A COMPARATIVE STUDY ON FOOD SECURITY AND NUTRITIONAL STATUS BETWEEN COFFEE AND NON-COFFEE GROWING HOUSEHOLDS IN KATHIANI DIVISION, MACHAKOS DISTRICT KENYA.

BY

DORCUS MBITHE DAVID, B.Ed. (Hons.)
(Bachelor of Education, Home Science and Technology)

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UNIT OF APPLIED HUMAN NUTRITION
DEPARTMENT OF FOOD TECHNOLOGY AND NUTRITION
FACULTY OF AGRICULTURE
UNIVERSITY OF NAIROBI
NAIROBI, KENYA

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DECLARATION

I, DORCUS MBITHE DAVID, hereby declare that this thesis is my original work and has not been presented for a degree in any other University.

Dorcus Mbithe David

Date 21/08/02

This thesis has been submitted for examination with our approval as University Supervisors.

Prof. N. M. Muroki
(Associate Professor and Supervisor)

Date 21.08.02

Dr. A. M. Omwega
(Supervisor and Lecturer)

Date Sept. 2, 2002.

DEDICATION

This thesis paper is dedicated to: My son, Willice Kigaru with much gratitude and affection

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ABSTRACT

A comparative study on food security and nutritional status of coffee and non-coffee growing households was carried out in Iveti Location of Kathiani Division, Machakos District, in the months of September, October and November, 2000.

The objective of the study was to determine the difference in household food security and nutritional status of children aged (6-59) months in coffee growing and non – coffee growing households in the location.

A sample size of 350 households was used. The study district, division and location were purposively selected. Random sampling was done at the sub–location to select the villages. The sampling unit was the household. The households were systematically sampled and equal number of coffee and non-coffee growing households drawn. Data were collected using a structured questionnaire, anthropometric measurements and focus group discussions.

About three quarters (76 %) of all the households visited did not meet 80% of their daily calorie requirements. Only 7.4% of the households were able to meet their calorie requirement. More households (55%) not growing coffee than households growing coffee (45%) were found to be food insecure.

The prevalence in the study area was high. Moderate and severe stunting were 29% and 26% respectively. The figure for severe stunting is too high indicating long-term cumulative effects of inadequate nutrition and health for most of the households. Immediate attention in implementing the recommendations, would, therefore, be necessary. Moderate and severe underweight were 26% and 9.1% respectively, while moderate and severe wasting 4.7% and 0.3%, respectively. Levels of severe underweight and severe stunting were higher than the national and provincial figures.

The level of malnutrition was generally higher among households without coffee than those growing coffee except for severe stunting where households growing coffee and those without coffee reported 29% and 26% respectively. Further, households growing coffee did not report any case of severe wasting while some households without coffee did (0.3%).

It was concluded that household food security is worsened by large household sizes, low levels of education, small land size holdings and other socio-demographic and socio-economic characteristics. It was also concluded that household food security and nutritional status could be improved by growing coffee.

It is suggested that coffee farming should be promoted in households without coffee. It is also recommended that income-generating activities should be initiated. Further, keeping of livestock should be encouraged in both types of households.

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ABBREVIATIONS

- MUAC - Mid- upper arm circumference
- SD - Standard Deviation.
- NCHS - National Centre for Health Statistics.
- SPSS – Statistical Package for Social Scientists
- p–value – Probability value (level of significance)
- KDHS – Kenya Demographic and Health Surveys
- Wt/ht – Weight for Height
- Ht/Age – Height for Age
- Wt/Age – Weight for Age
- KSH – Kenya Shillings
- ITDG – Intermediate Technology Development Group
- ANP – Applied Nutritional Programme
- BAT – British American Tobacco
- WHO – World Health Organisation
- Kcal – Kilocalories
- Kgs – Kilograms
- FAO – Food and Agricultural Organization
- CU – Consumer Unit
- IFPRI – International Food Policy Research Institute
- RDA –Recommended Daily Allowances

- P.E.M – Protein Energy Malnutrition
- ACC/SCN – Administrative Committee on Coordination/Sub-Committee on Nutrition
- UNICEF – united Nations Children's Education Fund
- CBS – Central Bureau of Statistics
- UNU – United Nations University
- NGOs – Non-Governmental Organization
- CI – Confidence Interval

OPERATIONAL DEFINITIONS

- ***Household(s)*** – Comprises group of persons or a person living together in the same homestead or compound who have common housekeeping arrangements and eating from one common pot (KDHS, 1998).
- ***Anthropometry*** - Physical measurements of weight, length/height, mid-upper arm circumference, head circumference etc (Pacey and Payne, 1985).
- ***Z-score or standard deviation (SD)score*** – The deviation of the anthropometric value(s) for an individual child from the median value of the reference population (National Centre for Health Statistics of the United States of America (NHCS)/(World Health Organization (WHO), divided by the standard deviation for the reference population. (Pacey and Payne, 1985).
- ***Malnutrition*** - Failure of body functions which occur when intake of nutrients fall below certain minimum requirement. (Pacey and Payne, 1985).
- ***Indices of malnutrition*** – Indicate level of malnutrition and may include:-

  a) Anthopometric measurements namely:-

    - weight for age – indicating degree underweight.
    - weight for height – indicating degree of wasting.
    - height for age – indicating degree of stunting.

  b) Level of nutrient in comparison to normal values. (Pacey and Payne, 1985).
- ***Food security*** - Ability of household to access sufficient and safe food for a healthy and active life at all times (Berg, 1987). This study however concentrates on sufficiency. Also defined by ACC/SCN (1989) as when a household has access to the food needed for a healthy life for all its members and when it is not at undue risk of loosing such access.
- ***Stunting*** – Refers to deficit in linear growth achieved pre and post – nataly. This indicates long-term cumulative effects of inadequate nutrition or health (Pacey and Payne, 1985).

- ***Underweight*** – This refers to low body weight relative to age. It reflects long term nutritional or health experiences of an individual or a population (Pacey and Payne, 1985).
- ***Wasting*** – This refers to low body weight relative to height. Usually results from acute shortage of food and/or severe disease (Pacey and Payne, 1985).
- ***Total malnutrition*** – Moderate and severe malnutrition combined.

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND INFORMATION

Malnutrition affects many parts of the world especially developing countries. The major causes of malnutrition are illnesses and insufficient food/dietary intake to meet nutritional requirements (Tomkins and Watson, 1989). Malnutrition is prevalent despite the fact that the world produces enough food mainly because of mal-distribution (ACC/SCN, 1991; Pacey and Payne, 1985; Mary and Tina, 1976). Africa is a continent that is among those most affected by the problem of malnutrition. Many people are not able to access sufficient and safe food required for a healthy and active life at all times (Berg, 1987).

Countries are food insecure because of frequent famines which result to poor food production (Felicity and Burgess, 1993). The factors leading to poor food production include: - poor economic status, low technology, poor rainfall patterns and other climatic factors and poor soils susceptible to bad weather conditions (ACC/SCN, 1991; ACC/SCN, 2000; Haddad, 1997). Other factors include poor food policy, poor political control and wars, small land size and national disasters such as drought, floods and earthquakes (Abelson, 1975; Pacey and Payne, 1985).

Further, many countries have concentrated more resources/inputs such as land and labour on cash crop production than food crop production (ACC/SCN, 1989; Biswas and Per Pinstrup, 1988).

It should be noted that in the past, cash crop growing was seen as a source of income to improve the purchasing power of households, which would make it possible for households to increase food expenditure. According to Biswas and Per Pinstrup (1988), agricultural exports such as coffee contribute to a worsening nutritional situation in low-income exporting countries. These authors suggested that the scarce resources and inputs such as land and labour be shifted out of export cash crop production into the production of food for domestic consumption. Even with the above observation in some cases/periods/instances cash crop growing had led to improved food security and nutritional status and health (ACC/SCN, 1989; Hazell and Roell, 1983).

In Kenya, the cash crops, tea, coffee, tobacco, sugarcane, cotton and horticultural crops are presently the main foreign exchange earners. These cash crops are grown in several provinces in the country. The study of the effect of cash crops on food security and nutritional status is, therefore, important.

1.2 STATEMENT OF THE PROBLEM

Families in cash crop growing areas have suffered and still suffer high levels of malnutrition, particularly those with small pieces of land, because they cannot grow adequate food(Mugo, 1995; Kinyingi 1988). This is exacerbated by the fact that men own

and control the land and are able to allocate less of the resource to food production or expenditure (ACC/SCN, 1991; Biswas and Per Pinstrup, 1988).

In Kenya, high levels of malnutrition have been reported in coffee and tea growing areas. A few studies (Kinyingi, 1988; ACC/SCN, 1989; Mugo 1995) carried out in tea, sugarcane, and tobacco sectors respectively show that reforms are needed to improve food security and nutritional status. The success or otherwise of the cash crop growing in various areas has, therefore, to be investigated. Factors which are likely to affect food security and nutritional status have also to be investigated.

1.3 OBJECTIVES

The main objectives of this study were:-

1.3.1 To determine socio-demographic characteristics of households.

1.3.2 To determine the difference in household food security between coffee and non-coffee growing households in Kathiani division of Machakos District.

1.3.3 To determine the differences in nutritional status of children aged 6 - 59 months in coffee and non-coffee growing households in Kathiani Division, Machakos District.

SPECIFIC OBJECTIVES

In order to achieve the objectives, the following specific objectives were formulated.

1.3.1.1 To determine household sizes, sex and marital status of household head, male to female ratio, levels of education and occupation in both types of households.

1.3.2.1 To determine the annual total food production for coffee and non-coffee growing in Kathiani Division, Machakos District.

1.3.2.2 To determine the coping strategies in the event of food shortage in both types of households in Kathiani Division, Machakos District.

1.3.2.3 To determine total household income in both types of households in Kathiani Division Machakos District.

1.3.3.1 To determine the daily household food intake in both types of households.

1.4 RESEARCH QUESTION

1.4.1 What are the effects of coffee growing on food security in Kathiani Division, Machakos District?

1.5 STUDY HYPOTHESIS

1.5.1 There is no significant difference in food security and in prevalence of malnutrition of children aged between 6 and 59 months in coffee and non-coffee growing households in Kathiani Division of Machakos District.

1.6 JUSTIFICATION AND BENEFITS OF THE STUDY

Most households in developing countries depend on growing cash crop (including coffee) for their income (Biswas and Per Pinstrup, 1988). It is, therefore, important to establish whether or not coffee growing in Kathiani Division of Machakos improves or worsens food security and nutritional status.

There are several benefits of this study. The information on food security and nutritional status will provide data and evidence for intervention measures by the government ministries, NGOs and other policy makers. It will also open avenues for further research. Other beneficiaries will include members of the households.

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CHAPTER TWO

LITERATURE REVIEW

2.1 ABSTRACT

Literature was reviewed on food security and malnutrition with the following objectives. To establish the effects of food security/insecurity and malnutrition, interaction between malnutrition and morbidity and the efforts made to improve food insecurity. Another objective was to establish the effect of cash crop growing on food security and nutritional status. The information was collected from textbooks, journals and other reports related to food security and nutritional status. From the chapter, it is clear that food insecurity and nutritional status can be worsened by socio-economic and socio-demographic activities. It has also been established that cash crop growing has different effects on food security and nutritional status depending on the type of cash crop being grown. Efforts that improve food security and nutritional status include improved agriculture and improved food policies among others.

2.2 OVERVIEW OF MALNUTRITION

Malnutrition is a major cause of morbidity and mortality in developing countries (Tomkins and Watson, 1989). Malnutrition is described as a pathological state resulting from relative or absolute deficiency or excess of one or more essential nutrients, the state being clinically manifested by biochemical, physiological or anthropometric effects/representations (Tomkins and Watson,1989). This state is due to various factors in the ecology i.e. ecosystems within which food is produced and consumed. From the above

definition, it is evident that although having adequate overall food supply in households is a necessary condition for ensuring nutritionally adequate consumption by all individuals within the households, other factors have to be addressed. Further is should be noted that the overall availability of food in a country, community or household is no guarantee of its equitable consumption (ACC/SCN, 1991; Haddad, 1997).

Food security is the need to encourage distribution that ensures good nutritional status for all members of the household (ACC/SCN, 2000). Berg (1987) stresses that nutritionists should stress the need to provide food to meet all the nutritional requirements of household members, which means a balanced diet providing all necessary energy, proteins and micronutrients (ACC/SCN 1991).

Malnutrition affects people at all ages but the period from 6 to 24 months of age is of paramount importance nutritionally. Figure 2.1 shows that the three indices of malnutrition namely stunting, underweight and wasting are highest from the age of 6 to 36 months

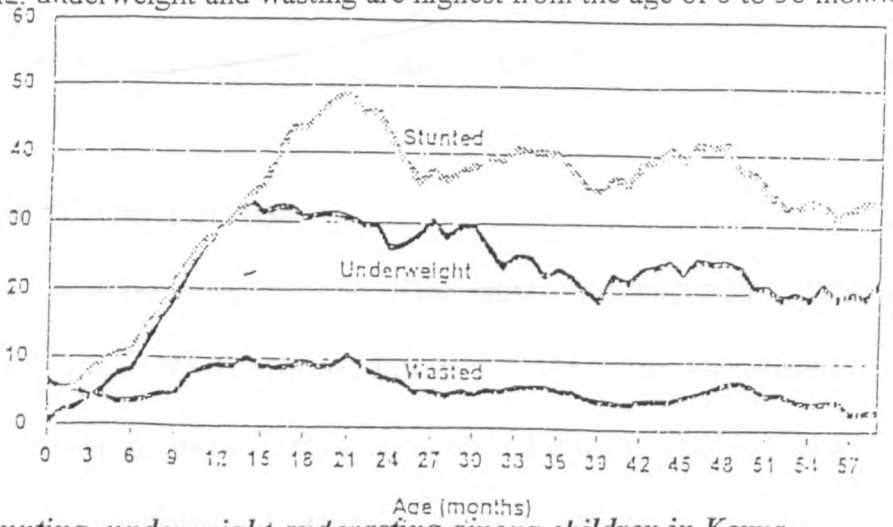

Figure 2.1. Stunting, underweight and wasting among children in Kenya.
Adopted from:, *Nutrition and Health Status of Young children and Their Mothers in Kenya* **(USAID/MACRO/IMPACT, 1996)**

Many children of this age in developing countries do not grow at the rate they should and some develop protein-energy malnutrition (USAID/MACRO/IMPACT, 1996). The period from 6 – 24 months of age is nutritionally important because children at this stage are most vulnerable to malnutrition due to inadequate dietary intake and illnesses/infections such as diarrhoea, worm infections and infections of the respiratory system and, therefore, it becomes a critical period for interventions to improve nutritional status (Tomkins and Watson, 1989). Inadequate dietary intake and illnesses experienced during this period can result in long term growth failure manifested by high levels of stunting in the fourth and fifth years of life (Tomkins and Watson, 1989).

Nearly half (55%) of the world's children are malnourished. In Africa one of every three children is underweight and in several countries the nutritional status is worsening (UNICEF, 1998). The common type of malnutrition in Africa is stunting and underweight. In Kenya stunting has been as high as 33% with one third of the cases severely stunted (KDHS, 1993; KDHS, 1998). Further still, boys more than girls are more likely to be stunted (KDHS, 1998; ITDG/ANP, 2000;USAID/MACRO/IMPACT, 1996).

2.3 CAUSES OF MALNUTRITION

The manifestation of all the different stages of the causes of malnutrition is maternal and under-five child deaths (USAID/MACRO/IMPACT, 1996). The immediate causes of malnutrition are inadequate dietary intake, infection and diseases (Tomkins and Watson, 1989; Berg, 1987). Inadequate food intake is a result of food insecurity at the household level and improper feeding practices (USAID/MACRO/IMPACT, 1996).

The underlying causes of malnutrition include, food insecurity, inadequate child health-care and inadequate maternal education (Tomkins and Watson, 1989). Inadequate health care facilities, poor access to other basic services and poor sanitation put children at increased risk of infection from contaminated food and water (ACC/SCN, 1991).

The basic cause of malnutrition is poor utilization of potential resources which could be influenced by political, socio-economic structures and other ideological factors (USAID/MACRO/IMPACT, 1996). Political, socio-economic, environmental and cultural factors operating at the national and community levels affect the nutritional status of children by determining the availability of formal and non-formal educational opportunities and employment by producing a source of income which determines household food security are some of the underlying causes of malnutrition (Berg, 1987; USAID/MACRO/IMPACT 1996).

2.4 ASSESSING NUTRITIONAL STATUS OF CHILDREN

According to Pacey and Payne (1985), there are several ways of identifying a malnourished child/individual. These may include biomedical indices and anthropometric indices. The anthropometric indices used are:-

(a) Height for Age to determine if a child is stunted.

(b) Height for Weight to determine if a child is wasted.

(c) Weight for Age to determine if a child is underweight or overweight.

The extent/degree to which the indices deviate from the reference i.e. the Z-score (SD scores) standards of the anthropometric value for an individual/child from the median value of the reference population determine the degree of malnutrition.

A child who is below minus 2 standard deviation (-2 SD) from the median of the reference population (National Centre for Health Statistics-NHCS) in terms of the respective indices is considered to be either stunted, wasted or underweight. (Pacey and Payne, 1985). A child who is minus 3 standard deviation (-3 SD) from the median of the reference population is considered to have severe states of the respective forms of malnutrition.

There are other indicators of food and nutritional insecurity which can be used to predict the possibility of malnutrition which include food frequency and they take into account the quality and quantity. These can be determined by use of the 24-hour recall (Pacey and Payne, 1985). There are, however, other ways of determining malnutrition such as biochemical and physiological presentations (Tomkins and Watson, 1989).

2.5 INTERACTION BETWEEN MALNUTRITION AND MORBIDITY

Interaction of malnutrition and infections is the leading cause of morbidity and mortality in Africa, Asia and Latin America. Viral, bacterial and parasitic infections tend to be prevalent and all can have a negative impact on the nutritional status of children and even adults. The effects of malnutrition on infections affect the immune system and the human body with time losses immunity (Gibney, 1986; Swaminathan, 1974).

According to a newsletter by ACC/SNC (2000), a child who is undernourished does not grow well and is more prone to infection. Frequent infections affect nutrient absorption and cause loss of appetite, which in turn means a child eats less. This is the start of the malnutrition – infection cycle. This cycle is illustrated in Figure 2.2.

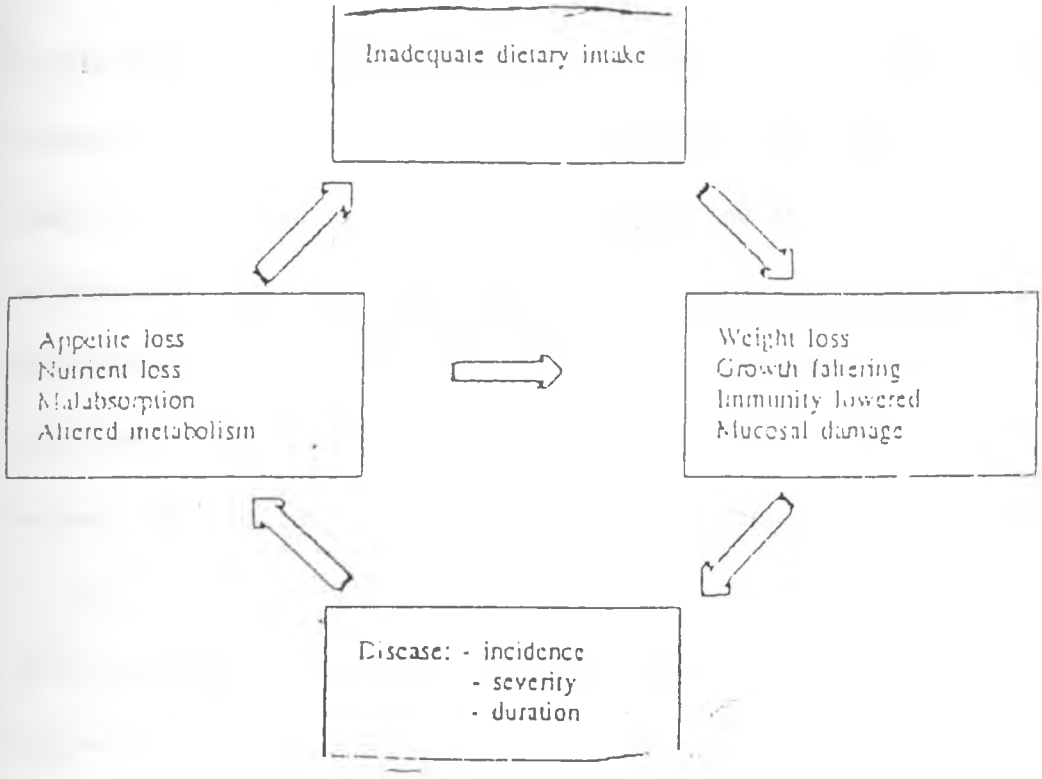

Figure 2.2 The Malnutrition/Infection Cycle
Source:*Malnutrition and Infection* **(Tomkins and Watson, 1989)**

Severely malnourished children need special care and attention. Bacterial and some other infections can lead to an increase in the loss of nitrogen in the body. This was first demonstrated in serious infections such as typhoid fever (Berg, 1987). Anorexia or loss of appetite is another factor in the relationship between infection and nutrition. Infection especially if accompanied by fever, often leads to loss of appetite and, therefore, leading to reduced food intake. Lowered immunity and mucosal damage are the major mechanisms by which defences are compromised. The disease process exacerbates loss of nutrients,

both by the host's metabolic response, and by physical loss from the intestines. This exacerbates malnutrition, leading to further possible damage to defence mechanism. Many diseases are associated with loss of appetite, and other possible disabilities, which lead to further lower dietary intake.

2.6 NUTRIENT INTERACTION AND CONSEQUENCES OF MALNUTRITION

Nutritional deficiencies such as calorie, protein, mineral salts and vitamin (especially vitamin A) often lead to malnutrition (Kirschman and Dunne, 1984). These micro-nutrients play a role in metabolic processes, immune status and or nutrient absorption and utilization (Jean and Ritchie, 1983). Micro–nutrient deficiencies mainly vitamin A and iodine may have a bearing on productivity and decreased household economic status because of increased health care expenditure and or increased morbidity (Gibney, 1986).

Apart from being a major cause of morbidity and mortality, malnutrition is a major cause of poor nutrient intake and a lower level of cognitive development which results in lower educational attainment and reduction of worker productivity among adults and a reduced earning potential (USAID/MACRO/IMPACT, 1996). Poor work output in later life leads to poor development in the community. Social and economic development of individuals and community are also slowed and hence national development (Latham, 1997). This will lead to poor economic status, which will fuel the vicious cycle referred to above.

2.7 HOUSEHOLD FOOD SECURITYAND COPING STRATEGIES

The debate of food security and nutrition is concerned with the question whether under–nutrition usually measured by growth faltering in children or possibly reduced body–mass in adults is an adequate proxy indicator of food insecurity. Food security literature concentrates on calories to measure sufficiency or 'what is enough'. This reflects a movement away from concerns with protein quantity and quality as it was in the 1970's (Abelson, 1975). Another definition of food security in addition stresses food quality as an objective (ACC/SCN, 1991). Food security is the absence of hunger and malnutrition. For this to be possible, households must have enough resources to produce or otherwise obtain food. Berg (1987) defines food security as the ability of households to access sufficient and safe food required for a healthy and active life at all times.

