geographical location with the non-beneficiary households. Overall, 60 households were selected to form the sample households for a detailed twenty-four-hour-diet recall survey. Since each household was interviewed for three consecutive days, the total interviews were 180. The study was conducted between February and April when farmers are busy with land preparation for seed sowing, weeding, and when household food stocks are low. This is a period of transient food insecurity and nutrient intakes are low.

The twenty-four-hour diet recall survey method was used to gather information on food and nutrient intake in households. Pre-tested interview schedules were used to collect data on food and nutrient intake for households and for women. Women were asked to recall and estimate the amounts of foods prepared and consumed in the households and their food intake for the past twenty-four hours. Information on the total food cooked for household consumption and the portion sizes consumed by mothers were estimated using standard household measures. This was repeated for three consecutive days, excluding special and non-feast days that could distort the food and nutrient intake patterns for women and households. The amounts of food reported cooked and consumed for households and women were quantified. Household food consumption was estimated using household measures. Foods consumed were classified into animal foods, cereals, pulses, green leafy vegetables, other vegetables, roots and tubers, milk and milk products, fats and oils, and sugars. Nutrients consumed were classified into energy, protein, calcium, iron, vitamin A, thiamine, riboflavin, niacin, and ascorbic acid. Daily food and nutrient intake for households and women were estimated using published food composition tables for Kenyan foods (Lechtig et al., 1987) and the FAO food composition table for East Africa (Rao, 1975). Mean food and nutrient intake (for each item) for women and for the entire household were compared with the recommended dietary allowances (RDA) for adequacy. Analysis of variance was used to determine the day-to-day variations in foods and nutrients intake between households, between days for households and women.

Table 1. Mean food intake of women in beneficiary and non-beneficiary households over a three day period.

Parameter	Beneficiary household	Non-beneficiary household	F-Value (df = 58)	Significant level
Meat and meat products	62.19(48.62)	37.21(44.87)	3.66	NS
Cereals	645.22(174.49)	532.69(128.95)	13.93	< 0.01
Pulses	6.96(23.11)	3.72(20.39)	0.61	NS
Green leafy vegetables	215.94(100.63)	200.82(154.58)	0.34	NS
Other vegetables	47.29(53.46)	32.51(38.45)	1.65	NS
Roots and tubers	0.00(0.00)	10.28(44.81)	2.91	NS
Milk and milk products	346.88(89.67)	181.12(100.97)	93.54	< 0.001
Fats and oils	5.18(4.54)	12.38(7.74)	5.70	< 0.05
Sugar	74.19(20.32)	59.61(24.93)	10.10	< 0.01

Note: NS, Not significant; figures in parentheses are standard deviations.

RESULTS

Food consumption and dietary pattern

Most households consumed three meals in a day. Breakfast was mainly composed of tea with or without sugar or milk accompanied occasionally with roasted maize, mandazi or bread. Lunch was normally composed of porridge with or without sugar for some households or ugali served with a vegetable or beef or fish stew for most households. Many households did not consume tubers, pulses and roots. The evening meal was mostly composed of ugali served with a vegetable, and occasionally with fish or beef stew. Maize was the main staple food and the main source of energy in this area. Maize was ground into fine meal in the flour mills spread over the area and was cooked to ugali, a form of stiff porridge and served mostly with a vegetable dish, and sometimes with fish or beef stew. This was common for all households for the evening meal. The maize flour was also stirred into a smooth consistency and taken as porridge, with or without sugar on certain occasions. The main vegetable eaten in this area was “sukuma wiki” or kales.

Foods consumed in households and by women were classified into animal foods, cereals, pulses, green leafy vegetables, other vegetables, roots and tubers, milk and milk products, fats and oils, and sugars. Mean food consumption varied significantly for all foods between beneficiary and non-beneficiary households (Table 1). Beneficiary households consumed significantly more cereals, milk and milk products and sugar than non-beneficiary households. However, consumption of fats and oils was significantly more in the non-beneficiary households. Though mean consumption of meat and meat products, pulses, green leafy vegetables, other vegetables were higher in the beneficiary households, the difference was not statistically significant. Mean consumption of roots and tubers was higher in the non-beneficiary households though the difference was not significant.

Table 2. Variations in food intake by women between households and days.

Food	Variation	
	Household F-ratio	Day F-ratio
Meat and meat products	5.03**	7.31***
Cereals	18.37***	6.81***
Pulses	17.77***	0.08NS
Green leafy vegetables	14.22***	4.49***
Other vegetables	7.53***	10.95***
Roots and tubers	18.31***	1.35NS
Milk and milk products	42.82***	2.66*
Fats and oils	20.32***	0.33NS

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; NS - not significant.