Another definition of food security by ACC/SCN (2000) is a state in which all people have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life at all times (ACC/SCN, 2000). This is clarified by defining food as a substance that people eat and drink to achieve an adequate nutritional status (maintain life and physical, cognitive, social development). It should be noted that food security is achieved when the food meets physiological requirements in terms of quantity, quality and safety and that it would be economically accessible, socially and culturally accepted and equally distributed.

To obtain food and achieve food security and nutritional status economic access is a major determining factor. Economic access refers to purchasing power, access to land, access to

credit, access to education and to health services (ACC/SCN, 2000). If poor people are given additional income, more food would be demanded and produced; thus food security can be provided to individuals either by increasing their monetary income or decreasing the prices at which adequate food is made available to them (ACC/SCN, 2000).

From the above observations various socio-economic and socio-demographic characteristics may be proxy indicators of food security or indicators to adequate household food and nutritional security. These include:- income sources, access to credits and loans, health and education has an influence on food security and nutritional status (Biswas and Per Pinstrup, 1988). Other household characteristics related to food production, food security and nutritional status are land ownership and availability, land use practices, livestock ownership, food storage and intra-house food distribution.

Food security and improved nutritional status in a community is not only food availability but refers also to even distribution (Kirshmann and Dunne, 1984). Uneven distribution of food is not only among people of different socio-economic groups but also between members of the household. Intra-household distribution of food could depend on who controls the use of stored or purchased food. (Kirshmann and Dunne (1984) further states that in most households men are normally responsible for staple foods while women are responsible for vegetables. Whereas it is well established that in households where wives are involved or are decision makers in terms of access to productive resources and their disposal there is better food security and nutritional status. Further still, priority in food allocation in terms of quantity and quality (especially for proteins) is given to adult males

over females and children (Kirschmann and Dunne, 1984). This can occur even in households of high economic status and may even lead to food insecurity and poor nutritional status to vulnerable members in times of scarcity.

An ideal indicator of household food security includes the measurement of household food availability and average household food consumption levels over a period of time, in relation to need (ACC/SCN, 1991). The proportion of available resources required for achieving food security may be assessed as the proportion of household income spent on food. A household using more than 80% of its income on food is said to be food insecure (ACC/SCN, 1991). This proportion is indicative of the stress on households' well being, and reflects on their capacity to cope and survive.

Households facing regular episodes of food insecurity have developed complex strategies for coping with these events. Several nutritional strategies have been cited. These include:- reduced food intake, skipping of meals and reduced energy stress (ACC/SCN, 2000). Other coping strategies include sale of firewood and charcoal, sale of livestock, attempt to find employment, request from the Government and Non Governmental Organizations (NGOs), seek assistance from relatives or migrate to areas not affected.

Food insecurity, as a household-level issue, can be addressed by a wide range of alternative policies which should aim at attaining required food consumption levels and reducing risk of the poor losing access to food (Biswas and Per Pinstrup, 1988;

ACC/SCN, 1991; Longhursts, 1985). This policies have been discussed in sub-heading 2.9 on efforts to improve food security and nutritional status.

2.8 CASH CROPPING AND FOOD SECURITY

Growing of cash crops such as coffee, tea, cotton, etc, can lead to food insecurity (Biswass and Per Pinstrup, 1988; Haddad, 1997). Growing of such cash crops contribute to a worsening food security and nutritional status since scarce resources such as land and labour are allocated to the production of cash crops for export rather than food crop growing (Biswas and Per Pinstrup, 1988). Some studies on the other hand have shown that food availability and nutritional status improved because of cash crop growing (Hazell and Roell, 1983; ACC/SCN, 1989).

In Kenya the issue of cash crops and food security has remained contradictory. Studies done at Mwea, Irrigation Schemes, Limuru in Kiambu district, on tea growing irrigation schemes and in Embu district on tobacco growing areas have found a positive relationship between cash crop production and food security (Mwadime, 1992; Kinyingi, 1988; Mugo, 1995).

In these studies cash crop growers were not only living in an environment unfavourable to their health but were also restricted to growing cash crop occupying most of their land in the schemes.

Other studies conducted in Western Kenya in sugarcane growing zone found no significant difference in nutritional status of sugarcane growers and non-sugarcane growers (Kennedy, 1989). A similar study conducted in Philippines, however, found that sugarcane growers had better nutritional status than non-sugarcane growers (ACC/SCN, 1989). The difference was attributed to self-selection bias because sugarcane growing favoured those with production resources (land and capital).

A study carried out among rice farmers in Malaysia showed increased energy intake among the farmers as a result of improved income (Hazell and Roell, 1983).

There are a number of reasons why agricultural projects fail to improve food security and nutritional status; for instance, the socio and cultural factors which affect the ability of the household to adjust to change such as food taboos and/or religious factors (Niemeijer et al , 1985; Mellor et al., 1987)).

The persons controlling the extra household income from cash crop determines the proportion of income to be spent on food (ACC/SCN, 2000). Some studies (Abelson, 1975; Kennedy, 1989 Oniang'o and Kennedy, 1990) have shown that the feeding patterns do not change on introduction of a new crop or a cash crop.

Another factor that can cause food insecurity is the introduction of cash crops may affect the role of some household members. It may increase women's workload and deny them

adequate time for food preparation and child- care, or worse still increase labour which increases calorie intake (Mellor et al., 1985; Biswas and Per Pinstrup, 1988; FAO, 1984).

The mode of payment for cash crops is another factor that can contribute to food insecurity and poor nutritional status (Oniang'o and Kennedy, 1990). The money is paid once a year and a few days of weeks the money has been spent often times on non-food items or is misused by men (ACC/SCN, 1989; Biswas and Pinstrup, 1988)

From observations above it can de deduced that food security and nutritional status varies from place to place and depend on the type of cash crop being grown.

2.9 EFFORTS TO IMPROVE FOOD SECURITY AND NUTRITIONAL ADEQUACIES

A government has an obligation to ensure food access for all. True food security comes from raising the level of food production and earned income and improving asset ownership. Some policies discussed in this section, if well applied have the potential to improve food security in many countries (ACC/SCN, 1991) including Kenya. These may, however, be accompanied by health and nutritional education as well as implementation of the projects to improve health and nutrition problems including feeding habits and patterns.

Promotion of small-scale agricultural food-crop production especially in poor and underdeveloped countries is reported to be a means of improving food security

(ACC/SCN, 1991; FAO, 1986). According to Pacey and Payne (1985), hunger can be eliminated if there will be an increase in the overall food production while malnutrition can be corrected if the deficiencies of specific nutrients are solved. Increased food production can be achieved if means of production such as land and labour are adequately allocated to food crop production other than concentrating mainly on cash crop production (Biswas and Pinstrup, 1988). Traditional food crops, improved storage facilities and adoption of new agricultural technologies should be given increased attention (ACC/SCN, 1991; Mellor et al., 1987; Benneh and Juhe, 1996)).

To achieve food security, Richard and Ronald (1980) emphasize that farmers should not resist changes to new high yielding varieties, new technologies and farming practices if they can afford and that the benefits overweigh the risks. The researchers urge scientists, economists and agriculturists to advice farmers on other inputs even though they cannot afford and insist adoption of these variables. They observe that farmers should understand the cost-benefit involved in farming. To achieve food sufficiency, food policies including credit facilities and land subsidies should be improved

Food quality and safety control can also improve food security and nutritional status (ACC/SCN, 1991). It would help reduce food contamination from chemicals, mycotoxins and bacteria, both during storage, preservation and preparation (ACC/SCN, 1991; ACC/SCN, 2000). Health problems arising from inadequate nutrient intake or morbidity due to food contamination may reduce household food productivity.

To improve food security, post-harvest wastage should be avoided. This is as high as between 5-20% (FAO, 1983; Benneh and Juhe, 1996; Muroki et al., 2000). This is due to insects, pests, moulds and high temperatures. Attention to storage is important not only to prevent post-harvest losses but for reasons of palatability and acceptability (Haddad, 1997).

However, it is also reportedly suggested that cash crop growing may have negative effects on food security and nutritional status as already discussed (ACC/SCN, 1991; Mellor et al., 1987; Abelson, 1975). Biswas and Per Pinstrup (1988) suggest that income received from cash crops could be used to adopt the new technologies and to improve storage facilities. They also suggest that the prices of food in cases of hunger should be subsidized and tax-free. They further suggest that inadequate land holdings, landlessness, sharecropping, cash cropping and other potential causes of household food insecurity should be addressed and permanent solutions sought.

Income generating projects including livestock and non-farm activities which will allow families to use time previously spent on low productivity work to switch to jobs with high returns have been suggested as a means of improving food security (ACC/SCN, 1991). Non-farm income not closely connected to farm income is also suggested for stabilization of household incomes (Mellor et al., 1987).

Creation of jobs is another intervention strategy which can be implemented in order to increase the purchasing power of households (Berg, 1987). This will have significant effects on human resource development and improved skills which enable the people to

engage in self-employment and to initiate projects which will create jobs (ACC/SCN, 1991).

Another effort that can improve the problem of food security could be free distribution of food to selected groups in emergency situation such as famines, floods and to vulnerable groups such as children, pregnant and lactating mothers. Supplementary feeding programmes and other intervention measures, such as food for work could be targeted to the absolute poor (UNICEF, 1992; Maritim et al., 1998).

Timely warnings and intervention systems integrating local levels of data gathering, analysis and response in order to initiate the necessary measures to prevent food shortage should be an integral part for effective solution to food security and nutritional status (ACC/SCN, 1991). The system requires very efficient data collection, analysis and interpretation as well as administration for them to succeed (Haddad, 1997).

2.10 CONCLUSION

Countries and households are food insecure because of poor food production, poor sources, use and control of income, poor technology, poor land use among others. As seen earlier cash crop growing has different effects on food security and nutritional status depending on the type of cash crop being grown. Efforts to improve food security and nutritional status have also being outlined such as improved agriculture, and improved food policies among others.

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CHAPTER THREE

DEMOGRAPHIC AND SOCIAL CHARACTERISITCS OF THE HOUSEHOLDS

3.1 ABSTRACT

A comparative study on food security and nutritional status of coffee and non-coffee growing households was carried out in Iveti Location of Kathiani Division, Machakos District with the objective of determining the demographic and social characteristics of the households because such characteristics are known to have effects on food security and nutritional status as seen in chapter two.

A sample size of 350 households was used with a total population of 1195 and 899 from coffee and non-coffee growing household. The study district, division and location were purposively selected. Random sampling was done at the sub–location to select the villages. The sampling unit was the household. The households were systematically sampled and equal number of coffee and non-coffee growing households drawn. Data were collected using a structured questionnaire and focus group discussions.

Average household size was found to be 6.1 which is higher than the national figure of 4.8 (KDHS 1998) with 6.2 and 5.2 from coffee and non-coffee growing households. Most of the households (70.8%) were male headed with more (82%) coffee growing households male headed compared to the non-coffee growing households (62%). 97% of the total population had received formal education but of a lower level (primary school and below).

There was no significant difference in level of education between both types of households. More non-coffee growing households (55) and coffee growing households reported that household members were occupied in casual labour. Generally household levels of income were low and therefore a threat to food security and nutritional status.

To improve food security and nutritional status, household members were encouraged to initiate and support income-generating activities. They were also encouraged to continue with formal education beyond primary education.

3.2 INTRODUCTION

Food security and nutritional status is influenced by a number of socio–demographic and socio–economic characteristics. These characteristics include household compositions, housing conditions, marital status, occupation and sources of income and education levels of household members. These have a bearing on food security and nutritional status (KDHS, 1998; ITDG/ANP, 2000).

Elimination of intellectual poverty is one of the major goals outlined by the Kenyan Government, in its 2000/2003 Poverty Eradication Strategy document (Government of Kenya, 2000). Hence the need to improve education and literacy levels. Access to employment opportunities increase with increasing levels of education and so does income (KDHS, 1998). Research indicates that education of mothers and of the wider community has positive influences on food security and the health and nutritional status of the community.

Considering observations made here, demographic and socio-economic characteristics should always be taken into account in determining food security and nutritional status of households.

This chapter discusses the issue of demographic and socio-economic characteristics (as mentioned earlier) of households in Kathiani Division, Machakos District.

3.3 METHODOLOGY

3.3.1 THE AREA AND THE PEOPLE

The study was carried out in Iveti location of Kathiani division, Machakos district, about 22 kilometres northeast of Machakos town (Appendix 4.0) The ethnic group is Kamba. Main occupation is farming with most people occupied as casual labourers on other people's farms who are paid a daily wage ranging from Ksh. 60 – 100 or food for work done. Most of the land is inherited. Brothers inherit their father's land once he is dead. Sisters have no say over land ownership. Some people have bought land, on which they live and farm.

3.3.2 STUDY DESIGN

The study was cross – sectional, comparing two groups of coffee and non-coffee growing households in aspects of food security and nutritional status in Kathiani Division, Machakos District from September to November, 2000. The two study groups comprised of small-scale farmers.

3.3.3 SAMPLE SIZE DETERMINATION

The sample size was determined on the prevalence of malnutrition (PEM) among children under five years in Machakos District using the following formulae for comparative studies:

$$n = \frac{2z^2 \times (pq)}{d^2}$$

n = Desired sample size for one population.
z = Standard normal deviate set at 1.96
p = Proportion of PEM in the target population in the district. The percentage of malnutrition in the district is 29.3% (KDHS, 1998). Therefore the proportion of malnutrition (p) is 29.3/100 = 0.293
q = 1-p, estimated proportion of well nourished children which is (1 – 0.293)
d = Difference between the 2 populations taken as 10% at 95% confidence interval is 0.1.

$$\text{Thus } n = 2 \times \frac{1.96^2 \times (0.293) \times (1-0.293)}{0.1^2}$$

$$= 159$$

Allowing for an attrition rate of 10% (15.9) the desired sample size for each of the two populations is 174.9 (i.e. approximately 175). A total sample of 350 was used. Thus, 175 represented non-coffee growing households and 175 coffee growing households.

3.3.4 SAMPLING PROCEDURE

The sampling procedure is presented in Figure 3.1. Machakos District was purposively selected as the study district. Purposive multi-stage sampling method was used to select the study division. Iveti Location and Kaliluni, Kombu and Kitunduni sub-locations were purposively selected because most of the other locations and sub-locations do not actively

grow coffee The study villages were chosen at random. The sampling unit was the household. From each sub-location, households were systematically sampled in the ratio of 1:1 coffee growing to non-coffee growing household respectively until the desired sample size was realized. Equal number of households was taken from each of the three Sub-Locations to make up the total sample. The figure below gives a summery of the sampling procedure.

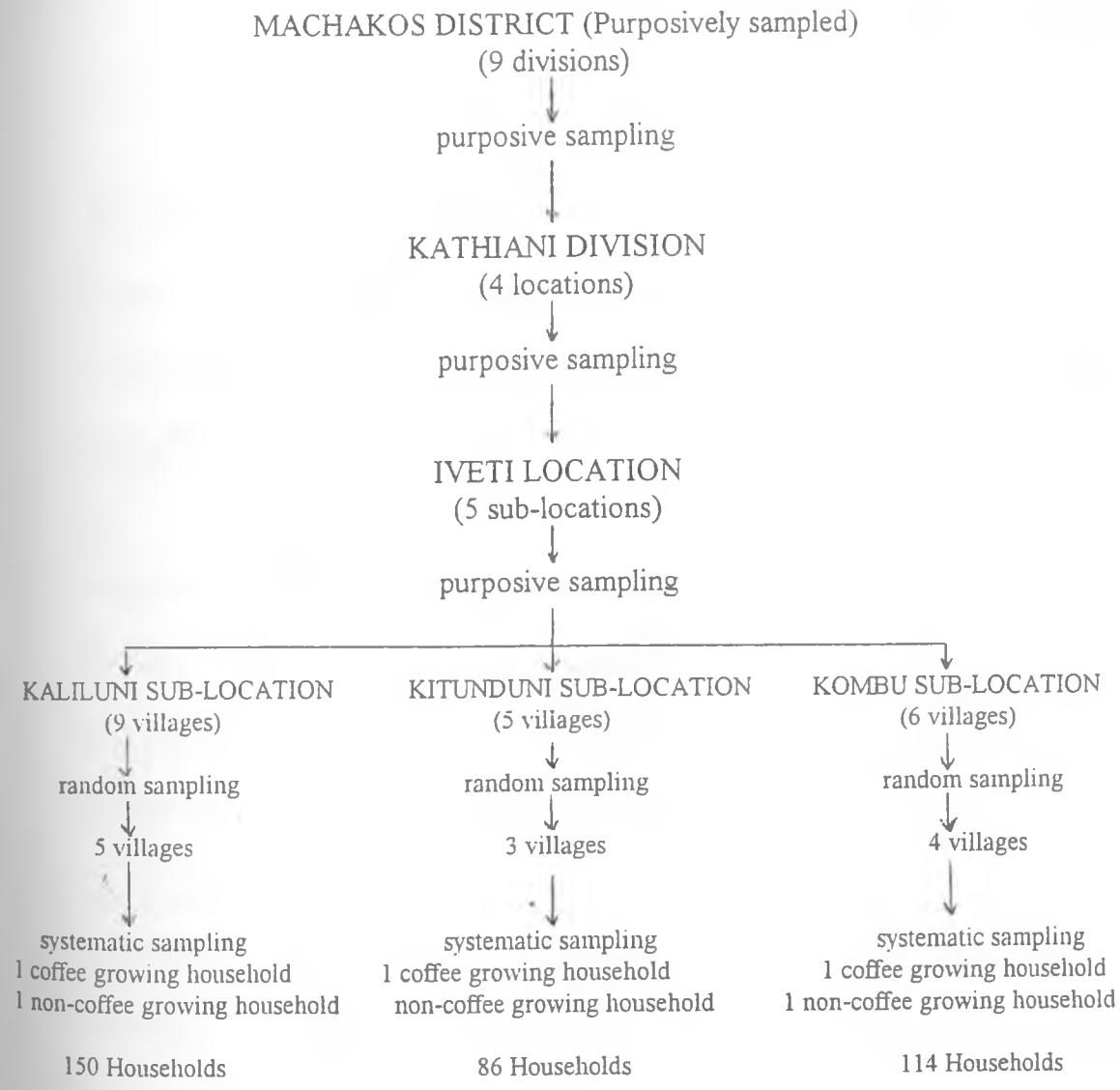


Figure 3.1 A Flow diagram showing the sampling procedure

3.3.5 INCLUSION AND EXCLUSION CRITERIA

The households to be included in the sample had to meet the following criteria.

Non-coffee growers :- Have not been growing coffee in their own farms at least five years to the date of the research and have a child aged between 6 and 59 months.

Coffee growers :- Have been growing coffee in their own farms at least five years to the date of the research and have a child aged between 6 and 59 months.

3.3.6 RESEARCH ACTIVITIES

In August 2000 the researcher obtained a research permit with the Ministry of Education. Courtesy calls were made to the Machakos District Commissioner and the local administrators.

Three field assistants were identified and trained for one week in early September 2000. The field assistants had minimum of four years secondary school education and able to speak the native language. A pilot study and pre-testing of the questionnaire and research equipment was carried out in mid September 2000.

The researcher and field assistants identified the study boundaries. Three *barazas* were organized to inform the local people about the project during the third week of September 2000. Data collection started the last week of September 2000 and ended mid November 2000.

3.3.7 DATA COLLECTION TOOLS

Data was collected using a structured questionnaire (Appendix 1.0) and focus group discussions (Appendix 2.0). The structured questionnaire contained the following information:-

(1) Demography

(2) Household income

The mother or caretaker was purposively selected as the respondent. He/she was requested to indicate her name, relationship to the household head and the marital status of the household head. He/she was also requested to indicate the following information for all members of the household:- number of all household members, relationship to household head, their names, sex, ages, religion, levels of education, occupation and whether household members brought money to the household or not. She/he was further requested to indicate the household income per day, week or month.

(ii) Focus group discussion

Two focus group discussions were held with participants who were all mothers and residents in the respective sub-locations on separate days. Each consisted of fifty percent respondents from coffee growing households and fifty percent respondents from households without coffee. The objective of the focus group discussion was to collect general information on the effects of coffee growing on food availability, sources of income, income controls, sources of food in case of food shortage and the common problems experienced by children under five years of age in terms of food availability and morbidity.

The researcher facilitated/moderated the discussions using a pre-tested guide (Appendix 2.0) while two field assistants recorded the discussion for comparison with notes taken by other researchers. The results of the Focus Group Discussion are integrated in all sections where they are relevant.

3.3.8 DATA QUALITY CONTROL

(a) DATA ENTRY, CLEANING

Data collected was entered and cleaned using the *SPSS (Statistical Package for Social Scientists)* computer package. *Epi Info 6* computer package was used to calculate the nutritional indicators and age (in months) for children age 6 to 59 months.

(b) DATA ANALYSIS

Analysis of demographic and social characteristics was done by categorizing members of households in aspects of age, sex, education and literacy levels, occupation and sources of income.

3.4 RESULTS AND DISCUSSIONS

3.4.1 HOUSEHOLD COMPOSITION

The average household size of the households was 6.1, which is higher than the national average, which is 4.8 (KDHS 1998). These findings were similar to those of a study carried out in Tharaka Nithi District in the same province where household sizes where also found to be 6.1 (ITDG/ANP, 2000). The large average household size in the study area was possibly because of nearness to Machakos town and the availability of other resources such as roads.

Coffee growing households had significantly higher average household size (6.2) than non-coffee growing households (5.2) ($p<0.05$). These findings were also similar to those of a study carried out in Embu among tobacco and non-tobacco growers where households growing tobacco were large than those not growing tobacco (Mugo, 1995). The household sizes are high possibly because parents bear more children or have relatives who stay with them. Household sizes could also be high because of the favourable condition such as nearness to town (about 20km), with reliable transport and communication and climate unlike other parts of the division and the district. It could also be because households felt more secure.

The study findings on large household sizes have a negative implication on food security and nutritional status in the sense that land holdings are small. Thus, adequate food for the households cannot be produced. A study carried out in Western and Nyanza Provinces of Kenya found out that large household sizes were food insecure and had poor nutritional status in cash crop growing area (Niemeijer et al., 1985).

Most of the respondents (96.4%) were married while a few were single, widowed or divorced. Coffee growing households had significantly more female-headed households (26%) than those in non-coffee growing households (19%) ($p<0.05$). There was a significant difference ($p<0.05$) in the number of married females in both types of households with coffee growing households having more married females than non-coffee growing households. There was a significant difference ($p<0.05$) in the number of single

respondents with a higher number (45%) among households without coffee than households growing coffee (33%).

Most of the households in both cases, 70.8% were male-headed while the rest were female-headed. The proportion of the males in coffee growing households (82%) was significantly higher than in households without coffee (62%), ($p<0.05$).

The findings from this study are similar to those of a study carried out in Mwea among rice and non-rice farmers and in Embu among tobacco and non-tobacco farmers where most households were headed by men and that most of the respondents were married (Mwadime, 1992; Mugo, 1995). The observation that there were more married household heads and more male household head are expected because of the cultural beliefs and norms in the area and in Africa in general.

The male to female ratio in the location was 1:1.1. For the age groups 0 – 14 however, there were more males than females (male to female ratio of 1.1:1) while for age group 20 – 29 the males were fewer than females (i.e. male to female ratio of 1:2) in both types of households. The observations that there were more adult females than males can be explained by a migration of males from the rural area to the towns or urban areas in search of employment and other opportunities.

These findings and discussions are in agreement with those of a nutritional survey conducted by ITDG/ANP (2000) in Tharaka Nithi District and Kennedy (1989) in Western Kenya among sugarcane farmers.

3.4.2 EDUCATION AND LITERACY LEVELS

Results of education and literacy levels are presented in Table 3.1.

Table 3.1 Distribution of households by education and literacy levels.

Education and literacy levels	Households with coffee N = 1195	Households without coffee N = 899	Significance (p – value)	Total N = 2094
Pre-school	26.8	35.8	0.021	31.2
Primary Education	56.8	49.8	0.041	53.3
Secondary Education	11.2	10.4	0.054	10.8
Post-secondary	1.2	1.6	0.051	1.4
No formal Education	3.7	2.4	0.044	3.1

* Figures represent percentages

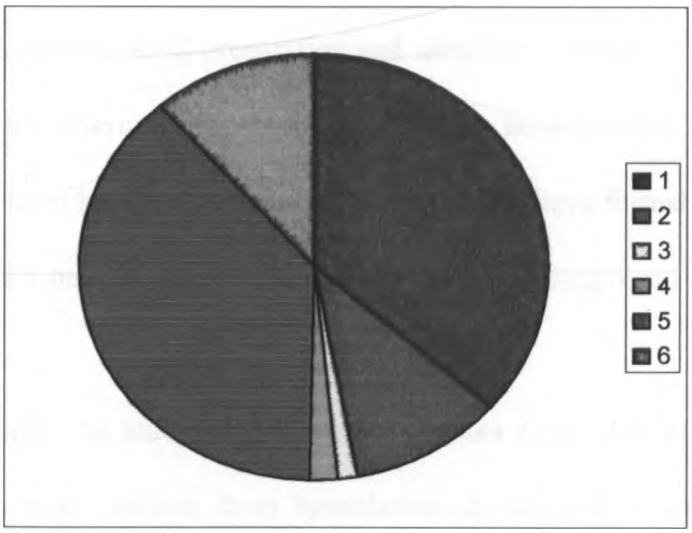
Most people in the study area have at least received some formal education. The general literacy level in the location is high (97%) (i.e98% and 95% for males and females, respectively). Still, there was no significant difference in levels of education among coffee growing households (96%) and non-coffee growing households (98%).

These findings compare well to those of a survey done by the Government of Kenya and reported in the Kenya Demographic and Health Survey (1998) where education levels for males(90%) was higher than for females (81%).

The differences though insignificant in secondary education among coffee growing households and non-coffee growing households could be due to the availability of school fees in form of loans or from income obtained from sale of coffee as noted during the focus group discussions.

These findings agree well with those of a study carried out in Embu among tobacco and non-tobacco farmers where tobacco farmers where better off in terms of formal education. This study also found out that the difference between the two cropping systems was because B.A.T (British American Tobacco), a company that purchases tobacco from the farmers used to give tobacco farmers cash loans and other forms of credit (Mugo,1995).

Maternal education levels indicate that most mothers (96%) have primary education (or not completed primary) as shown in Figure 3.2.



1= Completed primary, 2=Completed secondary, 3= Post secondary
4= Not attended school, 5= Not Completed primary, 6= Not Completed secondary

Figure 3.2: Maternal education levels in the study area.

There was no significant difference in the proportion of mothers having primary school education in coffee growing households (91.1%), and non-coffee growing households (88.9%) ($p>0.05$).

Table 3.2 Distribution of households by maternal education.

Levels of maternal Education	Households with coffee N = 175	Households without coffee N = 175	Significance (p – value)
Not attended school	2.9	3.1	0.054
Primary Education	91.1	88.9	0.059
Secondary Education	6.0	6.0	0.103
Post-secondary	1.0	2.0	0.046

*Chi-square tests

* Figures represent percentages

The number of mothers who had not attended school among coffee growing households was lower (2.9%) than that of non-coffee growing households (3.1%). The low education level of mothers is evident considering that most had primary school education.

The low levels of maternal education are likely to cause food insecurity and poor nutritional status. Maternal education has been shown to have a positive impact on the role of the woman in food preparation and childcare (Mwadime, 1992). A study carried out in South-western Kenya among sugarcane farmers also showed high levels of malnutrition from households where mothers did not have formal education as compared to households where mothers had formal education (Oniang'o and Kennedy, 1990).

On the contrary, the study carried out in Tharaka Nithi District by ITDG/ANP (2000) showed that more children from households of educated mothers were malnourished (underweight) than those from households of mothers without formal education.

As seen reported earlier, education is an important tool in alleviating poverty and improving food security because of the skills and techniques the people acquire to improve crop production and to increase sources of income (GoK, 2000). Education results seen in this chapter could, therefore, have bearing on food security as in chapter four.

3.4.3 HOUSING AND HOUSEHOLD CHARACTERISTICS

Table 3.3 shows housing conditions in households growing coffee and non-coffee household. About two thirds of the households (68.3%) had earthen/soil floors while the rest had cemented or wooden floors. There was no significant difference in the number of households with earthen floor in both types of households ($p>0.05$). The number of households with cemented floor among households growing coffee (34%) was higher but not significantly different from that of households without coffee (which was 29%). Earthen floors are common in most rural areas of Kenya, which is also seen as a measure of insufficiency.

Table 3.3 Distribution of households by type of flooring and roofing materials.

Flooring and roofing material		Type of household		Significance (p-value)
		With coffee N = 175	Without coffee N = 175	
Flooring material	Earthen	11.4 (65)	125.00 (71)	0.071
	Wooden	2.0 (1)	-	0.021
	Cement	59.0 (34)	50.00 (29)	0.091
Roofing material	Grass	2.0 (1)	-	0.011
	Makuti	2.0 (1)	-	0.031
	Iron sheets	171.0 (98)	175.0(100)	0.099

*Figures in parenthesis represent percentages of households.

Most people in the location (99%) used corrugated iron sheets and only a few (1%) use grass as roofing material. Tiles or *Makuti* were rarely used as roofing materials. Both

types of households were practically similar in the use of corrugated iron sheets and grass as roofing materials.

Although the housing conditions were not significantly different, the conditions for coffee growing households indicated slightly better economic status. The number of cemented floors and houses roofed with iron sheets in the study area were high because the area is near Machakos town and had little problem getting the construction material. Also the incomes could have been generally higher than other parts of Machakos district or Eastern province. The difference between coffee growers and non-coffee growers can be attributed to income from sale of coffee. Once coffee payments were done, the farmers were reported to use half of the money on non-food budgets, which included purchasing construction materials. This was confirmed by the focus group discussion.

Similar findings were also reported in a survey carried out in Nyanza Province among rice and non-rice farmers where rice farmers had more cemented floors in their houses and had used iron sheets for roofing than the non-rice farmers (Niemeijer et al., 1985). These findings could also explain why food insecurity was still a problem in the study area.

The number of households in the location with items characteristic of ideal households namely bathroom, latrine dish rack and refuse pit were 64.3%, 98%, 31%, and 66.6% respectively. Further analysis showed that there were more coffee growing households with bathrooms (52%), VIP latrines (75%) and dish racks (60%) than non-coffee growing households (which had bathrooms 48%, VIP latrines 5%, and dish racks 40%,

respectively. The conditions also indicate that coffee growing households belonged to slightly better economic status.

Results on ownership of household durables are presented in Table 3.4.

Table 3.4 Distribution of households by number of household durables

Item	Type of household				Significance (p-value)
	With coffee N = 175		Without coffee N = 175		
Radio	Yes	No	Yes	No	
	129.0 (73)	46.0 (27)	107.0 (61)	63.0 (39)	0.171
Bicycle	8.00 (4)	167.0 (96)	11.00 (6)	167.0 (94)	0.090
Plough	6.00 (3)	169.0 (97)	2.00 (1)	173.0 (99)	0.010

*Chi-square tests

*Figures in parenthesis represent percentages of households.

Nearly three quarters of coffee growing households had a radio as compared to slightly less that two thirds (61%) among non-coffee growing households. Very few households growing coffee had ploughs and bicycles (3% and 5% respectively). Similarly very few household not growing coffee had these items (i.e. 1% and 6% had ploughs and bicycles, respectively). The low ownership in the location would be expected to adversely affect food security and nutritional status since households work on smaller pieces of land because of these constraints.

The low ownership of ploughs in both types of households bearing the fact that the conditions were similar could be due to the rugged terrain in the location. Low ownership of ploughs was also reported in the ITDG/ANP (2000) survey on food security and nutritional status in Tharaka Nithi District. The ITDG/ANP study cited poverty as the reason for low ownership of the plough.

3.4.4 OCCUPATION AND SOURCES OF INCOME FOR HOUSEHOLD MEMBERS

Figure 3.3 shows the proportion of household members occupied in different activities among households growing coffee and those without coffee.

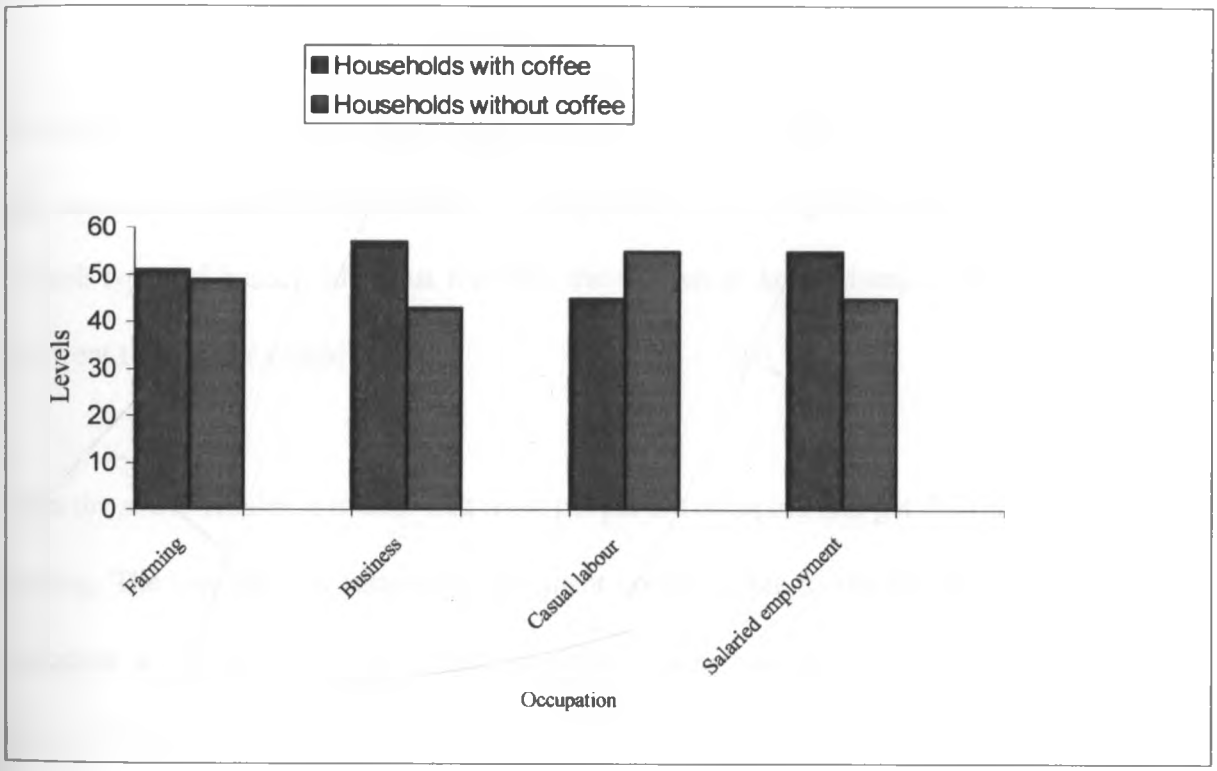


Figure 3.3 Distribution of households by occupation

Most households had members occupied with farming with a slightly higher percentage of coffee growing households (53%) than non-coffee growing households (47%). Households growing coffee had slightly more members occupied in business and salaried employment (57% and 55% respectively) than those from non-coffee growing households being business 43% and salaried employment 45%, respectively. The number of households depending on casual labour was significantly higher among households without coffee (55%) than among coffee growing households which was 45%.

Occupation by sex showed that more men are occupied in farming, casual labour, business and salaried employment than females in the ratios of 3:1, 11:1, 2:1 and 5:1 respectively. In both types of households most men left the women at home doing household chores and went to look for casual labour.

From the above results, it is clear that most people are occupied and get their income from farming. The low rates of salaried employment could be due to the low levels of formal education as earlier discussed. Many households also rely on casual labour for their income. This could reflect food insecurity because with little or no income, it will not be possible to purchase enough food.

These findings are again similar to those of studies conducted among tobacco and rice farmers in Embu and Mwea, respectively (Mugo, 1995; Mwadime, 1992). These studies reported that casual labour is seen as a measure of insufficiency (in terms of food and income) and, therefore, the high numbers of casual labourers from non-coffee growing

households could indicate that they are worse off than those from coffee growing households.

Also similar to the findings of this study, a study conducted in South-western Nyanza (Kenya) among sugarcane growers indicated that more men than women were occupied in casual labour. This could mean that women were left at home caring for the children or engaged in other activities.

These findings contradict the findings of the studies carried out in Mwea among rice growers and in Embu among tobacco growers where the women were more actively involved in casual labour than men, and this was suggested as the cause of food insecurity and poor nutritional status (Mwadime, 1992; Mugo, 1995).

The average income was Ksh.120 per day. Nearly all the money was spent on food. There was a positive correlation ($R=0.072$) though insignificant ($p>0.05$) between income and coffee growing. Results of average daily income show that food insecurity and poor nutritional status could be due to lack of sufficient money to purchase food in both types of households. It was found that an extraKsh.20 per day is required to meet a minimum of 1200 Kcal/cu/day (Muroki, et al., 2000). This was done using food balance sheets by taking a ration of maize to beans as 3:1.

Slightly less than half of the sampled population (40%) brings money to the household. The coffee growing households had fewer household members (39%) bringing money to

the household than non-coffee growing households (61%). The results further show that age group 20--50 years bring money to the household, the average being 30 years. More males than females involved in income generating activities as observed. However, they do not bring their money to the households but channel it to other uses e g. drinking alcohol.

3.5 CONCLUSION

In this chapter it is clear that large household sizes, low levels of formal education and low levels of income worsen food security and nutritional status because these are associated with poor food security and nutritional status. To improve food security income generating activities should be initiated and supported.

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CHAPTER FOUR

HOUSEHOLD FOOD SECURITY

4.1 ABSTRACT

A comparative study on food security and nutritional status of coffee and non-coffee growing households was carried out in Iveti location of Kathiani division, Machakos district. The objective was to determine the total food production, consumption patterns, coping strategies in the event of food shortage, prevalence of livestock rearing and coffee growing in both coffee and non-coffee growing households.

A sample size of 350 was used with 175 coffee and 175 non-coffee growing household. Random sampling was used to select the sub-location and village. The households were systematically sampled. A structured questionnaire and focus group discussions were used to collect data.

About three quarters (76 %) of all the households visited did not meet 80% of their daily calorie requirements. Only 7.4% of the households were able to meet their calorie requirement. More households (55%) not growing coffee than households growing coffee (45%) were found to be food insecure.

It was found out that coffee growing, rearing of livestock, proper food storage and use, and introduction of income generating activities which do not require large pieces of land can improve food security. Households not growing coffee were encouraged to do so.

4.2 INTRODUCTION

Household food insecurity is a problem faced by most people in the third world countries especially in the rural areas. Most households are not in a position to meet their daily calorie requirements. Household food insecurity results from households being unable to produce or purchase enough calories and other nutrients (Pacey and Payne, 1985). Factors that could lead to households being unable to produce enough calories include small land holdings, improper land use, poor technology and lack of farm inputs. Other factors include unreliable rainfall patterns, post harvest food spoilage/deterioration and poor food storage facilities (ACC/SCN, 1991; Latham, 1999). Factors limiting the purchasing power of household members include poor resource base, low incomes and lack of family assets, long distances to the market where food can be obtained among others.

Household practices could also lead to food insecurity. These include selling of food immediately after harvest when the prices are too low and unwillingness by household members especially teenagers to work on their own farms (Jean and Ritchie, 1983).

This chapter discusses the issue of household food insecurity in Iveti Location of Kathiani Division of Machakos District. It looks closely into factors related to food insecurity. These factors include household calorie intake, land ownership and land use, food crop production, cash crop (coffee production), and livestock production. Coping strategies in the event of food shortage are also discussed.

4.3 METHODOLOGY

4.3.1 THE AREA AND THE PEOPLE

Household land size is about 1.5 acres on average. Soils are well drained but easily eroded. The soils are dark red to dark yellowish in colour. Coffee is grown in the area while maize and beans are the major food crops. Other crops grown are vegetables and citrus fruits among others. The traditional African and exotic cattle are also kept at an average of one cow per household (GoK 1996). The area experiences a bimodal rainfall pattern annually which ranges from 500mm – 1000mm annually. Long rains start in early April and stretch up to June. Short rains start in late October or early November up to end of December. It is important to note that the rainfall is unreliable. The area is hilly with many water springs where two hills meet. These springs dry up during the dry season.

Coffee picking is at its peak in the months of April, May and June. Dry coffee berries (referred to as ***Mbuni***) are harvested and sold in August. The coffee is taken to the coffee factory owned by New Iveti Farmers Co-operative Society. The area has a network of untarmacked roads, which are almost impassable during rainy seasons.

During the coffee picking period, a lot of coffee is left unpicked because nearly every household has coffee to concentrate on. Farming is manual and traditional use of hands, fork *jembes* and *jembes*. School leavers and dropout work on other people's farms for pay in the morning hours and work on their parent's farms in the afternoon. Coffee payments to the farmers are made once in a year in December. By the time the payments are made,

most farmers usually have taken food from the local shops on credit to be paid once coffee is paid.

After taking the coffee to the factory, farmers go to do manual work at the factory for the following month or pay money for the work to be done. Fertilizer and pesticides are obtained from the factory and payment deducted when the coffee is being paid.

4.3.2 STUDY DESIGN

The study was cross – sectional, comparing two groups of coffee and non-coffee growing households in aspects of food security and nutritional status in Kathiani Division, Machakos District from September to November, 2000. The two study groups comprised of small-scale farmers.

4.3.3 SAMPLE SIZE DETERMINATION

The sample size was determined on the prevalence of malnutrition (PEM) among children under five years in Machakos District using the following formulae for comparative studies:

$$n = \frac{2z^2 \times (pq)}{d^2}$$

n = Desired sample size for one population.
z = Standard normal deviate set at 1.96
p = Proportion of PEM in the target population in the district. The percentage of malnutrition in the district is 29.3% (KDHS, 1998). Therefore the proportion of malnutrition (p) is 29.3/100 = 0.293
q = 1-p, estimated proportion of well nourished children which is (1 – 0.293)

d = Difference between the 2 populations taken as 10% at 95% confidence interval is 0.1.

$$\text{Thus } n = 2 \times \frac{1.96^2 \times (0.293) \times (1-0.293)}{0.1^2}$$

$$= 159$$

Allowing for an attrition rate of 10% (15.9) the desired sample size for each of the two populations is 174.9 (i.e. approximately 175). Thus a sample size of 175 coffee growers and 175 non–coffee growers households was used giving a total of 350 households.

4.3.4 SAMPLING PROCEDURE

The sampling procedure is presented in Figure 3.2. Machakos District was purposively selected as the study District. Purposive multi-stage sampling method was used to select the study division. Iveti Location and Kaliluni, Kombu and Kitunduni sub-locations were purposively selected because most of the other locations and sub-locations do not actively grow coffee. The study villages were chosen at random. The sampling unit was the household. From each sub-location, households were systematically sampled in the ratio of 1:1 coffee growing to non-coffee growing household respectively until the desired sample size was realized. Equal number of households was taken from each of the three Sub-Locations to make up the total sample. The figure below gives a summery of the sampling procedure.

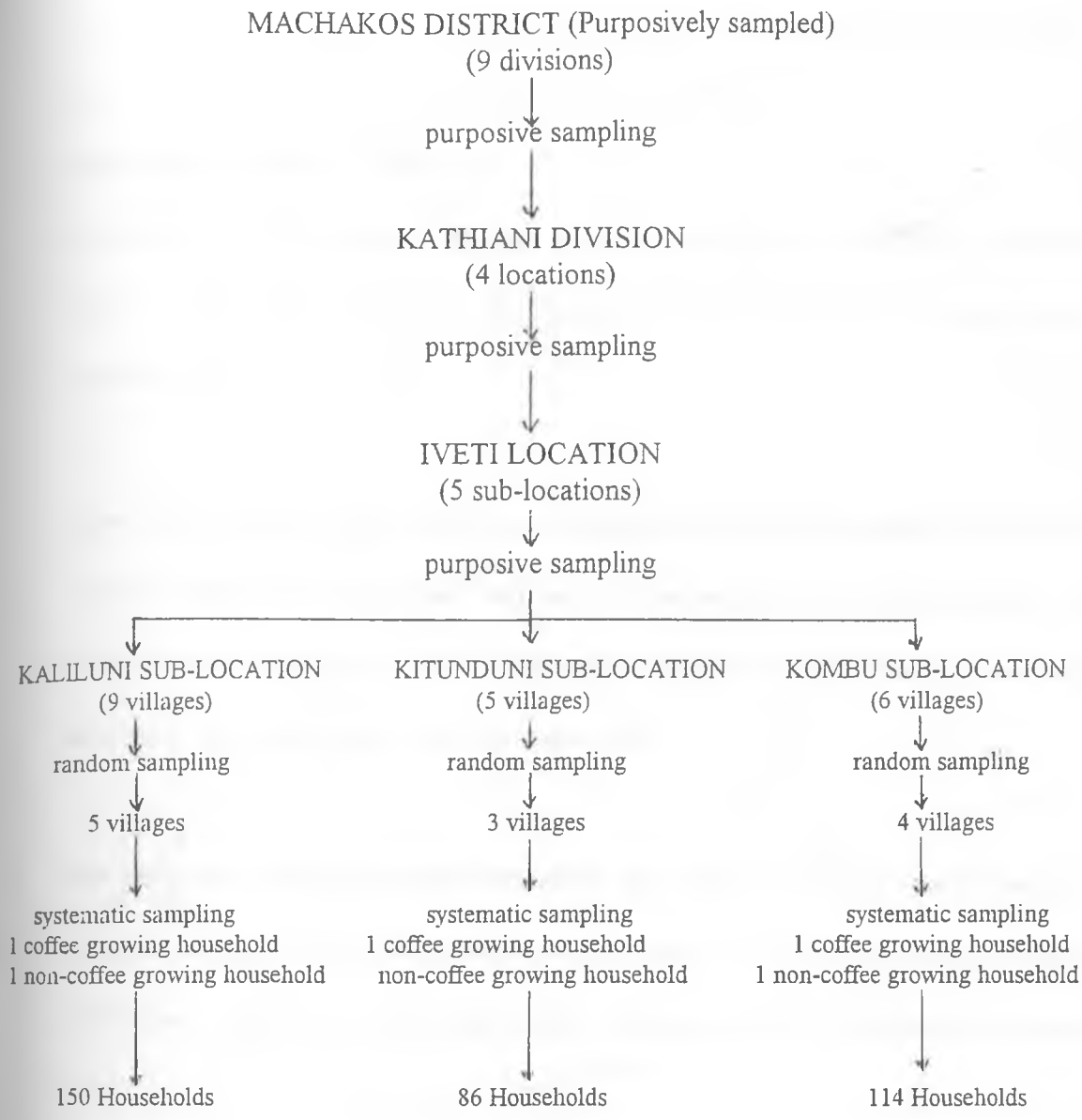

Figure 4.1 A Flow diagram showing the sampling procedure

4.3.5 INCLUSION AND EXCLUSION CRITERIA

The households to be included in the sample had to meet the following criteria.