Variations in food intake among women (Table 2) were conducted to identify variations in food consumption by women between days and by women in households. Trends in food consumption for women varied significantly between households for all foods and meat and meat products, and between days for animal foods, cereals, vegetables and milk and milk products. Consumption tended to be high in the beneficiary households for almost all foods. Effort was made to compare the food intake to the Indian Council of Medical Research (ICMR) Standard to check for any need to have population specific recommended dietary allowances. The ICMR was considered to identify the suitability of international standards in the assessment of dietary intakes, especially with the food, diet pattern and racial differences, and the possibility of independent standards for indigenous Kenyans. It was found that the mean food intake for women in the study was above the recommended daily intake (RDI) for all foods except for pulses, roots, tubers and fats/oils of the ICMR. Variations between households and between days conducted variations in food intake among households to identify

Table 3. Variations in food intake by households between households and days.

Food	Variation between	
	Household F-ratio	Day F-ratio
Meat and meat products	5.05**	6.92**
Cereals	12.39**	8.79**
Pulses	18.26**	0.05NS
Green leafy vegetables	11.28**	7.48**
Other vegetables	7.51**	12.47**
Roots and tubers	17.92**	1.45NS
Milk and milk products	42.25**	0.39NS
Fats and oils	17.63**	1.77NS
Sugar	14.56**	0.43NS

* P < 0.05, ** p < 0.001, NS - not significant.

Table 4. Mean nutrient intake by women in beneficiary and non-beneficiary households.

Nutrient	Beneficiary household	Non-beneficiary household	F - value (df = 58)	Significant level
Energy (kcal)	3395.27(659.55)	2774.20(714.83)	21.61	p < 0.001
Protein (g)	106.08(26.16)	81.39(23.64)	20.96	p < 0.001
Calcium (mg)	1685.49(898.50)	1423.20(1015.46)	1.37	NS
Iron (mg)	38.41(47.53)	35.88(9.93)	0.08	NS
Vitamin A retinol equivalent (ug)	920.59(449.95)	765.26(618.37)	0.41	NS
Thiamine (mg)	3.19(0.71)	2.14(0.77)	31.31	p < 0.001
Riboflavin (mg)	1.56(0.80)	1.41(0.35)	3.34	NS
Niacin (mg)	19.65(3.92)	15.00(5.23)	26.11	p < 0.001
Ascorbic acid (mg)	250.74(104.81)	243.10(208.48)	0.04	NS

Note: NS, Not significant; figures in parentheses are standard deviations.

changes in food intake. Between day variations was done to identify day-to-day changes in household food consumption, while between household variations was done to identify day-to-day changes in food consumption from one household to another. Between days variations were observed for meat and meat products, cereals and vegetables. There was no variation between days in the consumption of pulses, roots and tubers, milk and milk products, fats and oils in the households (Table 3). Food intake tended to be high in beneficiary than in non-beneficiary households.

Mean nutrients intake of women from beneficiary and non-beneficiary households is presented in Table 4. Nutrients consumed were classified into energy, protein, calcium, iron, vitamin A, thiamine, riboflavin, niacin, and ascorbic acid. Mean intakes of energy, protein, thiamine and niacin were significantly higher among the beneficiary than the non-beneficiary households. There was no significant difference in the consumption of calcium, iron, vitamin A retinol equivalent, riboflavin and ascorbic acid between the households. There was a significant variation in the intake of all nutrients by women in households. Higher nutrient intakes were observed for women from beneficiary that those from non-beneficiary households. Day-to-day variations were observed in nutrient intake by women for energy, calcium, thiamine, niacin and protein. There was no significant variation in the day-to-day intake of iron, vitamin A, riboflavin and ascorbic acid (Table 5) by women from all the households. Nutrient consumption for households varied significantly between households from households for all nutrients. Day-to-day variations were observed in nutrient intake by households for energy, calcium, thiamine, niacin and protein. There was no significant variation in the day-to-day intake of iron, vitamin A, riboflavin and ascorbic acid (Table 6) by all households.

DISCUSSION

Households' breakfast of tea is a major change in the traditional diet of fermented porridge with milk and sugar. The porridge was more nutrient-dense than the tea. Furthermore, serving porridge for lunch does not confer

Table 5. Variations in nutrient intake for women between households and days.

Nutrient	Variation	
	Household F-ratio	Day F-ratio
Energy	20.09**	5.33**
Protein	17.46**	3.61*
Calcium	7.07**	5.78**
Iron	5.47**	0.67NS
Vitamin A	9.69**	0.69NS
Thiamine	25.90**	8.89**
Riboflavin	12.84**	1.68NS
Niacin	18.79**	2.87**
Ascorbic acid	6.26**	0.31NS

*p < 0.01, ** p < 0.001; NS - not significant.

Table 6. Variations in nutrient intake for in households between households and days.