Non-coffee growers :- Have not been growing coffee in their own farms at least five years to the date of the research and have a child aged between 6 and 59 months.

Coffee growers :- Have been growing coffee in their own farms at least five

years to the date of the research and have a child aged between 6 and 59 months.

4.3.6 RESEARCH ACTIVITIES

In August 2000 the researcher obtained a research permit with the Ministry of Education. Courtesy calls were made to the Machakos District Commissioner and the local administrators.

Three field assistants were identified and trained for one week in early September 2000. The field assistants had minimum of four years secondary school education and able to speak the native language. A pilot study and pre-testing of the questionnaire and research equipment was carried out in mid September 2000.

The researcher and field assistants identified the study boundaries. Three *barazas* were organized to inform the local people about the project during the third week of September 2000. Data collection started the last week of September 2000 and ended mid November 2000.

4.3.7 DATA COLLECTION TOOLS

Data was collected using a structured questionnaire (Appendix 1.0) and focus group discussions (Appendix 2.0). Information on land ownership and land use (food and cash crop production), agricultural tools used, use of fertilizer/organic manure, reasons for not obtaining the expected amount food, food preservation, storage facilities and decision making on land use was collected using a structured questionnaire (Appendix 1).

Information on distance to the nearest food produce market was also obtained. Information on livestock rearing was collected by asking the respondent to list the number of livestock alive, number sold or dead. Also collected was information on access to animal health services.

Information on the total amount of food produced per annum for different foods and total amount of food purchased per annum for respective foods, amount sold, amount given out as gifts, amount consumed and amount remaining in store was obtained. Information on daily food consumption patterns was collected through the 24-hour recall using the data sheet on Appendix 1.

4.3.8 DATA ANALYSIS

To determine the extent of food insecurity in different households the following procedure was used.

(a) Food from own production was added to food purchased and gifts and converted to its energy value using the World Health Organization's (WHO) food conversion table (WHO, 1985).

(b) Food given out, spoiled/wasted and sold was determined and also converted to its energy value using the WHO food conversion tables (WHO, 1985).

(c) Available food was obtained by deducting (ii) from (i).

(d) Consumer units for each household were calculated and expressed as a proportion of the daily requirement of 2960kcal/cu/day based on FAO/WHO/UNU (1985) recommendations.

(e) Households that could not meet 80% (i.e.2368kcal/cu/day) of their calorie requirement from own food production and purchased food were considered food insecure (Hoorweg, et al., 1991).

(f) To determine the differences in food security/proportion of food insecure households between coffee growing households and households without coffee the data was subjected to t-test and chi-square tests as applicable.

4.4 RESULTS AND DISCUSSION

4.4.1 FOOD CONSUMPTION AND FOOD SECURITY

4.4.1.1 CALORIE AND PROTEIN INTAKE

Slightly more than three quarters (76%) of the households in the location are food insecure since they could not meet 80% of their calorie requirement (i.e. 2368kcal/cu/day). Only 7.4% met the recommended average calorie requirement of 2960 kcal/cu/day (FAO/WHO/UNU, 1985). Only a quarter (25%) of the households met 90% of their energy requirements.

Significantly more non-coffee households (55%) were found to be food insecure as compared to the number of households growing coffee (45%) ($p<0.05$). Slightly more than half of the households growing coffee (59%) met their energy requirement of 2960 kcal/cu/day (FAO/WHHO/UNU, 1985) compared to of the households without coffee (41%). There was a positive correlation ($R= 0.078$) (partial correlation) but not significant ($p>0.05$) between coffee growing and households without coffee as far as calorie intake was concerned. This was based on money from sale of coffee. The CI= 9.152, -6.292.

This is, while the mean difference was 1.43, it could fall as low as -6.292 and as high as 9.152.

Table 4.1 shows the mean calorie intake and proportion of RDA (Recommended Daily Allowance) met in the study area. The mean energy intake for the location was 2081kcal/cu/day. The mean calorie intake in coffee growing households (2140 kcal/cu/day) was higher than in the households not growing coffee (2022 kcal/cu/day) but there was no significance difference.

Table 4.1: Mean caloric and protein intake and proportion of RDA in the study area.

Type of household	Mean caloric intake/cu/day	% of RDA	Mean protein intake per day	% of RDA	% of household and food security
Coffee growers N=175	2140	72	28.0	80	45% (food secure) out of 24%
Non-coffee growers N=175	2022	68	25.0	71	55% (food secure) out of 24%
Location mean	2081	71	26.0	76	24% (food secure)

The findings of this study compare with those of studies done in Embu (among tobacco and non-tobacco farmers) and Western Kenya (among sugarcane and non-sugarcane farmers) which showed that farmers could not meet their calorie requirements and that about 80% of the visited households were food insecure. This was attributed to mono-cropping and less emphasis on food crops (Mugo, 1995; Mwadime, 1992; Oniang'o and Kennedy, 1998).

The higher caloric and protein consumption in coffee growing households compared to the households without coffee is explained by the fact that large land size holdings were higher in coffee growing households and most probably the fact that income from sale of coffee was used to purchase food.

These results contradict those of the Embu study on tobacco farming, which showed that non-tobacco growers consumed high amounts of calorie than tobacco farmers. This was attributed to the fact that farmers could not inter-crop food crop with the tobacco plant. It was reported that the beans grown on the land had "bitter taste" (Mugo, 1995).

Findings from 24 hour recall shows that close to three quarter (71%) of the children in the study area and in both types of households could still not meet at least 80% of their calorie requirements, (770–1600 kcal/cu/day) (Kirschman and Dunne, 1984; Greenfield and Southgate,1992). Only 14% of the children had more food than they require with energy intakes of more than 1600 kcal/cu/day mainly from smaller households and or had salaried employment. In the present study, however, there was no significance difference ($p>0.05$) in the number of children who did not meet their calorie requirements from coffee growing households(69%) and those from households without coffee (73%).

4.4.1.2 CALORIE INTAKE AND HOUSEHOLD CHHARATERISTICS AND COPING STRATEGIES

When food consumption was cross checked with sale of harvested food, 73% of the households sold food. It was also found that more household without coffee (67%) than

households growing coffee (33%) sold most of their own produced calories and as a result more households were left food insecure.

About three quarters (75%) of the study households (in both types of households) indicated that they run out of their food stocks before the next harvest season.

People in both cropping systems had various coping strategies in the event of food shortage. Table 4.2 shows the different ways of obtaining food other than from own produce.

Table 4.2 Distribution of households by sources of food other than from own produce

Source	Type of household		Significance (p – value)
	Coffee growing N = 175	Without coffee N = 175	
Purchase	45	55	0.134
Food for work	43	57	0.010
Government food	41	59	0.131
NGO/charitable orgs.	33	67	0.067
Remittance from relatives	33	69	0.098

*Figures in the table represent percentages of households.

There was no significant difference in the number of coffee growing households purchasing food (84%) and those from non-coffee growing households (87%) ($p>0.05$). Other copping strategies cited by the people included food for work with more households without coffee (57%) than with growing coffee (43%) relying on this strategy. Other coping strategies are social remittances from the government, NGOs and charitable organizations like the churches and remittances from relatives and friends. In both

cropping systems, household members indicated skipping meals (especially lunch) as a coping mechanism in periods of food shortage. This particular finding was confirmed by the focus group discussion and also from the structured questionnaire.

The money used to purchase food was obtained through different ways including:- casual labour, salaried employment, sale of vegetables and fruits to buy cereals, sale of livestock, sale of firewood and sale of charcoal (Table 4.3).

Table 4.3 Distribution of households by sources of money to purchase food.

Source of money to purchase food	Type of household		Significance (p – value)	Percentage in the location N = 350
	With coffee N = 175	Without coffee N = 175		
Salaries and wages	97	81	0.059	89
Sale of vegetables and fruits	76	79	0.061	78
Sale of livestock	32	37	0.053	35
Sale of firewood/charcoal	12	29	0.041	20

*Chi-square tests

*Figures represent percentages of households.

Although there was no significant difference (table 4.3) in the number of household depending on these sources between the two types of households ($p>0.05$) more households growing coffee (97%) than households without coffee (81%) obtained their money from salaries and wages. Significantly more households not growing coffee (29%) sold firewood/charcoal than did households growing coffee (12%) ($p<0.05$).

The sources of money to purchase food are similar to those of the Embu nutritional survey by Mugo (1995) such as sale of livestock, firewood and charcoal.

4.4.2 FOOD PRODUCTIOON AND FOOD SECURITY

4.4.2.1 LAND SIZE AND AGRICULTURAL TOOLS

Table 4.4 shows the mean land sizes among coffee growing households and households without coffee.

Table 4.4 Distribution of households by land size.

Land size	Type of household		Significance (p – value)	Total
	With coffee N = 175	Without coffee N = 175		
2.5 acres and below	138.0(46)	162.0(54)	0.010	300.0(100)
2.5 acres and above	37.0(74)	13.0(26)	0.014	50.0(100)
Mean land size (Acres)	2.3	1.43	-	1.93

*Figures in parenthesis represent percentages of households.

Almost all the visited (98%) households had their own land for cultivation while the remaining rented the land. Land sizes ranged from 0.25 acres to 10 acres with a mean of 1.5 acres per household. The land size was much less than required to produce the required calories for the average household size of 6.1 in the area. At least land size of about five acres and more would be required to produce the required calories.

There was a significantly higher number of households with large pieces of land among coffee growing households (74%) than there was among non-coffee growing households (36%).

More than three quarters (82%) of households in the location used *jembes*, fork *jembes* hoes and *pangas* as agricultural tools. Very few households (4%) used the plough. Both coffee growers and non – coffee growers were practically similar in the use of these equipment. As mentioned in chapter 4, the low ownership of the plough could be due to

the rugged terrain in the location unlike the ITDG/ANP (2000) study which cited poverty as the reason for the low ownership of plough.

These results are similar to those of a study done in Philippines among sugarcane farmers which indicated that sugarcane farmers where better of in terms of food security than non-sugarcane farmers because sugarcane farmers had production resources (land and capital) than their counterparts (ACC/SCN, 1989).

On the contrary, a study carried out in Western Kenya among sugarcane farmers found that there was no significant difference in food security and nutritional status between farmers holding different land sizes (Kennedy, 1989).

4.4.2.2 PRODUCTION OF VARIOUS FOOOD CROPS

Table 4.5 shows the mean annual food crop production by coffee and non-coffee growing households.

Table 4.5 Distribution of annual food production (mean) by type of household.

Food harvested	Type of household		Significance (p – value)	Output in the study area
	With coffee N = 175 Harvested	Without coffee N = 175 Harvested		
Maize (Kgs)	194	190	0.054	192
Beans (Kgs)	76	52	0.121	66
Fruits (avocado, passion) Kgs	246	180	0.310	224
Vegetables (Kales, tomatoes) Kgs	1398	1176	0.060	1300
Milk	2002	1990	0.090	1920

*Chi-square tests

The amounts harvested were lower than the average district means for most of the foods. Some coffee growing households (7%) and households without coffee (9%) even recorded cereal output of 0kgs while the highest was 360kg of maize per annum. Vegetable output was quite good but unfortunately most of the harvest is sold rather than being consumed at home. However, the money obtained from sale of the vegetables is used to buy other foods. This was confirmed by the focus group discussions. Milk and eggs production was high. However, about three quarters of the households (73%) sold most of the harvested milk than being consumed at home. Fruit (especially avocado and passion fruits) production was also high with still a good percentage of the produce being sold than being consumed at home.

These findings compare with those of a study carried out by ITDG/ANP (2000), in Tharaka Nithi District where most of the produced food was sold.

4.4.2.3 FACTORS AFFECTING FOOD PRODUCTION

As observed in Table 5.4, most households attributed low yields to small land holdings. Use of farm implements which are not advanced was also cited as a cause for low food productivity.

Other factors affecting food production included first and foremost source of water (rainfall). Kenya depends mainly on rain-fed agriculture, thus, a shortfall in the overall rain pattern poses a major threat to the overall food security especially for the poor most of whom live in the rural areas (GoK, 2000). In the study area members of households have

not received adequate rains for the previous two rainy seasons which was cited by most of the respondents (93%) cited lack of adequate rains as the main constraint for the low food production in the location.

Significantly more that two thirds (68%) of households in the location used both manure and fertilizer. Significantly more coffee growing households (30%) than households without coffee (13%) reported the use of fertilizer ($p<0.05$). Table 4.6 shows the distribution of fertilizer/manure use by type of household.

Table 4.6 Distribution of households by fertilizer and/or manure use.

Fertilizer/manure	Type of household		Significance (p – value)	Total
	With coffee N = 175	Without coffee N = 175		
Fertilizer	22(30)	6(13)	0.021	28.0(81)
Manure	38(25)	40(23)	0.051	78.0(22)
Both	130(74)	109(52)	0.039	239.0(68)
None	1 (1)	4 (2)	0.041	5.0 (2)

*Chi-square tests

*Figures in parenthesis represent percentage of households.

Significantly there were more households without coffee (2%) who did not use either manure or fertilizer than non-coffee growing households (1%) ($p<0.05$). This explains why the non-coffee growers were worse off in terms of food security than the coffee growers.

Significantly more coffee growing households (60%) cited insect and pest attack as a hindrance to food crop production than did households without coffee (38%) ($p<0.05$). More coffee-growing households (76%) reported poor technology (in farm tools) than did

households not growing coffee (69%) but there was no significant difference in constraints to food production between the two types of households ($p>0.05$).

Food insecurity was also found to be due to poor food storage and poor food preservation techniques. The results indicate that some food is wasted after harvest because of the low prevalence of food preservation and poor storage facilities. Significantly more households among coffee growers (60%) than among non-coffee growers (40%) ($p<0.05$) used chemical or ashes for food preservation.

The most popular storage facility was the use of sacks and bags (86% and 77%, respectively) in both cropping systems. Other storage facilities as reported by both types of households were baskets, drums and bins. This means that harvested food cannot last long and, therefore, the problem of food security sets in. There is generally a low prevalence of use of granaries to store food (12%) with more coffee growing households (11.4%) than non-coffee growing households (8.1%) owning granaries.

The factors contributing to low food production are similar to those of studies carried out in Tharaka Nithi and in Embu (among tobacco and non-tobacco farmers) by ITDG/ANP (2000) and Mugo (1995), where rainfall was cited as a major factor contributing to low food production because the agriculture in the areas is rain-fed. Other factors cited in the Tharaka Nithi study are similar to those cited in this study except that households which reported use of fertilizer were more than those reported in the Tharaka Nithi study.

Observations made in this study show that more households growing coffee use fertilizer than households without coffee are similar to those of the Embu study by Mugo (1995) and among tobacco and non-tobacco farmers because B.A.T (British American Tobacco), a company that buys tobacco from the farmers, supplied the farmers with fertilizers and pesticides.

4.4.2.4 LIVESTOCK REARING

The livestock reared in the location include cows, goats, sheep, chicken and donkeys. Most of the livestock are, however, the local/indigenous breeds. Slightly less than half (45%) of the visited households had livestock (Table 4.7). Further, households having livestock reported sale of livestock to obtain money to purchase food.

Table 4.7 Distribution of households by livestock.

Type of livestock	Type of household		Significance (p – value)
	With coffee N = 175	Without coffee N = 175	
Cows	103.0 (63)	59.0 (37)	0.101
Goats	71.0 (63)	41.0 (37)	0.176
Sheep	38.0 (61)	24.0 (39)	0.189
Chicken	111.0 (54)	93.0 (46)	0.124
Donkeys	41.0 (52)	38.0 (48)	0.038

*Figures in parenthesis represent percentage of households.

Coffee growing households showed a significantly higher ownership of livestock (cows, goats, sheep and chicken and donkeys) (57%) than did households not growing coffee (43%) ($p<0.05$). Households growing coffee had a mean of 2 cows, 2 goats 2 sheep and 3

chickens while non–coffee growers showed a mean of 1 cow, 1 goat, 2 sheep and 4 chicken.

Other animals reared are the donkeys (as beast of burden). The rearing of the donkey is high among coffee growing households (52%) than households without coffee (48%). Coffee growers reported that the donkey was used to transport harvested coffee berries to the coffee factories.

It is clear that rearing of livestock can be used to improve food security because sale of livestock could provide income to purchase food. Further, the animals themselves are sources of food in terms of milk, eggs and meat.

The study carried out in Nyanza Province (Kenya), among rice and non-rice farmers also showed that rearing and selling of livestock provided income that was used to purchase food among both types of households (Niemeijer et al, 1985).

4.4.3 COFFEE FARMING AND ITS EFFECTS ON FOOD SECURITY

Land occupied by coffee plants was found to be about half of the household land holdings. Land acreage covered by coffee plants increased with increasing land sizes. There was a positive correlation (R=1.24) (partial correlation) between coffee acreage and the amount of money obtained from sale of coffee.

Ripe coffee berries are harvested in the months of April, May, June and December. During the off harvest months, farmers inter-crop other crops (especially legumes and

vegetables) with the coffee plants. Thus, coffee farmers had relatively more land put to food crop production than households not growing coffee.

Results from focus group discussions showed that during periods of coffee harvesting members of the households spent most of the time on the cash crop. The berries are dehusked at the coffee factory and farmers can recycle the husks as manure. This could explain why coffee growers recorded high use of organic manure than non– coffee growers. It could also partly explain why coffee farmers had relatively high yields of food crops.

Inadequate rainfall, poor technology in terms of farm implements, lack of farm inputs such as insecticides and pesticides which resulted to low coffee yields were mentioned by most of the coffee farmers (87%) as the factors leading to lower yields than expected. Households growing coffee reported that cash from sale of coffee could purchase food for a household for more than one month. This was confirmed by the focus group discussion.

These findings are similar to those of studies carried out in Malaysia and rice farmers and Philippines among sugarcane and farmers which showed that rice and sugarcane farmers had increased calorie intake as a result of increased income from sale of the cash crop (Hazell and Roell1983; ACC/SCN, 1989).

4.5 CONCLUSION

From the observations made in this chapter, it is evident that more than half of the households in the location are food insecure. Non–coffee growers are worse off than coffee growers in terms of food insecurity. Land size holdings are small and as such cannot produce enough food to support all household members. Other issues such as poor farming methods, lack of rainfall, lack of farm inputs, poor storage facilities and the low prevalence of food preservation lower food crop production. In all this factors non–coffee growers are worse off than coffee growers.

Further, households not growing coffee sell most of their own produced calories as seen earlier and as a result more households are left food insecure from own food production source.

The findings in this chapter indicate that cash cropping has different effects on food security depending on the type of cash crop being grown because some of the discussed studies have shown negative effect of cash crop growing and food security/nutritional status. In this study however, coffee growing has shown to have positive effects on food security.

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CHAPTER FIVE

NUTRITIONAL SITUATION

5.1 ABSTRACT

A comparative study on food security and nutritional status of coffee and non-coffee growing households was carried out with an objective to determine the differences in nutritional status of children aged 6-59 months and the role of food gate keepers in the study location.

A sample size of 350 households was used. The study district, division and location were purposively selected.. Random sampling was done at the sub–location to select the villages. The sampling unit was the household. The households were systematically sampled and equal number of coffee and non-coffee growing households drawn. Data were collected using a structured questionnaire, anthropometric measurements and focus group discussions.

The prevalence in the study area was high. Moderate and severe stunting were 29% and 26% respectively. The figure for severe stunting is too high indicating long-term cumulative effects of inadequate nutrition and health for most of the households. Immediate attention in implementing the recommendations, would, therefore, be necessary. Moderate and severe underweights were 26% and 9.1% respectively, while moderate and severe wasting 4.7% and 0.3%, respectively. Levels of severe underweight and severe stunting were higher than the national and provincial figures.

The level of malnutrition was generally higher among households without coffee than those growing coffee except for severe stunting where households growing coffee and those without coffee reported 29% and 26% respectively. Further, households growing coffee did not report any case of severe wasting while some households without coffee did (0.3%). Except for wasting more boys than girls were at a higher risk of being malnourished (stunting and underweight) possibly because they tend to go and play far away from home and could therefore, miss some food/snack.

It is suggested that nutritional education, improved maternal education and improved intra-household practices such as food distribution, decision on food use could better the nutritional status. Non-coffee growing coffee were encouraged to do so along with initiating income generating activities.

5.2 INTRODUCTION

Malnutrition has multifaceted causality (USAID/MACRO/IMPACT, 1996). In order to address this problem an integrated approach is required. It is, therefore, important to establish the effect of various demographic and socio-economic factors that influence nutritional status and to investigate the food security issue such as land availability (Pacey and Payne, 1985). Other key issues to nutritional status are maternal education, morbidity and hygiene (Tomkins and Watson, 1989; GOK, 1983). Not to be under-rated are key food gate-keepers and decision makers of what and how much to be grown, stored and to be eaten as well as care takers and feeding practices (ITDG/ANP, 2000).This chapter reports and discusses the nutritional status of children aged between 6 and 59 months in

Iveti Location of Kathiani Division, Machakos District. The chapter looks at the three forms of malnutrition (wasting, stunting and underweight) and other factors that interplay with these forms of malnutrition.

5.3 METHODOLOGY

5.3.1 THE AREA AND THE PEOPLE

The study was carried out in Iveti location of Kathiani division, Machakos district, about 22 kilometres northeast of Machakos town (Appendix 4.0) The ethnic group is Kamba. Main occupation is farming with most people occupied as casual labourers on other people's farms who are paid a daily wage ranging from Ksh. 60 – 100 or food for work done. Most of the land is inherited. Brothers inherit their father's land once he is dead. Sisters have no say over land ownership. Some people have bought land on which they live and farm.

5.3.2 STUDY DESIGN

The study was cross – sectional, comparing two groups of coffee and non-coffee growing households in aspects of food security and nutritional status in Kathiani Division, Machakos District from September to November, 2000. The two study groups comprised of small-scale farmers.

5.3.3 SAMPLE SIZE DETERMINATION

The sample size was determined on the prevalence of malnutrition (PEM) among children under five years in Machakos District using the following formulae for comparative studies:

$$n = \frac{2z^2 \times (pq)}{d^2}$$

n = Desired sample size for one population.
z = Standard normal deviate set at 1.96
p = Proportion of PEM in the target population in the district. The percentage of malnutrition in the district is 29.3% (KDHS, 1998). Therefore the proportion of malnutrition (p) is 29.3/100 = 0.293
q = 1-p, estimated proportion of well nourished children which is (1 – 0.293)
d = Difference between the 2 populations taken as 10% at 95% confidence interval is 0.1.

Thus $n = 2 \times \frac{1.96^2 \times (0.293) \times (1-0.293)}{0.1^2}$

$= 159$

Allowing for an attrition rate of 10% (15.9) the desired sample size for each of the two populations is 174.9 (i.e. approximately 175). A total sample of 350 was used comprising 175 coffee growers and 175 non–coffee growers.

5.3.4 SAMPLING PROCEDURE

The sampling procedure is presented in Figure 3.2. Machakos District was purposively selected as the study District. Purposive multi-stage sampling method was used to select the study division. Iveti Location and Kaliluni, Kombu and Kitunduni sub-locations were purposively selected because most of the other locations and sub-locations do not actively grow coffee. The study villages were chosen at random. The sampling unit was the

household. From each sub-location, households were systematically sampled in the ratio of 1:1 coffee growing to non-coffee growing household respectively until the desired sample size was realized. Equal number of households was taken from each of the three Sub-Locations to make up the total sample. The figure below gives a summery of the sampling procedure.

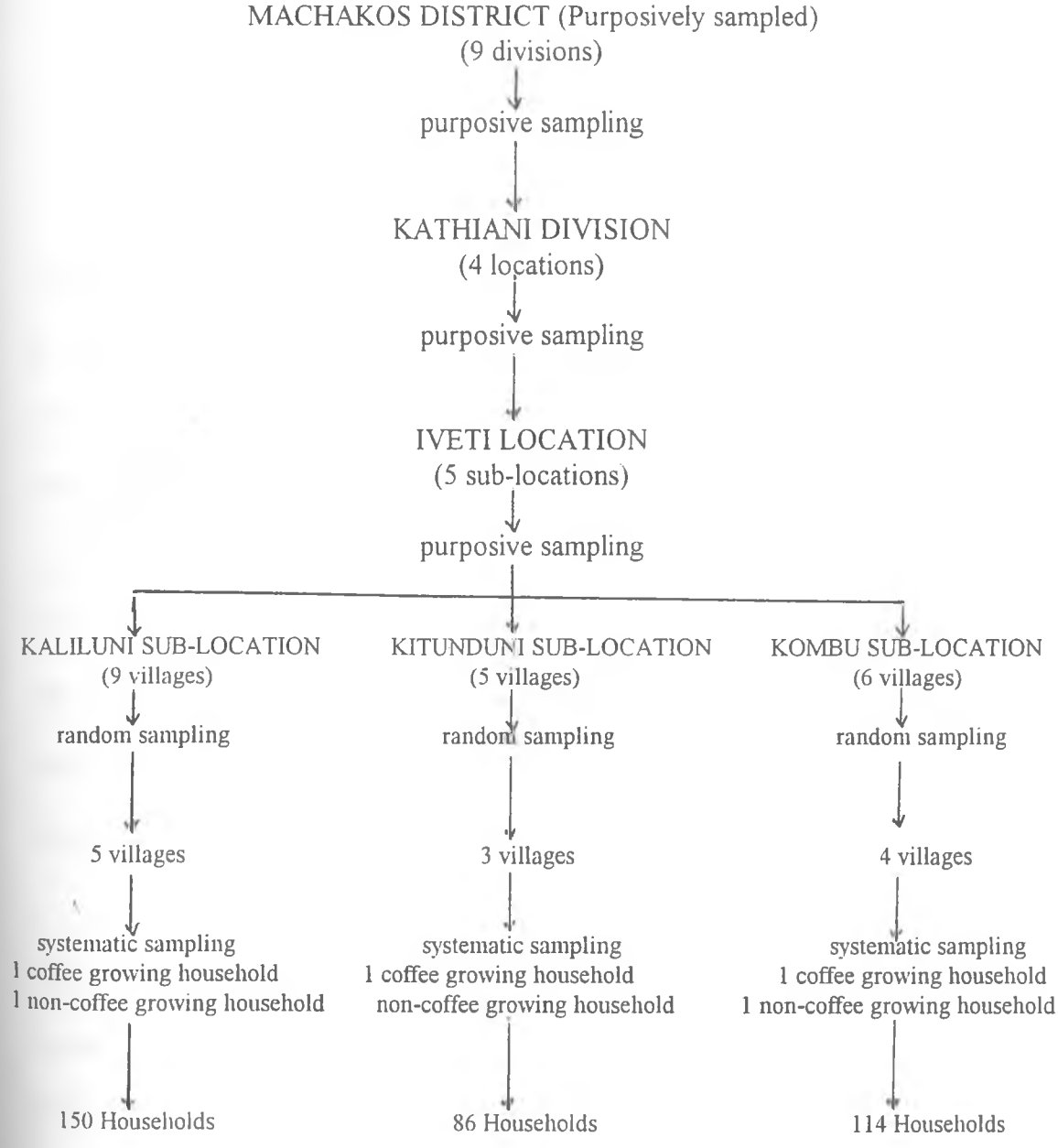

Figure 5.1 A Flow diagram showing the sampling procedure

5.3.5 INCLUSION AND EXCLUSION CRITERIA

The households to be included in the sample had to meet the following criteria.

Non-coffee growers :- Have not been growing coffee in their own farms at least five years to the date of the research and have a child aged between 6 and 59 months.

Coffee growers :- Have been growing coffee in their own farms at least five years to the date of the research and have a child aged between 6 and 59 months.

5.3.6 RESEARCH ACTIVITIES

In August 2000 the researcher obtained a research permit with the Ministry of Education. Courtesy calls were made to the Machakos District Commissioner and the local administrators.

Three field assistants were identified and trained for one week in early September 2000. The field assistants had minimum of four years secondary school education and able to speak the native language. A pilot study and pre-testing of the questionnaire and research equipment was carried out in mid September 2000.

The researcher and field assistants identified the study boundaries. Three *barazas* were organized to inform the local people about the project during the third week of September 2000. Data collection started the last week of September 2000 and ended mid November 2000.

5.3.7 DATA COLLECTION TOOLS

Data was collected using a structured questionnaire (Appendix 1.0) and focus group discussions (Appendix 2.0) Data collection tools and procedures was as described by FAO/WHO (1983).

a) Anthropometric measurements were taken as described by FAO/WHO (1983) as follows:

(i) Weight measurements

The SALTER scales were calibrated every morning using a 1kg stone.

Two measurements were done. Children were weighed without clothes except a pant.

(ii) Height measurements

This was done for children above 2 years and length (to the nearest 0.1cm) for children below 2 years using a length board. The length board had a sliding headrest and a tape measure attached to the side. A child was well positioned with knees and chin held straight. The researcher and assistant read the height or length. Two measurements were done.

(iii) Mid Upper Arm Circumference (MUAC) (in mm):

MUAC was done using a TALC tape. The left mid upper arm was identified and the circumference taken.

b) Determination of date of birth

To identify the date of birth to be able to calculate the age of the children, the health growth monitoring cards from growth monitoring clinics were used. For

children without health cards, the mother was asked to remember when the child was born and whether the child had received all the immunizations.

a) Socio-economic and socio-demographic household characteristics

b) Questions asked included decisions on food use, use of stored food and land use in the household, age and level of education of other of index child, source of household income, household land holdings and morbidity. (Appendix 1)

5.3.8 DATA ANALYSIS

Anthropometric indices were used to assess the nutritional status of children between 6 and 59 months. These were:-

(a) Stunting (height for age): A child was considered stunted if he/she fell below –2 SD of the reference child (National Centre for Health Statistics). If the child was more than –3 SD the child was considered to be severely stunted.

(b) Wasting (weight for height): A child was considered wasted if he/she fell below –2 SD of the reference child (National Centre for Health Statistics). If the child was more than –3 SD the child was considered to be severely wasted.

(c) Underweight (weight for age): A child was considered underweight if he/she fell below –2 SD of the reference child (National Centre for Health Statistics). If the child was more than –3 SD the child was considered to be severely underweight.

5.4 RESULTS AND DISCUSSION

The three indices reflect different, although not independent, aspects of nutritional status Weight for Height (degree of wasting) is used to estimate the extent of acute malnutrition and the need for immediate attention. Height for Age (stunting) reflects the nutritional history of the child and low height for age indicates chronic illness and/or inadequate dietary intake relative to need over a long period of time i.e. the possible chronicity of malnutrition. Weight for Age (underweight) is a combination of wasting and stunting. It is a useful measure of nutritional progress in a community of mixed age composition. In all these measurements including MUAC, children were classified as normal, moderately or severely malnourished.

5.4.1 STUNTING

Close to a half of the children (55%) of the children in the location were malnourished i.e. moderately and severely malnourished. Moderate and severe stunting rates in the study area are 29 and 26 % respectively. Figures for moderate stunting are slightly lower than the national figures of 33% but figures for severe stunting are almost twice as high as the national figures of 12.7% (KDHS 1998).

Table 5.1: Distribution of children by levels of stunting.

Malnutrition (stunting)	Stunting in the location N = 350	Type of household		Significance (p – value)
		With coffee N = 175	Without coffee N = 175	
Total malnutrition (stunting)	55	56	57	0.059
Moderate (<-2SD)	29	27	31	0.041
Severe (<-3SD)	26	29	26	0.038

*Total malnutrition is moderate and severe malnutrition combined.
*Figures in the table represent percentages of stunting

There was no significant difference ($p>0.05$) the number of stunted children from coffee growing households (28%) and those from not growing coffee (27%).

A study by Mugo (1995) in Embu among tobacco and non-tobacco farmers also indicated that children from households not growing tobacco were much more malnourished (stunted) compared to those from households growing tobacco.

These findings also agree with those of a study carried out in Western and Nyanza Provinces (Kenya) among rice farmers which found out that malnutrition especially stunting and underweight rates were higher among children from households not growing rice compared to those who grew rice (Niemeijer et al, 1985).

Boys were at a greater risk of being stunted as compared to girls as shown in Table 5.2. The prevalence was 59 and 50% for boys and girls respectively (Table 5.2). Severe stunting was significantly higher among boys (30%) than among girls (21%) ($p<0.05$) in

both types of households. This could be due to the fact that boys tend to go to play far away from home and, therefore, there is a high chance of missing some snack.

Table 5.2 Distribution of children by sex and levels of stunting

Malnutrition (stunting)	Boys N = 185	Girls N = 165	Significance (p – value)
Total malnutrition (stunting)	(59)	(50)	0.064
Moderate (<-2SD)	53 (29)	48 (29)	0.109
Severe (<-3SD)	57 (30)	34 (21)	0.011

*Total malnutrition is moderate and severe malnutrition combined.
*Figures in parenthesis represent percentages of malnourished children

5.4.2 UNDER WEIGHT

Table 5.3 below shows the percentages of underweight in the study area. About 35.1% of the children in the location were underweight. Table5.3 shows that only 9.1% of the children in the study are were severely underweight (Weight for Age of <-3SD). About 26% were moderately underweight (between –3 SD and –2 SD). The prevalence of moderate underweight was not much different from that obtained from Eastern province which was 25.7% (KDHS, 1998). Severe underweight was higher (9.1%) than the figures of 6.6%.

Table 5.3 Distribution of children by levels of underweight

Malnutrition (underweight)	Underweight in the location N = 350	Type of household		Significance (p – value)
		With coffee N = 175	Without coffee N = 175	
Total malnutrition (underweight)	35.1	23.3	38	0.0491
Moderate (<-2SD)	26.0	26.0	27	0.0509
Severe (<-3SD)	9.1	7.3	11	0.0190

*Total malnutrition is moderate and severe malnutrition combined.
*Figures represent percentages of underweight children.

There was no significant difference ($p>0.05$) in moderate underweight among coffee and non-coffee growers but there was a significant difference ($p<0.05$) in severe underweight among coffee growers (7.3%) and non-coffee growers (11%).

These findings on underweight were also similar to those of a study carried out in Western and Nyanza Provinces (Kenya) among rice farmers which found out that malnutrition especially stunting and underweight rates were higher among children from households not growing rice compared to those who grew rice (Niemeijer et al, 1985).

Table 5.4 shows that boys are likely to be severely underweight than girls. This was so probably because girls remained in the kitchen with their mothers and ate while cooking and also during meal service. This was confirmed during the focus group discussion.

Table 5.4 Distribution of children by sex and levels of underweight

Malnutrition (underweight)	Boys N = 185	Girls N = 165	Significance (p – value)
Total malnutrition (underweight)	(41)	(28)	0.039
Moderate (<-2SD)	55 (30)	36 (22)	0.132
Severe (<-3SD)	21 (11)	11 (6)	0.039

*Total malnutrition is moderate and severe malnutrition combined.
*Figures in parenthesis represent percentages of malnourished children

5.4.3 WASTING

Wasting levels indicate failure to receive adequate nutrition in the period immediately preceding the study or survey and may be due to inadequate food intake, recent illness or seasonal variation of food availability.

Five percent of the children in the location were wasted. Moderate and severe wasting stood at 4.7 and 0.3%, respectively. The prevalence of moderate and severe wasting in the study area was lower than the national figures of moderate and severe which stand at 6 and 1% (KDHS, 1998). The indices of wasting were high possibly the survey was conducted at a time when there was a series of famines. Table 5.5 shows the levels of wasting in the study area.

Table 5.5 Distribution of children by levels of wasting

Malnutrition (wasting)	Wasting in the location	Type of household		Significance (p – value)
		With coffee N = 175	Without coffee N = 175	
Total malnutrition (wasting)	5	4.2	5.1	0.029
Moderate (<-2SD)	4.7	4.2	4.8	0.038
Severe (<-3SD)	0.3	0.0	0.3	0.019

*Total malnutrition is moderate and severe malnutrition combined.
*Figures represent percentages of wasting.

The prevalence of moderate and severe wasting among coffee growing households was significantly lower than that of non-growing coffee households ($p<0.05$). This could be probably because coffee growers had increased income from sale of coffee when payments were done.

The findings of this study agree with those of a study carried out among rice farmers in Malaysia which showed improved nutritional status among the farmers as a result of improved income from the sale of paddy (Hazell and Roell, 1983).

For both coffee growers and non-coffee growers girls are at a significantly higher risk of wasting compared to boys ($p<0.05$) (Table 5.6).

Table 5.6 Distribution of children by sex and levels of wasting

Malnutrition wasting	Boys N = 185	Girls N = 165	Significance (p – value)
Total malnutrition (wasting)	(4)	(5)	0.038
Moderate (<-2SD)	8 (4)	8 (4.8)	0.059
Severe (<-3SD0	-	1 (0.2)	0.037

*Total malnutrition is moderate and severe malnutrition combined.
*Figures in parenthesis represent percentages of malnourished children.

Generally the nutritional indices (underweight, wasting and stunting) indicate that there is general malnutrition in the study area. The levels of co-current and chronic malnutrition are even higher than the national and provincial figures as shown in the 1998 KDHS and as reported earlier.

A study conducted by ITDG/ANP (2000) in Tharaka District also showed general malnutrition in the area and worse among food insecure households but the rates were slightly lower than the findings of this study.

Nutritional indicators indicate that more children among non-coffee growers were malnourished compared to the coffee growers because most of the coffee growing households were food insecure as observed in chapter four.

5.4.4 NUTRITIONAL STATUS OF CHILDREN AND FOOD GATE KEEPERS

5.4.4.1 Food Gatekeepers – Decision on land use

In the study area, in close to three quarters (71%) of the households, the husbands make decisions on land use while in 18% of the household wives make decisions on the same. Other family members (mostly parents–in-law) make decisions on land use in the rest of the households.

There was no significant difference in the number of households where husbands make decisions on land use in coffee growing households and in non-coffee growing households Significantly there were more wives making decision on land use from households growing coffee (63%) than in households not growing coffee (37%) ($p<0.05$). More households growing coffee (76%) than non-coffee growing households (57%) had other family members (parents–in–law) making decision on land use.

Among households where husbands make decision on land use no cases of moderate and severe stunting were reported, but in households where wives (22%) and other relatives (19%) make decisions, cases of moderate and severe stunting were reported. This could be attributed to the higher levels of formal education among males than females which helped them make decisions and that parents-in-law (male) had much more experience in

farming than their children did. The ANP/ITDG (2000) report in Tharaka Nithi had similar findings.

Among all households where parents–in–law make decision no cases of wasting were reported. However, in households where husbands made decisions on land use, levels of moderate wasting (2.9%) were reported. In all situations cases of moderate and severe underweight were reported except households where parents–in–law make decisions. No cases of wasting reported because wasting is periodical malnutrition due to seasonal inadequate food intake, recent illnesses or variation of food shortage.

5.4.4.2 Food Gatekeepers – Decision of Food Use

Most households (84.4%) visited reported that wives make decisions on food use. Households where parents–in–law make decisions on food use were more (9%) than households where husbands make decisions on food use (6.6%). There was, however, no significant difference between the two ($p>0.05$).

More households not growing coffee had wives making decision on food use (78%) compared to households growing coffee (74%). More parents–in-law among coffee growers (67%) make decisions on food use compared to those not growing coffee (59%).

The prevalence of stunting in households where husbands made decision on food use was high (22%) than in households where the wife or parents-in-law made decisions on food

use which was 19%. This was possibly because men channeled the money earned into alcohol or other non-food budgets.

Wasting (2.6%) was also reported in households where wives make decisions on food use. No cases of wasting were reported in households where husbands and parents–in–law make decisions on food use. Underweight was highest (23%) in households where husbands make decisions on food use. Wasting was probably in households because the survey was conducted at a time when there was a series of famines.

The findings are similar to those of the Embu study referred to earlier by Mugo (1995) among tobacco and non-tobacco farmers where nutritional status of children in households where husbands and parents made decisions was better than in households where wives made decisions. The study attributed the difference to the fact that parents were more experienced than their children. Similar findings were also reported by the Tharaka District nutritional survey by ITDG/ANP (2000). The result of this study are also the same, bearing in mind that the Kamba, Embu and Meru communities share similar cultural traditions.

Households growing coffee showed low levels of malnutrition because of a similar reason that parents-in-law were much more experienced on land and food use than their children. The study by Mugo (1995) in Embu also had similar findings.

5.4.5 NUTRITIONAL STATUS AND HOUSEHOLD SOURCES OF INCOME

Table 5.7 compares nutritional status and sources of income.

Table 5.7 Distribution of households nutritional status and sources of income.

Nutritional status		Sources of income			
		Salaried employment N = 48	Sale of livestock N = 13	Casual labour N=70	Business N = 44
Underweight N=350	Total malnutrition	35	31	56	30
	Moderate (<-2SD)	31	23	26	30
	Severe (<-3SD)	4	8	20	0
Wasting N=350	Total malnutrition	5	8	7	10
	Moderate (<-2SD)	3	8	7	0
	Severe (<-3SD)	2	0	0	10
Stunting N=350	Total malnutrition	56	84	64	58
	Moderate (<-2SD	29	69	32	31
	Severe (<- 3SD)	27	15	32	27

*Total malnutrition is moderate and severe malnutrition combined.

* Figures represent percentages of malnourished households.

Underweight was highest among households which got their income from casual labour followed by salaried employment while the highest number of stunted children was from households who got their income from sale of livestock followed by casual labour. This is possibly because the livestock were sold in the events of extreme starvation. Wasting was highest among households which got their income from business followed by casual labour. This could be because income from causal labour and business is seasonal depending on different situations and so is wasting which is periodical malnutrition. It could have also be because income earned was not put to food use by husbands.

Households which got their income from casual labour reported poor nutritional status because the income was uncertain and the rates were low as seen in chapter three implying that the households could not purchase enough food.

The findings also compare with those of a study carried out in Limuru among workers of Brooke Bond tea estates which found out that money earned from salaried employment was insufficient to purchase food thus the poor nutritional status reported (Kinyingi, 1989). It could also have been wage employment was not put to food use by husbands.

Similar still, the ANP\ITDG (2000) report in Tharaka Nithi found out that most malnourished children were those from households occupied in casual labour and sale of livestock. It is, therefore, clear that income has an impact on nutritional status because it determines how much and what kind of food is purchased (ACC/SCN, 1991).

5.4.6 NUTRITIONAL STATUS AND MORBIDITY

Malaria, diarrhoea, colds and flu were reported as the most frequent illnesses. Table 5.8 compares nutritional status and morbidity.

Table 5.8 Distribution of households by nutritional status and illnesses.

Nutritional status		Malaria N=205	Diarrhoea N=22	Colds and flu N=97	Pneumonia N=12	Worms N=10
Underweight N=350	Total malnutrition	40	37	26	25	33
	Moderate (<-SD)	28	23	21	16	33
	Severe (<-3SD)	12	14	5	9	0
Wasting N=350	Total malnutrition		5	3	0	0
	Moderate (<-SD)	6.3	5	3	0	0
	Severe (<-3SD)	0.7	0	0	0	0
Stunting N=350	Total malnutrition	56	59	45	59	100
	Moderate (<-SD)	31	32	25	9	50
	Severe (<-3SD)	25	27	20	50	50

*Figures represent percentages of malnourished households.
*Total malnutrition is moderate and severe malnutrition combined.

Still more children among non–coffee growers were reported to have been sick in the last 14 days preceding the survey than coffee growers. A higher number of sick children among coffee growing households (77%) were treated in the hospital than those without coffee (59%). Among the children who were ill 14 days preceding the survey 1.2% were moderately wasted (1.2%). About 10 and 11% of them were also moderately underweight and stunted respectively. The possible reason could be because August is rather too cold and that the area is high.

Overall morbidity did not differ among coffee growing and non-coffee growing households. This could be because the households are mixed and the fact that the area is affected by the same factors causing disease.

Food insecurity results in inadequate food intake and also contributes to disease and death (USAID/MACRO/IMPACT, 1996). This explains why nutritional status is worsened by disease.

From this, most households that were food insecure and had poor nutritional status showed high levels of disease and infection. Mwadime (1992) also found the same results in a study he carried out among rice farmers in Mwea where households which were food insecure and had low nutritional status also recorded high levels of illnesses most of which were not treated.

5.4.7 NUTRITIONAL STATUS AND MATERNAL EDUCATION

Results in table 5.9 shows levels of malnutrition (underweight, stunting and wasting) and maternal education in both types of households.

Table 5.9 Distribution of malnourished children with maternal education

Levels of malnutrition		Maternal education			
		Not attended school	Primary education	Secondary education	Post secondary
Underweight N=350	Total malnutrition	1	46	37	1
	Moderate	0	17	8	0
	Severe	1	29	29	1
Wasting N=350	Total malnutrition	0	0.4	0	1
	Moderate	0	0.4	0	1
	Severe	0	0	0	0
Stunting N=350	Total malnutrition	1	89	50	1
	Moderate	0	48	25	0
	Severe	1	41	25	1

*Figures represent percentages

*Total malnutrition is moderate and severe malnutrition combined.

Results show that most malnourished children were from households where the mothers had primary education and below followed by those of mothers who had secondary education. Minimal malnutrition was reported from households with mothers having post-secondary education. The most common form of malnutrition was stunting which was found to be among children of mothers of primary education and below. Malnutrition in households where mothers had not attended school were low because the percentages of these mothers was also low compared to other levels of education as in figure 3.2.

Similar findings were reported in the ANP/ITDG (2000) report in Tharaka Nithi and Mwadime (1992) report in Mwea among rice and non-rice farmers. It is, therefore, evident that improved maternal education has a positive effect on nutritional status.

It is clear that nutritional status improved with higher levels of maternal education. The observations made here could be due to the fact that mothers have nutritional education in terms of food choice, preparation and child-care practices in addition to better nutrition.

5.5 CONCLUSION

From the observations made in this chapter, there are generally high levels of malnutrition in the study area and also in both types of households even though the levels were higher in non-coffee growing households except for severe stunting. As discussed earlier, boys are at a higher risk of being stunted and underweight than girls. Maternal education and decisions on land and food use among others are also seen to have an influence on nutritional status.

It is suggested that household members should improve on formal education, maternal education, and generally nutritional education. Income generating projects should be initiated and supported to improve household income because poor nutritional status were reported in households which got their income from casual labour. Households not growing coffee were also encouraged to do so.

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CHAPTER SIX

TEST OF HYPOTHESIS, CONCLUSION AND RECOMMENDATIONS

The hypothesis that "there is no significant difference in food security and in prevalence of malnutrition of children aged between 6 and 59 months in coffee and non-coffee growing house-holds in Kathiani Division of Machakos District" is not valid and is thus rejected. The results of the study have shown a significant difference in food security and nutritional status with the non-coffee growing households being worse off that the coffee growing households.

Food insecurity and poor nutritional status is worsened by large household sizes, low levels of education, unreliable sources of income and other socio-demographic and socio-economic characteristics.