Nutrient	Variation	
	Household F-ratio	Day F-ratio
Energy	10.95**	5.56**
Protein	14.65**	1.97*
Calcium	7.57**	6.17**
Iron	5.04**	0.72NS
Vitamin A	11.15**	0.92NS
Thiamine	12.86**	10.15**
Riboflavin	10.90**	0.95NS
Niacin	12.42**	2.46*
Ascorbic acid	5.54**	0.19NS

* p < 0.05, ** p < 0.01, NS - not significant.

the recommended nutrient and food allowances for the households. The food consumption pattern exhibited in this community is a result of limited resources in terms of land and income amongst others. Resource empowerment has promising potential for improved household food consumption patterns. There was lack of diversity and variety in the foods consumed in this community. Variety in type of food and nutrient intake, including food colour has a contributory influence to an individual's nutrition and health status. Variety in food and nutrient intake is good for reduced prevalence of morbidity and poor nutrition status of populations, especially when consumed in adequate amounts. Variety and variation even in the methods of cooking confer variety in nutrients and amino acid profiles for improved human health and nutrient status. Colourful variety of fruits and vegetables for example, provide a wide range of vitamins, minerals, fibre and phytochemicals that help to maintain a healthy weight, protect against effects of aging and reduce risk of heart disease, Type 2 diabetes, high blood pressure, infections, and some cancers. Most households sold milk to purchase sugar and maize from the market to supplement household stocks if any. This is an indication of very low understanding of the food and nutrition component that was not adequately build in to the dairy project to the extent of affecting a positive influence on food quality and nutrition status.

Mean food intake by women was found to be below the Food and Agriculture Organization (FAO) recommendations and yet above the ICMR standards (ICMR, 1989; FAO, 1987; FAO, 1964). The ICMR are recommended for Indians by their Medical council after extensive studies. There exists a possibility of Kenyan specific food and nutrient recommendations (Lechtig et al., 1987), especially with genetic variations and other environmental factors that have an influence on the individual body size and health status. Households made adjustments in food intake by consuming less of the major staple because of reported low household food stocks that they associated with the planting and weeding period. Women consumed a higher amount of milk in the form of tea as a way of relaxation in households. Except for phytochemicals, the level of milk dilution in the tea did not confer any useful nutritive value to the consumers. There was no significant

variation in the consumption of pulses, roots and tubers, and fats and oils between days. There was rare consumption of roots and tubers in the study area, indicating a possible shift in the food consumption patterns of households. This shift in diet pattern is detrimental to household food security since they develop tastes for new foods that are less suitable for the prevailing micro-climates.

Variations in food intake were associated with the differences in economic power, nutrition knowledge and practice beneficiary and non-beneficiary households. In days of scarcity some households served porridge without a relish, and occasionally without sugar. This porridge required less amount of maize meal than the stiff porridge that was served with a relish. Households made affordable dietary adjustments depending upon daily economic resource and food availability. Each individual household is endowed with resources in varying amounts. Furthermore, the resource combination for individual household in livelihood attainment varies widely between households and individuals.

Nutrition intervention measures if implemented in this area at such a time could concentrate on providing a steady supply of animal foods, milk and milk products, cereals and vegetables for improved food security in households and for women. These foods are not only important sources of energy but also for the body protection and maintenance of body tissues. These foods are useful in reducing the body's susceptibility to infections and enhanced nutrition and health status. There was lack of variety in both foods and nutrients consumed by households and by women. This was attributed to shrinking agricultural biodiversity as more food sources are lost due to increased population and reduced farmlands.

There was lack of variety in the sources of nutrients in households compromising the quality of food consumed by household members. The higher mean consumption of energy, protein, thiamine and niacin can be attributed to the benefits of participation in the Livestock Development Projects. Mean nutrient intake for women for all nutrients was above the FAO and ICMR recommended dietary intakes. There was lack of variety in the sources of nutrients affecting nutrient quality and diversity in the population. Assessment of nutrition and health status of this population could help identify the suitability of international standards in the assessment of nutrition status and diet assessment. Though it may look like a 1-day survey is sufficient to show the levels of intake of iron, vitamin A, riboflavin and ascorbic acid for women, to set adequacy levels for all nutrients, more research need to be done to consider the day-to-day variation in consumption. A study that seeks to set levels for the intake of these nutrients at the household level, if conducted for one day would fail to show the true picture of the nutrient intake given the day-to-day variation in the intakes. There was no significant variation in the intake of iron, vitamin A, riboflavin and ascorbic acid in the three-day period. Good quality food served in adequate amounts assures a healthy population, strong human capital formation and reduced prevalence of malnutrition.

Conclusion

Variations in foods and nutrients intakes between households and between days observed indicates that a 1-day 24 h diet recall method may not bring out the true pattern of food and nutrient intake of households and individuals. The 24 h recall diet survey method conducted for a period of days could show food and nutrient consumption pattern clearly from which averages for the population can be derived. This will allow a clear understanding of the food consumption pattern that can be addressed by the food and agricultural policies more adequately. However, the study design adopted a 3-day consecutive assessment which may have allowed for adjustments to be made by households in their food intake. Possibly, a study design that allows for dietary data collection over neither non-feast nor special days could be considered in designing such surveys. Further research is recommended to determine the appropriate duration of 24 h diet recall survey that would allow the variations in the intake of foods and nutrients on non-consecutive and non-feast days to be seen in order to establish the appropriate period for diet assessment. Transient food insecurity should be considered when estimating the food and nutrient requirements of population.

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