Despite the fact that small land holding, low productivity, low purchasing power have worsened food security and nutritional status in Iveti location of Kathiani division, coffee growing has shown to slightly improve food security and nutritional status by improving the purchasing power of households. Coffee growing should therefore be encouraged.

RECOMENDATIONS

The following recommendations were made towards improving household food security and nutritional status.

(a) Income generating activities which do not require large land area should be initiated to improve household food security and nutritional status. They should be supported by communities, government ministries or other organizations.

(b) Buyers of harvested coffee should increase the prices so as to improve household income. Households without coffee should be encouraged to grow coffee.

(c) Members of households should be encouraged to rear livestock especially cows of improved breed that will not only increase the volume of milk but also provide manure which will in turn increase crop production. This should be accompanied with nutritional education.

(d) Sale of own food produce immediately after harvest should be discouraged because at this time the prices are low.

(e) Efforts to improve nutritional status should be targeted to households members with small land holdings such as supplementary feeding to selected groups.

(f) Household members should direct income from sale of cash crop and other food crops on food rather than non-food budgets. Nutritional education can help achieve this.

(g) Control of diseases and infections such as treatment should be done because diseases and infections have shown to have negative impact on nutritional status.

(h) Further research is recommended in maternal education and nutritional education in general Research can also be done to establish the nutritional status of adults in cash crop growing area because this study considered the nutritional status of children under five years.

APPENDIX 1.0

QUESTIONNAIRE

UNIVERSITY OF NAIROBI

FACULTY OF AGRICULTURE. DEPARTMENT OF FOOD TECHNOLOGY AND NUTRITION
UNIT OF APPLIED HUMAN NUTRITION (ANP)

A STUDY ON COMPARISON OF FOOD SECURITY AND NUTRITIONAL STATUS OF COFFEE GROWERS AND NON – COFFEE GROWERS IN KATHIANI DIVISION. MACHAKOS DISTRICT

INSTRUCTIONS TO THE ENUMERATOR.

EXPLAIN TO THE RESPONDENT THAT THE INFORMATION IS FOR THE PURPOSE OF RESEARCH BY STUDENTS FROM UNIVERSITY OF NAIROBI AND THAT IT IS CONFIDENTIAL. ENSURE THAT YOU INTERVIEW ONE RESPONDENT AT A TIME. INTERVIEW HOUSEHOLDS THAT WHICH CHILDREN AGED BETWEEN 6 AND 59 MONTHS. IF A HOUSEHOLD DOES NOT HAVE SUCH A CHILD, SKIP IT AND MOVE TO THE NEXT. CIRCLE AS APPLICABLE UNLESS OTHERWISE INSTRUCTED. FILL ALL THE RESPONSES IN THE SPACES PROVIDED. WRITE CLEARLY AND LEGIBLY, USE PENCIL MARK ONLY, AND ERASERS WHEN CORRECTIONS HAVE TO BE MADE.

1. Identification

Location _____ Sub-location _____ Village _____ H.Hold No ._/_/_

Name of interviewer _____ Date of interview _____

Respondent's Name: _____ Sex: ____ Relationship to HH head:_____

Marital status of HH head ____ 1=Married 2=Single 3=Separated/divorced 4=Widowed

2. Record the following information for all household members

S/No.	Name	Sex 1=male 2=female	Age (years)	Religion – codes-	Education – codes -	Occupation - codes	Brings money to HH 1=YES 2=NO
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							

Education
1=completed primary
2=attending primary
3=attending secondary
4=completed secondary
5=post secondary
6=preschool
7=not attended school
8=not completed primary
9=not completed secondary

Religion
1=catholic
2=protestant
3=Muslim
4=others (specify)

Occupation
99=preschool
1=housewife/farming
2= Herding
3=business/self employed
4=student
5=casual labourer
6=salaried employed
7=housewife
8=farming

3. Source of income

What are your sources of income (circle as appropriate and mark * main source)
1=employed 2=livestock farming 3=Business 4=crop farming 5=casual labour 6=cash crop growing 7=mixed farming 8=others (specify)

4. About how much do you earn per day/week/month?

5. Do you own any of the following?

Item		1 = Yes	2 = No
Radio			
Bicycle			
Plough			
Wheel barrow			
House	Own		
	Rental		

6. Type of housing

Record type of main roofing
1=grass thatched 2=Makuti 3=corrugated iron sheets 4=tiles 5=others (specify)

7. Record type of floor

1=earthen 2=wooden 3=cemented 4=others (specify)

8. Ideal household – check items for ideal household

Item	Check (tick if available)
Refuse pit	
Hang line	
Dish rack	
Kitchen garden	
Bathroom	
Latrine (Pit)	
Latrine (VIP)	

9. Food security and consumption patterns

Do you own land for cultivation? 1=Yes 2=No

10.How big is the land ____acres 77=Do not know

11. Of the total land what portion do you grow food crops? ____ acres

12. Of the total land what portion do you grow coffee plants? ____ acres

13. What agricultural tools do you use when cultivating (tick where necessary)

Jembe		
Fork jembe		
Panga		
Hoe		
Others (specify)		

14. Do you use fertilizer/manure for your food crops? 1=fertilizer 2=manure 3=both 4=none

15. Let me know how much food you purchase per day

Food	Amount

16. Does your crop produce last to the next harvest season? 1=Yes 2=No

17. (If No) how do you obtain food before the next harvest?

1= Government food 2= Food for work 3=Purchase 4=NGO food/charity 5=Remittances (from relatives) 6=others (specify)_____

18. Do you do anything to prevent food from spoilage? 1=Yes 2=No

19. (If Yes) How do you do this and let me know for which foods

Method	Food

20. What methods do you use for storing your food produce? (tick all options mentioned)

Granaries	
Baskets	
Sacks/bags	
Drums/bins	
Others (specify)	

21. Who makes decisions on land use? 1=husband 2=wife 3=others (specify)

22. Who makes decisions about food use in this house? 1=husband 2=wife 3=others (specify)

23. Who decides when to use the stored food? 1=wife 2=husband 3=others (specify)

24. Record the crops grown in the last 12 months, the amount that you harvested and how it was used

Crop	Acreage	Actual Q harvested (Kgs)	Expected Q (Kgs)	Q sold (kgs)	Q given out as gifts (kgs)	Q consumed (kgs)	Cash earned from food crops	Q of food remaining in store

Let me know why you could not get the expected amount
1 _____ 2_____ 3_____

25. How far is the nearest produce market where you buy most of your foods? ___ Km

26. Please let me know what type of livestock you have and their numbers and how many you have sold or have died in the last 12 months

Livestock	Number Alive	Number Sold	Number Died

27. Do you have access to animal health services. e.g. Dip tank. vaccination ____?
1=Yes 2=No

28. Let me know the foods consumed in the last 24 hours in this household. their amounts. ingredients and the amount served to the child and leftovers

Indicate name of child _____ Serial No _____

Time	Dish	Total vol. of dish	Amnt of ingredient in family meal	Name of ingredient	Amount served to child	Amount of food left over	Amnt of consumed by the child
Break-fast							
Snacks all day							
Lunch							
Supper							

29. Morbidity

What is the most common sickness among children aged between 0 to 5 years?

1-_____

30. In your opinion. which sickness cause more deaths than any other among children of 0 to 5 years in this community?

_____

_____

31. For the past 14 days. has this child had any illness? 1=Yes 2=No

32. (If Yes) what was the illness _____

33. Where was this child treated? 1=home 2=hospital 3=traditional doctor 4= others (specify)
34. Has this child received all the immunizations? (confirm from the health card)
1=Yes 2=No 3=child is below 9 months

35. Anthropometry of all children aged 6-59 months in a household (confirm age from the card)

Household No. _____ Date of weighing _____

S/N	Child No.	Child's Name	Sex	Date of birth	Age in months	Weight 0.1 kg	Weight 0.1 kg	Height 0.1 cm	Height 0.1cm	MUAC 0.1 mm

Appendix 2.0

QUESTIONS TO BE ASKED DURING FOCUS GROUP DISCUSSION

(a) What changes have you witnessed since coffee growing started in this area in terms of: (a) Household food availability?
(b) Household income?
(c) In income controls?

(b) What are the major sources of household income in this area?

(c) In your own opinion whom do you refer as rich?

(d) What would you say are the factors affecting food production in this area?

(e) Please can you remember the last time there was famine?

(f) Was it severe? Was it given a name?

(g) What foods were consumed during the last period of food shortage?

(h) Who supported the households which were food insecure?

(i) How do people generally cope during times of food shortage?

(j) What months of the year are the busiest and what activities do you do?

(k) What are the common problems experienced by children under five years here in terms of:

- Food availability
- Morbidity?

APPENDIX 3.0

FOOD COMPOSITON TABLES (next pages)

Source:

Kirschman, J.D. Dunne, J.L. (1984) *Nutrition Almanac* McGraw-Hill Book Company; New York. pp 239-283

BAKERY AND GRAINS (*cont.*)

Flours (*cont.*) | Grains

	Measure	Pastry, all-purpose	Pastry, wholewheat	Protein	Rye	Rye, dark	Rye, light	Soy	Wheat, all-purpose	Wheat, wholewheat	Barley, pot or scotch	Bran, wheat	Bran, rice
Measure		1 C.	1 C.	1 C.	1 C.	1 C.	1 C.	1 C.	1 C.	1 C.	1 C.	1 C.	1 C.
Weight	gm	100	80	110	125	120	80	72	110	120	200	57	105
Calories		364	327	396	478	418	286	302	400	400	696	121	278
Protein	gm	9.9	26.7	9.9	7.5	20.9	7.2	29.4	11.9	16	19.2	9	12.7
Carbohydrate	gm	78.4	18.5	92.9	107	87.2	42.9	21.9	83.7	85.2	154	36.4	80.8
Fiber	gm	2	12.5	1.76	2	3.60	3	1.7	3	2.8	3.14	5.2	2.4
VITAMINS													
Vitamin A	IU	0	—	0	0	—	—	75	0	0	0	0	0
Vitamin B$_1$	mg	.03	.45	.46	.52	.78	.12	.61	.40	.86	.42	.41	1.93
Vitamin B$_2$	mg	.03	.13	.16	.14	.26	.05	.22	.29	.24	.14	.2	.19
Vitamin B$_6$	mg	.045	—	.009	0	.384	.07	.46	.089	.41	—	.468	—
Vitamin B$_{12}$	mcg	0	—	0	0	0	0	0	0	0	0	0	—
Biotin	mcg	—	—	—	—	—	—	45	11	6	—	—	—
Niacin	mg	1	16.1	3.74	7.2	3.3	.8	1.5	3.9	5.2	7.4	13	29.6
Pantothenic acid	mg	.37	—	—	—	—	.56	1.22	.51	1.32	—	1.65	—
Folic acid	mcg	0	—	—	—	—	69	31	24	65	40	147	39
Vitamin C	mg	0	0	19	0	0	0	0	0	0	0	0	0
Vitamin E	IU	—	—	—	—	—	—	—	1.87	3.12	—	—	—
MINERALS													
Calcium	mg	17	62	36.3	11	69	19	143	16	45	69	87.8	72
Copper	mg	—	—	—	—	54	2	—	21	6	—	8	—
Iron	mg	1.3	3.1	10.9	5.8	5.8	6	6	3.2	4	5.4	8.48	16.9
Magnesium	mg	26	210	—	35	142	56	177	39	136	71.4	279	—
Manganese	mg	—	—	—	—	—	—	—	—	—	—	—	—
Phosphorus	mg	73	432	196	120	696	140	402	96	445	580	727	1161
Potassium	mg	98	710	1747	—	1193	125	1195	105	444	592	639	750
Selenium	mcg	—	—	—	—	—	—	—	21.7	77.4	—	35.9	—
Sodium	mg	1	5	37.4	—	1	1	1	1	4	—	5.13	1
Zinc	mg	1.1	—	—	—	—	—	—	1	2.88	—	5.58	—
LIPIDS													
Total lipid fat	gm	1	3.9	.89	1	3.3	.5	14.2	.9	2.4	2.2	2.6	12.9
Total saturated	gm	—	.75	—	—	.42	—	2.5	—	1	.46	.42	2.44
Total unsaturated	gm	—	4	—	—	—	—	10.6	—	2	1.52	1.76	9.34
Cholesterol	mg	—	—	—	—	—	—	—	—	—	—	—	—
AMINO ACIDS													
Tryptophan	gm												
Threonine	gm												
Isoleucine	gm												
Leucine	gm												
Lysine	gm												
Methionine	gm												
Cystine	gm												
Phenylalanine	gm												
Tyrosine	gm												
Valine	gm												
Arginine	gm												
Histidine	gm												
Alanine	gm												
Aspartic acid	gm												
Glutamic acid	gm												
Glycine	gm												
Proline	gm												
Serine	gm												

(WILL BE ENTERED WHEN AVAILABLE)

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Ridge	Cornmeal, whole grain	Cornstarch	Margarine, soybean oil	Millet	Noodles, egg, enriched	Potato, whole utensil	Popcorn	Rice, brown	Rice, white	Rice, wild	Spaghetti, enriched	Tapioca
1 C.	1 C.	1 T.	1 C.	1 C.	1 C.	4 oz.	1 C.	1 C.	1 C.	1 C.	1 C.	1 C.
170	118	8	140	228	160	113	14	195	185	160	140	152
802	427	29	151	746	200	400	54	704	168	585	155	535
10	10.6	1	4.8	22.6	8.8	20	1.8	14.8	13.1	22.6	4.8	9
129	88	7	32.2	166	37.3	78	10.7	152	157	121	32.2	131
3	1.2	1	1	7.3	2	—	3	1.6	4	10	2	1
0	569	0	0	0	112	200	—	0	0	0	0	0
48	35	0	2	1.66	.22	.8	055	84	86	72	2	0
24	09	008	11	.87	.13	.85	02	08	06	1.01	11	15
38	28	1	029	—	.04	—	03	1	3	—	—	—
0	0	—	0	—	1	—	0	0	0	0	0	—
—	1	—	—	—	—	—	—	18	3.86	—	—	—
7.8	2.2	.002	1.5	5.24	1.9	6	3	9.2	6.8	9.9	1.5	0
1.12	85	—	—	—	—	—	—	2.1	1.26	1.83	—	—
7.7	18	—	—	—	—	—	—	32	20	—	—	12
0	—	0	0	0	0	10.8	0	0	0	0	0	0
—	—	—	—	4	—	—	—	3	—	—	—	—
49	20	0	11	45.6	18	20	2	94	47	30	11	15
—	.156	004	026	—	.27	—	04	4	2	—	—	14
6.3	2.1	04	1.2	15.9	1.4	9.4	4	3.2	57	61	1.5	1
—	125	18	25	388	—	—	—	179	13	144	23	7
—	—	—	—	—	—	—	—	3.2	2.1	—	—	04
575	263	2.4	70	709	94	400	39	432	183	542	70	17
388	293	32	85	980	70	—	376	426	179	352	85	14
—	—	—	—	—	—	—	—	77.2	65	—	—	—
—	1	32	1	—	3	—	1	15	10	11	1	1
—	2.1	—	7	—	—	—	1	574	3.4	0.5	—	—
2.5	4	.05	1	6.8	2.4	1	7	3.6	1.5	1.1	6	3
34	46	1	—	1.06	1	—	1	—	4	—	—	—
1.48	3	.04	—	4.1	1	—	5	—	9	—	—	—
—	—	—	—	—	30	—	—	—	—	—	—	—

(WILL BE ENTERED WHEN AVAILABLE)

BAKERY AND GRAINS (*cont.*)

Desserts and Sweets (*cont.*)

	Measure	Weight	Doughnut, raised	Eclair, custard	Granola bars	Honey	Jams	Jellies	Molasses, blackstrap	Molasses, light	Pie, apple, 9"	Pie, chocolate cream	Pie, lemon meringue	Pie, pecan	Pie, pumpkin 9"
Measure			1	1		1 T.	1 T.	1 T.	1 T.	1 T.	1/6		1/6	1/6	1/6
Weight	gm		30	100	100	21	20	18	20	20	160	100	140	160	150
Calories			124	239	454	64	54	49	43	50	410	264	357	688	317
Protein	gm		1.9	6.2	9.79	.1	.1	1	0	0	3.4	4.58	5.2	8.2	6
Carbohydrate	gm		11.3	23.2	98.7	17.8	14	12.7	11	13	61	29.4	52.8	82	36.7
Fiber	gm		1	0	96	0	1	0	—	—	5	15	1	.3	.8
VITAMINS															
Vitamin A	IU		18	340	—	0	1	1	—	—	49	284	238	258	3700
Vitamin B_1	mg		05	04	28	002	1	1	02	01	03	.1	05	.25	.04
Vitamin B_2	mg		05	16	11	014	01	01	04	01	03	.17	.11	.11	.15
Vitamin B_6	mg		—	—	—	004	005	—	054	—	—	047	—	—	—
Vitamin B_{12}	mcg		—	—	0	0	0	—	—	—	0	366	—	—	—
Biotin	mcg		—	—	—	—	—	—	1.8	—	—	—	—	—	—
Niacin	mg		4	1	—	1	1	1	.4	1	.8	.72	.3	.5	.8
Pantothenic acid	mg		—	—	544	04	1	—	1	—	.176	481	—	—	.778
Folic acid	mcg		7	—	—	1	2	—	2	—	6	9	—	—	—
Vitamin C	mg		0	1	—	1	0	1	—	—	2	1	4	1	1
Vitamin E	IU		—	—	—	—	—	—	—	—	32	—	—	—	—
MINERALS															
Calcium	mg		11	60	40	1	4	4	137	33	1	94	20	75	76
Copper	mg		—	—	—	008	052	016	284	.2	.096	119	—	—	—
Iron	mg		5	7	3.16	1	2	.3	3.2	9	.5	1.06	.7	4.5	8
Magnesium	mg		4	—	—	.6	1	.72	51.6	3.2	—	25	—	—	—
Manganese	mg		—	—	—	008	—	—	—	—	—	—	—	—	—
Phosphorus	mg		23	112	277	1	2	1	17	9	35	109	59	165	104
Potassium	mg		24	122	326	11	18	14	585	183	128	142	70	197	240
Selenium	mcg		—	—	—	—	—	—	—	5.2	—	—	—	—	—
Sodium	mg		70	62	278	1	2	3	19	3	482	273	395	354	321
Zinc	mg		—	—	—	.016	.006	—	—	—	.143	.56	—	—	—
LIPIDS															
Total lipid (fat)	gm		8	13.6	17.6	0	1	1	—	—	17.6	15.1	14.3	36.6	16.6
Total saturated	gm		1.8	4	—	—	—	—	—	—	4.74	—	4.67	5.36	5.77
Total unsaturated	gm		5.69	8	—	—	—	—	—	—	11.8	—	8.33	28	9.23
Cholesterol	mg		—	—	—	—	—	—	—	—	156	—	100	—	91
AMINO ACIDS															
Tryptophan	gm														
Threonine	gm														
Isoleucine	gm														
Leucine	gm														
Lysine	gm														
Methionine	gm														
Cystine	gm														
Phenylalanine	gm														
Tyrosine	gm														
Valine	gm														
Arginine	gm														
Histidine	gm														
Alanine	gm														
Aspartic acid	gm														
Glutamic acid	gm														
Glycine	gm														
Proline	gm														
Serine	gm														

(WILL BE ENTERED WHEN AVAILABLE)

Flours

Pie crust, unbaked	Pudding, bread, with raisins	Pudding, chocolate	Pudding, rice, with raisins	Pudding, tapioca cream	Sugar, cane	Sugar, brown, packed	Sugar, confectioners'	Sugar, white	Syrup, cane	Syrup, maple	Wheat, whole	Cereal	107 Corn	Cornstarch, unsifted
9"	1 C.	1 C.	1 C.	1 C.	1 T.	1 C.	1 C.	1 T.			1 C.	1 T.	1 C.	1 C.
135	255	390	265	165	12	220	120	14	20	20	100	8	117	140
973	498	385	367	281	48	837	462	54	57	56	333	14	431	529
9.2	14.9	8.1	9.5	8.3	0	0	0	08	0	0	11.7	4	—	56
58.1	79.3	66.8	70.8	28.2	11.9	242	119	12.7	14.8	12.8	72	5.5	98.9	98.1
3	2	2	100	0	0	0	0	—	0	0	1.4	54	—	5
0	800	390	290	480	0	0	0	1	0	0	0	—	400	0
27	16	05	08	07	0	0	0	003	0	—	58	—	23	—
18	5	38	37	3	0	07	0	016	002	—	15	—	07	—
—	—	—	—	—	—	—	—	—	—	—	378	—	—	—
—	—	—	—	—	—	—	—	—	—	—	0	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2.4	1.3	.3	5	2	0	4	2	04	1	—	2.5	—	1.8	—
—	—	—	—	—	—	—	—	—	—	—	1.5	—	—	—
—	—	—	13	3	—	—	0	—	—	—	—	—	0	0
0	3	1	1	2	0	2	0	3	1	0	—	—	0	0
1.17	—	1.79	—	—	—	—	—	—	—	—	—	—	—	—
19	289	250	260	173	0	187	0	7	9	33	33	28	7	58
—	212	—	08	066	002	77	02	039	072	09	7	—	—	—
2.3	2.9	1.3	1.1	7	1	7.5	1	8	8	2	5	33	2.1	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	2.8	—	2.08	—	—	—
97	302	255	249	180	0	42	0	0	3	3	347	9	32	196
87	570	445	469	323	1	757	4	—	—	28	958	—	—	84
—	—	—	—	—	—	—	—	—	—	—	—	—	—	3
925	533	146	186	257	1	66	1	—	—	3	1	—	7	—
715	—	—	42	—	006	—	—	—	—	—	—	—	—	—
49.2	16.2	12.2	8.2	8.4	0	3	0	07	0	0	8.5	1	3	2.7
12	7.95	7	5.3	4	—	—	—	—	—	—	47	—	38	—
30	5.3	4	2.65	3	—	—	—	—	—	—	1.76	—	2.34	—
—	170	30	29	—	—	—	—	—	—	—	—	—	—	—

(WILL BE ENTERED WHEN AVAILABLE)

DAIRY AND EGGS (cont.)

Cheese (cont.) | Cream

Measure	Abridged	Roquefort	Swiss	Edam	Neufchatel, American	Provolone, Swiss	Cheddar, American	Cheddar, Swiss	Cheese, spread, American	Half and Half	Coffee	Whipping, light	Whipping, heavy	Whipped, pressurized	Sour cream
		1 oz	1 oz	1 oz	1 oz	1 oz	1 oz	1 oz	1 oz	1 C.	1 T.	1 C.	1 C.	1 C.	1 C.
Weight	gm	28	28	28	28	28	28	28	28	242	15	239	238	60	230
Calories		105	107	96	106	95	94	82	82	315	29	699	821	154	493
Protein	gm	6.11	8.06	8.92	5.28	*	5.57	6.2	4.85	7.16	4	5.19	4.88	1.92	7.27
Carbohydrate	gm	57	95	93	45	0	2.39	1.28	2.48	10.4	55	7.07	6.64	7.49	9.82
Fiber	gm	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VITAMINS															
Vitamin A	IU	297	240	295	342	229	200	243	220	1050	108	2694	3499	548	1817
Vitamin B1	mg	.011	.000	.017	.008	.004	.009	.004	.014	.055	.005	.057	.052	.022	.041
Vitamin B2	mg	.166	.103	.102	*	.078	.126	.113	.122	.361	.022	.299	.262	.038	.343
Vitamin B6	mg	.035	.024	—	.00	.01	.04	—	.033	.094	.005	.067	.062	.025	.037
Vitamin B12	mcg	.182	.472	.595	.197	.346	.383	.652	.113	.796	.033	.466	.428	.175	.88
Biotin	mcg	*	—	—	—	—	—	—	—	—	—	.119	.071	—	—
Niacin	mg	.229	.229	.056	.02	.011	.021	.029	.037	.195	.008	*	.093	.042	.151
Pantothenic acid	mg	.441	.122	.098	.137	.074	.227	.142	.194	.691	.041	.619	.607	.183	.628
Folic acid	mcg	14	4	—	—	—	2	—	2	8	1	9	9	—	25
Vitamin C	mg	*	*	*	*	0	0	0	0	2.04	.11	1.40	1.36	0	1.09
Vitamin E	IU	*	.096	—	—	—	—	—	—	—	—	1.4	3	—	—
MINERALS															
Calcium	mg	186	272	199	174	219	141	225	154	264	14	186	154	61	269
Copper	mcg	31	036	—	017	—	—	—	—	—	032	—	—	—	—
Iron	mg	.16	.02	.06	.14	.12	.24	.17	.09	.17	.01	.07	.07	.03	.14
Magnesium	mg	4	10	4	4	8	8	8	8	25	1	17	17	6	26
Manganese	mg	.007	.035	—	.004	—	—	—	—	—	—	—	—	—	—
Phosphorus	mg	117	171	142	211	216	113	144	207	230	12	146	149	54	185
Potassium	mg	29	31	18	46	41	103	81	69	314	18	231	179	88	331
Selenium	mcg	—	2.82	—	2.52	—	—	—	—	—	075	—	—	—	—
Sodium	mg	349	74	213	436	386	274	440	381	91	1	87	69	78	123
Zinc	mg	.59	.111	.85	.85	1.02	.85	1.01	.75	.170	.01	.6	.55	.22	.62
LIPIDS															
Total lipid (fat)	gm	8.69	7.78	7.36	8.86	7.09	9.03	6.84	8.02	37.8	2.9	73.8	88	13.3	48.3
Total saturated	gm	5.46	5.04	4.78	5.58	4.55	4.35	—	3.76	17.3	1.8	46.2	54.8	8.3	30
Total unsaturated	gm	2.77	2.24	2.22	2.82	2.16	2.23	—	1.94	9.07	.95	23.8	28.7	4.35	15.7
Cholesterol	mg	28	24	28	27	24	18	23	18	89	10	265	326	46	102
AMINO ACIDS															
Tryptophan	gm	—	.114	*	.092	.102	—	—	—	.101	.006	.073	.089	.027	—
Threonine	gm	—	.294	.355	.204	.227	—	—	—	.178	.323	.018	.234	.22	.087	—
Isoleucine	gm	—	.436	.421	.29	.324	—	—	—	.336	.453	.025	.314	.395	.116	—
Leucine	gm	—	.839	.722	.552	.62	—	—	—	.505	.702	.04	.508	.478	.186	—
Lysine	gm	—	.735	.678	.623	.695	—	—	—	.427	.568	.032	.411	.387	.152	—
Methionine	gm	—	.222	.214	.182	.181	—	—	—	.152	.18	.01	.130	.122	.048	—
Cystine	gm	—	.062	—	.04	.045	—	—	—	—	.066	.004	.048	.045	.018	—
Phenylalanine	gm	—	.471	.385	.319	.356	—	—	—	.264	.346	.02	.25	.236	.093	—
Tyrosine	gm	—	.46	.413	.344	.384	—	—	—	.252	.340	.02	.25	.236	.093	—
Valine	gm	—	.606	.497	.378	.42	—	—	—	.387	.479	.027	.347	.327	.129	—
Arginine	gm	—	.253	.241	.287	.293	—	—	—	.155	.255	.015	.188	.177	.07	—
Histidine	gm	—	.302	.3	.255	.269	—	—	—	.144	.194	.011	.141	.132	.052	—
Alanine	gm	—	.354	.23	.157	.176	—	—	—	.171	.247	.014	.179	.166	.066	—
Aspartic acid	gm	—	.445	.51	.387	.431	—	—	—	.313	.542	.031	.393	.37	.146	—
Glutamic acid	gm	—	1.01	1.02	.73	1.42	—	—	—	.965	1.5	.085	1.08	1.02	.402	—
Glycine	gm	—	.144	.141	.102	.115	—	—	—	.088	.152	.009	.110	.103	.041	—

Frozen Desserts | Milk

Measure	Ice cream	Ice cream, rich	Ice milk	Sherbet	Whole	Lowfat, 2%	Skim	Buttermilk	Whole, dry	Nonfat, dry	Nonfat, instant	Canned, evaporated	Evaporated, skim	Evaporated, skim	Yogurt
	1 C.	1 C.	1 C.	1 C.	1 C.	1 C.	1 C.	1 C.	1 C.	1 C.	1 C.	1 C.	1/2 C.	1/2 C.	1 C.
Weight	133	148	131	193	244	244	245	245	120	120	68	306	126	128	250
Calories	269	349	184	270	150	121	88	99	635	435	244	982	169	88	208
Protein	4.8	4.10	5.16	2.16	8.03	8.12	8.35	8.11	33.6	43.4	23.8	24.2	8.58	9.82	7.92
Carbohydrate	31.7	31.9	28.9	58.7	11.37	11.7	11.8	11.7	49	62.3	35.8	186	12.8	14.4	25.6
Fiber	0	0	0	*	0	0	0	0	0	0	0	0	0	0	15
VITAMINS															
Vitamin A	543	687	214	185	307	500	500	81	1180	47	18.2	1004	306	500	302
Vitamin B1	.052	.044	.076	.033	.093	.095	.098	.083	.362	.496	.281	.275	.059	.057	.092
Vitamin B2	.329	.283	.347	.089	.395	.403	.343	.377	1.54	1.86	1.18	1.27	.398	.384	.405
Vitamin B6	.061	.053	.065	.025	.102	.105	.096	.083	.367	.433	.235	.236	.083	.07	.1
Vitamin B12	.625	.537	.875	.158	.871	.888	.926	.537	4.16	4.84	2.71	1.36	.205	.305	.835
Biotin	—	—	—	—	5	—	5	5	17	19	—	9	3.5	—	—
Niacin	.134	.115	.118	.131	.205	.21	.218	.142	.827	1.14	.606	.643	.244	.222	.313
Pantothenic acid	.854	.562	.662	.062	.788	.781	.806	.674	2.9	4.28	2.2	2.29	.804	.841	.738
Folic acid	3	2	3	14	12	12	13	—	47	60	34	34	10	11	10
Vitamin C	7	.61	.78	3.86	2.29	2.32	2.4	2.4	11	8.11	3.79	1.86	2.37	1.58	2.29
Vitamin E	.398	—	—	—	.293	—	1	.118	—	—	—	—	.37	—	—
MINERALS															
Calcium	178	151	176	103	291	297	302	285	1168	1500	837	966	329	309	290
Copper	2	—	—	—	5	—	1	047	4	—	—	86	037	—	—
Iron	.12	.1	.18	.31	.12	.12	.1	.12	.8	.11	.07	.58	.074	.07	.9
Magnesium	18	16	19	15	33	33	29	27	108	132	81	78	30	34	33
Manganese	—	—	—	—	.005	—	—	—	—	—	—	—	—	—	—
Phosphorus	134	115	129	74	226	232	247	219	882	1162	670	775	255	248	251
Potassium	257	221	265	166	370	377	406	371	1702	2153	1180	1136	382	422	417
Selenium	—	—	—	—	3.17	—	—	—	—	—	—	—	1.6	—	—
Sodium	116	108	105	88	120	122	126	257	475	642	372	389	130	147	149
Zinc	1.61	1.21	.91	1.33	.93	.95	.99	1.02	4.28	4.9	3	2.89	.97	1.15	1.02
LIPIDS															
Total lipid (fat)	14.3	23.6	5.63	3.85	8.15	4.88	.44	2.16	34.2	.92	.49	20.6	9.53	20	8.48
Total saturated	8.82	14.7	3.51	2.38	5.07	2.82	.287	1.34	21.4	.6	.32	18.6	5.78	155	5.26
Total unsaturated	4.67	8.75	1.84	1.24	2.63	1.52	.132	.7	11	.28	.15	6.46	3.26	.087	2.74
Cholesterol	59	86	18	14	33	18	4	9	124	24	12	104	37	5	31
AMINO ACIDS															
Tryptophan	.068	.056	.073	.03	.113	.115	.118	.084	.475	.612	.357	.341	.121	.136	.112
Threonine	.217	.186	.233	.099	.362	.367	.377	.286	1.52	1.96	1.07	1.09	.387	.435	.358
Isoleucine	.29	.25	.312	.131	.486	.492	.505	.5	2.03	2.62	1.44	1.46	.519	.582	.479
Leucine	.47	.405	.506	.212	.788	.796	.818	.807	3.3	4.25	2.33	2.37	.841	.943	.776
Lysine	.381	.327	.409	.171	.637	.644	.663	.579	2.67	3.44	1.86	1.92	.681	.763	.629
Methionine	.12	.104	.128	.054	.201	.204	.21	.198	.845	1.08	.519	.607	.215	.241	.199
Cystine	.044	.038	.048	.02	.074	.075	.077	.076	.312	.401	.221	.224	.079	.089	.073
Phenylalanine	.232	.189	.249	.104	.388	.392	.403	.427	1.62	2.1	1.15	1.16	.414	.465	.383
Tyrosine	.232	.189	.249	.104	.388	.392	.403	.329	1.62	2.1	1.15	1.16	.414	.465	.387
Valine	.321	.278	.345	.145	.537	.544	.558	.396	2.25	2.9	1.59	1.62	.574	.644	.52
Arginine	.174	.15	.187	.078	.291	.294	.302	.309	1.22	1.57	.894	.878	.311	.348	.297
Histidine	.130	.112	.14	.059	.218	.22	.227	.233	.914	1.17	.667	.656	.233	.261	.215
Alanine	.166	.142	.172	.075	.277	.28	.288	.282	1.16	1.49	.853	.835	.296	.332	.273
Aspartic acid	.364	.313	.392	.164	.630	.638	.654	.642	2.64	3.39	1.91	1.93	.651	.73	.601
Glutamic acid	1	.865	1.09	.453	1.54	1.7	1.74	1.57	7.85	9.08	4.99	5.07	1.79	2.01	1.68
Glycine	.102	.087	.109	.046	.17	.172	.177	.178	.713	.918	.505	.512	.182	.204	.169

DAIRY AND EGGS (*cont.*)

	Measure	Milk (*cont.*)					Yogurt				Eggs			
		Fgnog	Malted, powder	Goat	Human	Whey, dry, sweet	Plain	Plain, lowfat	Plain, skim	Fruit, lowfat	Whole	White	Yolk	Whole, dried
Measure		1 C.	1 T.	1 C.	1 C.	1 T.	1 C.	1 C.	1 C.	1 C.	1 lge	1 lge	1 lge	1 T.
Weight	gm	254	21	244	246	7.5	227	227	227	227	50	33	17	5
Calories		342	86	168	171	26	139	144	127	225	79	16	63	30
Protein	gm	9.68	2.74	8.69	2.53	.96	7.88	11.9	13	9.04	6.07	3.35	2.79	2.29
Carbohydrate	gm	34.4	15.2	10.9	17	5.56	10.5	16	17.4	42.3	.6	.41	.04	.24
Fiber	gm	0	13	0	0	0	0	0	0	.27	0	0	0	0
VITAMINS														
Vitamin A	IU	894	68	451	593	3	279	150	16	111	290	0	313	98
Vitamin B_1	mg	.086	111	.117	.034	.039	.066	.1	.109	.077	.044	.002	.043	.015
Vitamin B_2	mg	.483	.142	.337	.089	.165	.322	.486	.531	.366	.15	.094	.074	.059
Vitamin B_6	mg	127	078	.112	.027	.044	.073	.111	.120	.084	.06	.001	.053	.02
Vitamin B_{12}	mcg	1.14	.164	.159	.111	.177	.844	1.27	1.39	.967	.773	.021	.547	.5
Biotin	mcg	—	—	5	1	—	—	—	—	—	11	2	9	—
Niacin	mg	267	1.07	.676	435	.094	.17	.259	.281	.195	.031	.029	.012	.012
Pantothenic acid	mg	1.06	—	.756	.549	.419	.883	1.34	1.45	1.01	.864	.08	.753	.319
Folic acid	mcg	2	10	1	13	1	17	25	28	19	32	5	26	9
Vitamin C	mg	3.81	0	3.15	12.3	.11	1.2	1.82	1.96	1.36	0	0	0	0
Vitamin E	IU	—	—	—	55	—	—	—	—	—	.57	—	.51	—
MINERALS														
Calcium	mg	330	36	326	79	59	274	415	452	314	28	4	26	11
Copper	mg	018	—	095	.12	.07	—	—	—	—	.1	.025	.045	.009
Iron	mg	51	16	.12	07	07	.11	18	.2	.14	1.04	.01	.95	.39
Magnesium	mg	47	20	34	8	13	26	40	43	30	5	3	3	2
Manganese	mg	—	—	.019	1	—	—	—	—	—	.029	.013	.015	—
Phosphorus	mg	276	79	270	34	70	215	326	355	247	90	4	86	34
Potassium	mg	420	159	499	126	155	351	531	579	402	65	45	15	24
Selenium	mcg	—	—	—	—	—	—	—	—	—	3.2	1.88	2.96	—
Sodium	mg	138	96	122	42	80	105	159	174	121	69	50	8	26
Zinc	mg	1.17	.21	.73	.42	.15	1.34	2.02	2.2	1.52	.72	.01	.58	.27
LIPIDS														
Total lipd (fat)	gm	19	1.78	10	10.7	.08	7.36	3.52	.41	2.61	5.58	1	5.6	2.09
Total saturated	gm	11.3	.89	6.51	4.94	.05	4.76	2.27	.264	1.68	1.67	0	1.68	.63
Total unsaturated	gm	6.53	.8	3.07	5.3	.02	2.24	1.07	.124	.79	2.95	0	2.97	1.11
Cholesterol	mg	149	4	28	34	1	29	14	4	10	274	0	272	96
AMINO ACIDS														
Tryptophan	gm	137	.029	.106	.041	.015	.044	.067	.073	.051	.097	.051	.041	.037
Threonine	gm	444	.07	.398	.112	.061	.323	.489	.534	.371	.298	.149	.151	.113
Isoleucine	gm	583	.082	.505	.137	.054	.43	.65	.709	.493	.380	.204	.16	.143
Leucine	gm	937	.157	.765	.233	.088	.794	1.2	1.31	.911	.533	.291	.237	.201
Lysine	gm	758	.075	.708	188	.077	.706	1.06	1.16	.81	.41	.208	.189	.155
Methionine	gm	.222	.038	196	.052	.018	.232	.351	.383	.266	.196	.13	.071	.074
Cystine	gm	097	055	.113	.047	.019	—	—	—	—	.145	.083	.05	.055
Phenylalanine	gm	.463	.092	.377	.113	.03	.43	.65	.709	.493	.343	.21	.121	.129
Tyrosine	gm	462	076	437	.129	.027	.398	.601	.656	456	.253	.134	.12	.095
Valine	gm	643	.094	.585	.156	.052	.652	.986	1.07	.748	.437	.251	.17	.165
Arginine	gm	378	—	.291	.105	.028	.237	.359	.391	.272	.388	.195	.193	.147
Histidine	gm	24	055	.218	.057	.018	.195	.295	.322	.224	.147	.078	.067	.055
Alanine	gm	346	—	.287	089	.045	.337	.51	.557	.387	.354	.216	.14	.134
Aspartic acid	gm	74	—	.512	.201	.095	.625	.945	1.03	.717	.602	.296	.233	.227
Glutamic acid	gm	1.95	—	1.52	.414	.168	1.54	2.33	2.54	1.77	.773	.467	.341	.292
Glycine	gm	213	—	123	.064	.021	19	.288	.314	218	.202	.125	.084	.076
Proline	gm	89	—	.899	203	.059	.933	1.41	1.54	1.07	.241	.126	.116	.091
Serine	gm	55	—	441	.107	.046	.488	.738	.805	559	.461	.247	.231	.174

FATS AND OILS

	Fats					Oils							
	Beef tallow	Butter	Chicken	Margarine	Vegetable shortening	Corn	Olive	Peanut	Safflower	Soybean	Soybean	Sunflower	Wheat germ
Measure	1 T.	1 T.	1 T.	1 T.	1 T.	1 T.	1 T.	1 T.	1 T.	1 T.	1 T.	1 T.	1 T.
Weight	12.8	14.1	12.8	14.1	12.8	13.6	13.5	13.5	13.6	13.6	13.6	13.6	13.6
Calories	115	101	115	101	115	120	119	119	120	120	120	120	120
Protein	0	.12	0	0	0	0	0	0	0	0	0	0	0
Carbohydrate	0	.008	0	0	0	0	0	0	0	0	0	0	0
Fiber	0	0	0	0	0	0	0	0	0	0	0	0	0
VITAMINS													
Vitamin A	—	433	—	465	—	—	—	—	—	—	—	—	—
Vitamin B_1	—	1	—	0	—	—	—	—	—	—	—	—	—
Vitamin B_2	—	.004	—	.006	—	—	—	—	—	—	—	—	—
Vitamin B_6	—	1	—	0	—	—	—	—	—	—	—	—	—
Vitamin B_{12}	—	—	—	.012	—	—	—	—	—	—	—	—	—
Biotin	—	—	—	—	—	—	—	—	—	—	—	—	—
Niacin	—	.006	—	.003	—	—	—	—	—	—	—	—	—
Pantothenic acid	—	—	—	.012	—	—	—	—	—	—	—	—	—
Folic acid	—	.375	—	.24	—	—	—	—	—	—	—	—	—
Vitamin C	—	0	—	.024	—	—	—	—	—	—	—	—	—
Vitamin E	3	.223	.3	1.25	—	11.3	1.7	3.4	5.2	4	12.7	1.3	34.6
MINERALS													
Calcium	—	3.37	—	4.23	—	—	.02	.01	—	—	.01	.03	—
Copper	—	.004	—	.006	—	—	.01	.001	—	—	.058	—	—
Iron	—	.022	—	—	—	—	.05	0	—	—	0	0	—
Magnesium	—	.25	—	.36	—	—	0	.01	—	—	0	.03	—
Manganese	—	.006	—	—	—	—	—	—	—	—	—	—	—
Phosphorus	—	3.26	—	3.24	—	—	.16	—	—	—	.03	—	—
Potassium	0	3.62	—	5.97	—	—	—	0	—	—	—	—	—
Selenium	—	—	—	—	—	—	0	—	—	—	—	—	—
Sodium	0	117	—	103	—	—	.01	0	—	—	0	.01	—
Zinc	—	.007	—	—	—	—	.01	0	—	—	0	—	.52
LIPIDS													
Total lipd (fat)	12.8	11.5	12.8	11.4	12.8	13.6	13.5	13.5	13.6	13.6	13.6	13.6	13.6
Total saturated	6.4	7.15	3.6	1.9	5.2	1.7	1.8	2.3	1.2	1.9	2	1.4	2.6
Total unsaturated	5.8	3.74	8.4	9	7.1	11.3	11	10.5	11.7	11	11	11.7	10.5
Cholesterol	14	31	11	01	—	—	—	—	—	—	—	—	—
AMINO ACIDS													
Tryptophan	—	002	—	003	—	—	—	—	—	—	—	—	—
Threonine	—	005	—	006	—	—	—	—	—	—	—	—	—
Isoleucine	—	007	—	008	—	—	—	—	—	—	—	—	—
Leucine	—	011	—	012	—	—	—	—	—	—	—	—	—
Lysine	—	009	—	008	—	—	—	—	—	—	—	—	—
Methionine	—	003	—	003	—	—	—	—	—	—	—	—	—
Cystine	—	001	—	0	—	—	—	—	—	—	—	—	—
Phenylalanine	—	005	—	006	—	—	—	—	—	—	—	—	—
Tyrosine	—	005	—	006	—	—	—	—	—	—	—	—	—
Valine	—	006	—	009	—	—	—	—	—	—	—	—	—
Arginine	—	004	—	003	—	—	—	—	—	—	—	—	—
Histidine	—	003	—	003	—	—	—	—	—	—	—	—	—
Alanine	—	004	—	003	—	—	—	—	—	—	—	—	—
Aspartic acid	—	009	—	008	—	—	—	—	—	—	—	—	—
Glutamic acid	—	025	—	024	—	—	—	—	—	—	—	—	—
Glycine	—	002	—	003	—	—	—	—	—	—	—	—	—
Proline	—	011	—	013	—	—	—	—	—	—	—	—	—
Serine	—	008	—	008	—	—	—	—	—	—	—	—	—

FRUITS AND FRUIT JUICES

	Measure	Apple	Apple, dried	Apple juice	Applesauce, unsw.	Apricot	Apricot, dried	Apricot nectar	Avocado	Banana	Blackberries	Blueberries	Boysenberries	Cherries
Measure		1	10 rings	1 C.	1 C.	3	10 halves	1 C.	1	1	1 C.	1 C.	1 C.	1 C.
Weight	gm	150[1]	64	248	244	114[1]	35	251	272[1]	173[1]	144	145	132	145
Calories		81	155	116	108	51	83	141	324	105	74	82	86	104
Protein	gm	.27	.59	.15	.4	1.48	1.36	.92	3.89	1.18	1.04	.97	1.48	1.74
Carbohydrate	gm	21	42	29	27.5	11.7	21.6	36	14.8	26.7	16.3	20.5	16	24
Fiber	gm	1.05	1.84	52	1.3	64	1.03	48	4.24	57	5.8	1.88	3.96	56
VITAMINS														
Vitamin A	IU	74	0	2	70	2768	253#	3304	1230	92	237	148	88	310
Vitamin B_1	mg	.023	0	.052	.032	.032	.003	.023	.217	.051	.043	.07	.07	.073
Vitamin B_2	mg	.018	.102	.042	.061	.042	.053	.035	.245	.114	.056	.073	.049	.087
Vitamin B_6	mg	.066	.08	.074	.063	.057	.055	—	.563	.859	.084	.052	.074	.062
Vitamin B_{12}	mcg	0	0	0	0	0	0	0	0	0	0	0	0	0
Biotin	mcg	1.8	—	1.2	—	—	—	—	—	6	6	—	—	52
Niacin	mg	1.08	593	248	458	636	1.05	853	3.66	616	.576	.521	1.01	.56
Pantothenic acid	mg	.264	—	—	232	.254	.264	—	1.95	.296	.346	.135	.330	.164
Folic acid	mcg	3.9	—	2	1.4	9.1	3.6	3.3	124	21.6	—	8.3	83.6	6.1
Vitamin C	mg	7.8	2.5	2.3	2.9	10.6	.8	1.4	15.8	10.3	30.2	18.9	4.1	10.2
Vitamin E	IU	1	—	—	—	—	—	—	—	6	—	—	—	—
MINERALS														
Calcium	mg	10	9	16	7	15	16	17	22	7	46	9	36	21
Copper	mg	.057	.122	.055	.063	.094	.15	.163	.527	.119	.202	.086	.106	.136
Iron	mg	.25	.9	.32	.29	.58	1.65	.96	2.05	.35	.63	.24	1.12	.56
Magnesium	mg	8	10	8	7	8	16	13	.78	33	.29	7	21	16
Manganese	mg	.062	.056	.28	.183	.084	.096	—	.454	.173	1.86	.408	.722	.133
Phosphorus	mg	10	55	18	16	21	41	23	63	22	30	18	36	28
Potassium	mg	159	288	296	183	313	482	286	1204	451	282	129	183	325
Selenium	mcg	1	—	—	488	—	—	—	—	1.5	—	—	—	—
Sodium	mg	1	56	7	5	1	3	8	21	1	0	9	2	1
Zinc	mg	.05	.13	.07	.08	.28	.26	.23	.64	.18	.39	.16	.29	.09
LIPIDS														
Total lipid (fat)	gm	.49	.2	.28	.12	.41	.16	.22	30.8	.55	.56	.35	.35	1.38
Total saturated	gm	.08	.033	.047	.02	.029	.011	.015	4.9	.21	—	—	—	.313
Total unsaturated	gm	.196	.068	.094	.039	.262	.102	.136	23.2	.149	—	—	—	.577
Cholesterol	mg	0	0	0	0	0	0	0	0	0	0	0	0	0
AMINO ACIDS														
Tryptophan	gm	.003	.008	—	.005	.016	.023	—	.042	.014	—	.004	—	—
Threonine	gm	.01	.021	—	.015	.05	.046	—	.133	.038	—	.029	—	—
Isoleucine	gm	.011	.024	—	.015	.043	.039	—	.143	.038	—	.03	—	—
Leucine	gm	.017	.036	—	.024	.062	.075	—	.247	.081	—	.058	—	—
Lysine	gm	.017	.037	—	.024	.103	.089	—	.189	.055	—	.017	—	—
Methionine	gm	.003	.008	—	.005	.006	.006	—	.074	.013	—	.016	—	—
Cystine	gm	.004	.008	—	.005	.003	.004	—	.042	.019	—	.01	—	—
Phenylalanine	gm	.007	.017	—	.012	.035	.053	—	.137	.043	—	.035	—	—
Tyrosine	gm	.006	.011	—	.007	.031	.03	—	.086	.027	—	.012	—	—
Valine	gm	.012	.026	—	.02	.05	.047	—	.185	.054	—	.041	—	—
Arginine	gm	.008	.019	—	.012	.048	.049	—	.119	.054	—	.049	—	—
Histidine	gm	.004	.01	—	.007	.029	.021	—	.058	.092	—	.015	—	—
Alanine	gm	.01	.021	—	.015	.072	.061	—	.239	.044	—	.041	—	—
Aspartic acid	gm	.047	.104	—	.068	.333	.293	—	.569	.129	—	.075	—	—
Glutamic acid	gm	.028	.062	—	.041	.166	.129	—	.416	.127	—	.12	—	—
Glycine	gm	.011	.024	—	.015	.042	.04	—	.167	.042	—	.041	—	—
Proline	gm	.01	.02	—	.015	.107	.078	—	.155	.046	—	.036	—	—
Serine	gm	.011	.024	—	.017	.068	.074	—	.183	.054	—	.029	—	—

[1] with refuse

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Crabapple (allow)	Cranberries	Currants, black	Dates	Elderberries	Figs	Figs, dried	Gooseberries	Grapefruit	Grapefruit juice	Grapes, dip skin	Grapes, different skin	Grape juice	Guava	Kiwi fruit
1 C.	1 C.	1 C.	10	1 C.	1	10	1 C.	1/2	1 C.	1 C.	1 C.	1 C.	1	1
110	95	112	83	145	80[1]	160[1]	150	241[1]	247	153[1]	160	253	112[1]	88[1]
83	46	71	228	105	47	477	67	39	98	58	114	166	46	46
.44	.37	1.07	1.83	.95	.48	8.7	1.32	.75	1.24	.58	1.08	1.41	.74	.75
21.9	12	17.2	61	26.8	12.2	102	15.2	9.7	22.7	15.7	28.4	37.8	16.7	11.3
.66	1.14	2.66	1.83	10	.77	8.07	2.85	.24	—	.7	.72	—	5.04	84
44 .033 .022 — 0	44 .029 .018 .062 0	258 .056 .056 .074 0	42 .075 .063 .189 0	870 .102 .087 .334 0	91 .038 .032 .072 0	248 .123 .166 .419 0	436 .08 .046 .12 0	148 .043 .024 .05 0	— .099 .048 — 0	92 .085[1] .052 .1 0	117 .147 .081 .178 0	20 .066 .094 .184 0	713 .045 .045 .129 0	133 .015 .039 — 0
— .11 — — 0.8 —	— .095 .208 1.6 12.8 —	2.5 .336 .448 — 202 —	— 1.88 .647 10.4 0 —	3 .725 .203 — 52.2 —	— 256 .182 — 1.3 —	— 1.3 .813 14.1 1.6 —	7 45 .489 — 41.6 —	3 .3 .34 12.2 41.3 28	1.7 484 — — 93.8 1	3 276 .022 3.6 3.7 —	3.2 48 .038 6.3 17.3 —	9 .663 .104 8.5 .2 —	— 1.08 .135 — 165 —	— 38 — — 74.5 —
20 .074 .39 7 .127	7 .055 .18 5 .148	61 .096 1.72 27 .287	27 .239 88 29 .247	55 — 2.12 — —	22 .045 .23 11 .882	269 .886 4.18 111 .726	38 .105 .47 16 .218	14 .056 .1 10 .014	22 .082 .48 30 .048	13 .037 .27 5 .061	17 .144 41 10 .083	22 .071 8 24 .811	18 .083 .26 9 .13	20 — .31 23 —
17 213 — 1 —	6 67 — 1 .12	66 .361 — 2 .3	33 .541 — 2 .24	87 .408 — — —	9 .146 — 1 .08	128 1.332 — 20 .94	40 .297 — 1 .18	10 .107 — 0 .09	37 .400 — 2 .13	9 .178 — 2 .04	21 .296 — 3 .08	27 .334 10 7 .13	23 .256 — 2 .21	31 .252 — 4 —
33 .053 .11 0	.18 — — 0	45 .036 — .285 0	.27 — — 0	.73 — — 0	.19 .036 .134 0	2.18 .436 1.52 0	.87 .057 .553 0	.12 .017 .048 0	.25 .035 .08 0	.32 105 .107 0	.82 .302 .307 0	.19 .083 .094 0	.54 .195 .278 0	.34 — — 0
.004 .015 .018 .028 .028	— — — — —	— — — — —	.042 .043 .036 .073 .06	.019 .038 .036 .087 .036	.001 .015 .015 .021 .019	.049 .187 .174 .249 .236	— — — — —	.002 — — — .019	— — — — —	.003 .016 .006 .012 .013	.005 .029 .006 .022 .024	— .04 .018 .03 .025	.006 .028 .027 .05 .021	— — — — —
.004 .006 .012 .009 .021	— — — — —	— — — — —	.018 .037 .046 .025 .056	.02 .022 .056 .074 .046	.004 .006 .012 .02 .016	.047 .094 .138 .247 .215	— — — — —	.002 — — — —	— — — — —	.019 .016 .012 .01 .016	.035 .016 .022 .019 .029	.003 — .03 .006 .025	.005 — .002 .009 .025	— — — — —
.014 .007 .015 .077	— — — —	— — — —	.055 .025 .063 .105	.088 .022 .044 .084	.011 .007 .029 .113	.131 .08 .344 1.34	— — — —	— — — —	— — — —	.042 .021 .024 .071	.078 .038 .045 .13	.119 .018 .218 .056	.019 .008 .037 .047	— — — —
.048 .018 .015 .018	— — — —	— — — —	.177 .079 .088 .095	.139 .062 .036 .046	.048 .016 .031 .024	.552 .193 .378 .262	— — — —	— — — —	— — — —	.121 .017 .019 .028	.221 .032 .035 .051	.278 .03 .04 .033	.098 .037 .023 .022	— — — —

[1] with refuse

MEATS (*cont.*)

Luncheon and Sausage (*cont.*)

	Measure	Kielbasa	Knockwurst	Liver cheese	Liverwurst	Mortadella	Pepperoni	Polish sausage	Pork and beef sausage	Pork sausage	Salami, hard	Summer sausage	Vienna sausage
Measure		1 oz	1 link	1 oz	1 oz	1 oz	1 slice	1 oz	1 link	1 link	1 slice	1 slice	1
Weight	gm	28	68	28	28	28	5.5[1]	28	13	28	10[2]	23[1]	16
Calories		88	209	86	93	88	27	92	52	118	42	80	45
Protein	gm	3.76	8.08	4.3	4.01	4.84	1.15	4	1.79	3.31	2.29	3.89	1.65
Carbohydrate	gm	.61	1.2	.59	.63	.87	.16	.46	.35	.29	.26	.53	.33
Fiber	gm	0	0	—	—	—	0	0	0	0	0	0	0
VITAMINS													
Vitamin A	IU	—	—	4956	—	—	—	—	—	—	—	—	—
Vitamin B_1	mg	.065	.233	.06	.077	.034	.016	.142	.096	.155	.06	.039	.014
Vitamin B_2	mg	.061	.095	.631	.292	.043	.014	.042	.019	.046	.029	.069	.017
Vitamin B_6	mg	.05	.11	.13	—	.035	.01	.05	.01	.07	.05	.07	.02
Vitamin B_{12}	mcg	.46	8	6.96	24.2	.42	.14	.28	.06	.32	.19	1.06	.16
Biotin	mcg	—	—	—	—	—	—	—	—	—	—	—	—
Niacin	mg	.816	1.86	3.33	—	.758	.273	.976	.438	.804	.487	.94	.258
Pantothenic acid	mg	.23	.22	1	.84	—	.1	.13	.06	.11	.11	.13	—
Folic acid	mcg	—	—	—	8	—	—	—	—	1	—	—	—
Vitamin C	mg	1	1	1	—	1	—	0	—	0	1	1	0
Vitamin E	IU	—	—	—	—	—	—	—	—	—	—	—	—
MINERALS													
Calcium	mg	12	7	2	7	5	1	3	—	5	1	2	2
Copper	mg	.03	.04	11	—	.02	0	.03	0	.02	.01	.02	0
Iron	mg	.41	.62	3.07	1.81	.4	.08	.41	.15	.26	.15	.47	.14
Magnesium	mg	5	8	3	—	3	1	4	1	3	2	3	1
Manganese	mg	.011	—	.057	—	.008	—	.014	—	—	.004	.007	.005
Phosphorus	mg	42	67	59	65	27	7	39	14	34	14	23	8
Potassium	mg	77	136	64	—	46	19	67	—	58	38	53	16
Selenium	mcg	—	—	—	—	—	—	—	—	—	—	—	—
Sodium	mg	305	667	347	—	353	112	248	105	228	186	334	152
Zinc	mg	.57	1.13	1.05	—	.5	.14	.55	.24	.45	.32	.47	.26
LIPIDS													
Total lipid (fat)	gm	7.7	18.8	7.25	8.09	7.2	2.42	8.14	4.71	11.4	3.44	6.86	4.03
Total saturated	gm	2.81	6.94	2.54	3	2.7	.89	2.93	1.68	4.1	1.22	2.77	1.48
Total unsaturated	gm	4.54	10.7	4.45	4.52	4.12	1.4	4.7	2.74	6.73	2.03	3.63	2.28
Cholesterol	mg	19	39	49	45	16	—	20	—	19	8	16	8
AMINO ACIDS													
Tryptophan	gm	.039	.073	.056	.043	.043	.011	.039	.017	.027	.021	.035	.017
Threonine	gm	.122	.326	.185	.192	.179	.047	.168	.072	.131	.096	.158	.057
Isoleucine	gm	.181	.317	.179	.167	.201	.05	.173	.069	.121	.097	.177	.089
Leucine	gm	.248	.558	.377	.326	.344	.087	.305	.127	.222	.173	.241	.128
Lysine	gm	.286	.634	.334	.331	.358	.09	.315	.141	.252	.182	.318	.127
Methionine	gm	.078	.195	.097	.081	.112	.029	.107	.043	.061	.059	.081	.042
Cystine	gm	.064	.1	.093	.043	.058	.014	.045	.018	.033	.026	.045	.028
Phenylalanine	gm	.142	.277	.203	.177	.17	.043	.153	.062	.111	.087	.133	.068
Tyrosine	gm	.139	.245	.132	.104	.15	.037	.126	.053	.096	.071	.125	.055
Valine	gm	.181	.35	.229	.246	.208	.054	.192	.077	.133	.108	.185	.092
Arginine	gm	.267	.482	.237	.232	.291	.074	.262	.111	.196	.152	.228	.113
Histidine	gm	.089	.245	.111	.128	.147	.037	.126	.054	.096	.07	.108	.044
Alanine	gm	.240	.459	.264	.237	.326	.077	.256	.106	.185	.148	.233	.104
Aspartic acid	gm	.345	.687	.383	.333	.448	.108	.367	.154	.276	.207	.331	.161
Glutamic acid	gm	.459	1.1	.52	.628	.742	.178	.6	.259	.458	.338	.507	.209
Glycine	gm	.295	.478	.265	.314	.374	.087	.281	.117	.201	.164	.254	.162
Proline	gm	.195	.367	.203	.244	.312	.067	.202	.085	.154	.119	.198	.097
Serine	gm	.15	.324	.196	.199	.188	.047	.166	.069	.128	.094	.156	.069

[1] 1/8" thick [2] 1/16" thick

NUTS AND SEEDS

	Almonds	Brazil nuts	Cashews	Chestnuts, fresh	Coconut, shredded	Coconut, liquid	Hazelnuts	Hickory nuts	Macadamia nuts	Pecans	Peanut butter	Pecans	Pine nuts	Pistachios, shelled	Pumpkin seeds & squash	Sesame seeds	Sunflower seeds	Tahini	Walnuts
Measure		1 C.	1 C.	1 C.	1 C.	1 C.	1 C.	1 C.	10-nuts	1 C.	1 C.	1 T.	1 C.	1 oz	1 C.	1 C.	1 C.	1 T.	1 C.
Weight	gm	142	140	140	160	80	240	136	10	134	144	15	109	28	129	140	140	15	100
Calories		848	816	765	319	277	53	866	101	940	836	96	742	169	706	774	873	812	98	851
Protein	gm	28.4	20	24.1	4.6	2.8	.7	17	2.1	11	37.7	3.9	8.9	3.7	26	40.6	27.3	34.8	2.55	14.8
Carbohydrate	gm	27.7	15.3	41	67.4	7.5	11.3	22.5	2	18.4	28.7	3.2	15.8	5.8	31.7	21	26.4	28.9	3.19	16.8
Fiber	gm	3.84	4.8	1.96	1.68	2.7	1	1.05	3	7.08	2.88	.33	2.3	.31	2.4	2.88	3.8	5.5	.78	2.1
VITAMINS																				
Vitamin A	IU	0	1	140	0	0	0	144	—	0	1	0	160	19	899	100	91	70	—	30
Vitamin B_1	mg	.24	1.34	.6	.35	.04	1	.62	.08	.489	.46	.015	.93	.36	1.06	.34	.27	2.64	.183	.33
Vitamin B_2	mg	1.31	.17	.38	.35	.02	1	.738	—	.147	.19	.02	.14	.07	.223	.442	.2	.33	.071	.13
Vitamin B_6	mg	.142	.236	.325	.587	.003	.046	.736	—	—	.576	.06	.169	—	—	—	.126	1.8	—	.73
Vitamin B_{12}	mcg	0	0	0	0	0	0	0	—	0	0	0	0	0	0	0	0	0	0	0
Biotin	mcg	25	—	—	2.1	—	—	—	—	—	46	5.8	—	—	—	—	—	—	—	37
Niacin	mg	5	2.2	2.5	1	.4	.2	1.2	—	2.87	24.6	2.4	1	1.3	1.38	3.4	8.1	7.8	.818	9
Pantothenic acid	mg	.666	.323	1.82	.736	.16	.12	1.54	—	—	3	.147	1.7	—	—	—	1.02	2	—	8
Folic acid	mcg	136	008	005	—	031	—	087	—	—	183	013	020	—	74	144	—	—	—	0 96
Vitamin C	mg	1	14	0	9.6	2	5	1	0	—	0	0	2	1	—	—	0	—	0	2
Vitamin E	IU	21.3	8.1	—	0	0	—	28	—	—	8.36	—	1.5	—	—	—	—	—	—	1.5
MINERALS																				
Calcium	mg	332	260	53	43	16	48	282	9	94	104	11	79	3	173	71	185	174	64	89
Copper	mg	1.18	2.14	2.82	67	.368	—	1.72	.214	.987	62	.085	1.14	.29	1.52	1.9	2.38	2.57	242	1.39
Iron	mg	6.7	4.8	5.3	2.7	1.4	.7	4.8	4	3.23	3.3	.3	2.6	1.5	8.67	18.7	3.8	10.3	1.34	3.1
Magnesium	mg	366	351	374	65.8	37	67	313	24	156	252	26	142	—	203	738	270	57	14	131
Manganese	mg	2.7	3.8	—	5.9	1.05	—	5.07	—	—	2.17	.257	1.54	—	419	—	—	2.9	—	1.8
Phosphorus	mg	716	970	522	141	76	31	455	49	183	586	50	312	171	844	1114	866	1214	110	380
Potassium	mg	1096	1001	660	728	206	363	990	84	480	1089	123	651	179	1366	—	610	1334	82	450
Selenium	mcg	2.8	144	—	—	—	—	2.7	—	—	—	—	3.24	—	—	—	—	—	—	—
Sodium	mg	6	1	21	10	18	60	3	0	6	7	18	1	1	7	24	59	4	17	2
Zinc	mg	4.14	7.1	6.1	96	88	—	4	61	2.29	4.78	47	3.91	1.21	1.71	10.3	15.4	7.3	.89	2.26
LIPIDS																				
Total lipid (fat)	gm	77	93.7	64	2.7	28.2	.5	84.2	10.1	98.8	76.1	8.1	76.9	14.3	61.9	65.4	80	66.6	8.06	84
Total saturated	gm	6.8	18.7	10.9	.44	24.3	—	4.2	9	14.8	15.4	1.5	5.4	1.7	7.84	11.8	11.2	8.2	1.13	4.5
Total unsaturated	gm	67	68.3	46.2	2.04	2	—	59	8.8	80	50.5	6.1	63.9	11.7	50	51	64	56.9	6.57	49.5
Cholesterol	mg	0	0	0	0	0	—	0	0	0	0	0	0	0	0	0	0	0	0	0
AMINO ACIDS																				
Tryptophan	gm	.908	.364	.325	.056	.031	—	.248	.2	—	.453	.055	.215	.096	.362	.595	.71	.5	.096	.227
Threonine	gm	1.05	.844	.813	.196	.097	—	.616	.08	.352	1.09	.132	.273	.216	.984	1.25	1.77	1.34	.106	.536
Isoleucine	gm	1.23	.841	1	.174	.106	—	.663	.092	.327	1.46	.177	.346	.206	1.25	1.74	1.93	1.64	.11	.679
Leucine	gm	2.2	1.66	1.79	.299	.199	—	1.27	.146	.619	2.8	.342	.662	.491	2.15	2.87	3.22	2.39	.185	1.19
Lysine	gm	.946	.757	1.12	.246	.118	—	.499	.07	.434	1.46	.176	.315	.296	1.84	2.63	1.24	1.39	.082	.486
Methionine	gm	.322	1.42	.375	.112	.06	—	.186	.042	.123	.384	.047	.201	.122	.486	.76	1.34	.711	.094	.336
Cystine	gm	.508	.469	.388	.116	.053	—	.263	.038	.129	.48	.058	.229	.124	.657	.415	.785	.649	.051	.414
Phenylalanine	gm	1.99	1.04	1.09	.207	.135	—	.706	.1	.348	2.14	.26	.442	.261	1.52	1.66	2.29	1.89	.105	.754
Tyrosine	gm	1	.64	.672	.134	.082	—	.521	.064	.452	1.8	.219	.307	.249	914	1.41	1.66	.968	.107	.527
Valine	gm	1.46	1.28	1.43	.341	.182	—	.781	.1	.43	1.7	.206	.417	.252	1.8	2.72	2.22	1.9	.143	.866
Arginine	gm	3.84	3.38	2.38	.47	.437	—	2.48	.299	1.2	5.05	.813	1.19	1.38	2.79	5.57	4.99	3.46	.378	2.52
Histidine	gm	.782	.563	.546	.134	.068	—	.376	.06	.225	1.08	.133	.245	.163	.666	.94	1.02	.91	.075	.431
Alanine	gm	1.34	.786	.862	.218	.136	—	.614	.094	.441	1.68	.201	.366	.288	1.28	1.8	2.11	1.8	.133	.731
Aspartic acid	gm	3.33	1.89	2.09	.93	.26	—	1.86	.194	1.1	5.04	.813	.785	.621	2.7	3.42	3.4	3.8	.237	1.77
Glutamic acid	gm	8.43	4.4	4.97	.566	.609	—	4.07	.409	2.39	8.9	1.06	1.67	1.16	6.3	6	7.42	8.03	.569	3.37
Glycine	gm	1.76	.82	1.1	.202	.126	—	.81	.1	.467	2.89	.315	.467	.347	1.4	2.48	2.64	2.1	.175	.906
Proline	gm	1.78	1.07	.946	.179	.11	—	.585	.091	.531	1.82	.221	.366	.268	1.2	1.4	2.04	1.7	.116	.664
Serine	gm	1.28	1.04	1.17	.2	.136	—	.768	.115	.47	2.89	.295	.406	.299	1.73	1.58	1.97	1.55	.139	.836

VEGETABLES AND VEGETABLE JUICES (*cont.*)

	Measure	Kale	Kidney beans, ckd	Kohlrabi	Leeks	Lentils, ckd	Lettuce, sprouts	Lettuce, iceberg	Lettuce, romaine	Lima beans, ckd	Mung bean sprouts	Mushrooms	Navy beans, ckd
Measure		1 C.	1 C.	1 C.	1	1 C.	1 C.	1 C.	1 C.	1 C.	1 C.	1 C.	1 C.
Weight	gm	67	185	140	124	200	77	76	56	170	104	70	190
Calories		33	218	36	76	212	61	10	8	208	32	18	224
Protein	gm	2.21	14.4	2.36	1.86	15.6	6.9	.7	.9	11.8	3	1.46	14.8
Carbohydrate	gm	6.7	39.6	8.68	17.5	38.6	17	2.2	1.3	40	6	3	40.3
Fiber	gm	1	2.78	1.4	1.87	2.4	2.25	35	.4	3.6	.84	.52	3
VITAMINS													
Vitamin A	IU	5983	10	50	116	40	35	250	1458	630	22	0	0
Vitamin B_1	mg	.074	2	.07	.074	.14	.178	.05	.056	.238	.066	.072	.27
Vitamin B_2	mg	.087	.11	.029	.037	.12	.098	.05	.056	.163	.126	.3	.13
Vitamin B_6	mg	.162	—	.21	.2	—	.146	.028	—	.328	.092	.068	—
Vitamin B_{12}	mcg	0	0	0	0	0	0	0	0	0	0	0	0
Biotin	mcg	5	—	—	1.4	—	—	.35	—	—	—	11.2	—
Niacin	mg	.67	1.3	.56	.498	1.2	.998	.148	.28	1.77	.778	2.88	1.3
Pantothenic acid	mg	.061	—	.231	.12	—	.445	.1	—	.437	.396	1.54	—
Folic acid	mcg	19.6	.068	.015	78.5	—	76.9	.02	76	—	63	14.8	—
Vitamin C	mg	80.4	—	66.8	14.9	0	12.7	5	13.4	17	13.8	2.4	0
Vitamin E	IU	8	—	—	1	—	—	—	—	—	—	.56	—
MINERALS													
Calcium	mg	90	70	34	73	50	18	15	20	54	14	4	95
Copper	mg	.194	.647	.21	.09	.54	.27	.035	—	.516	.17	.078	—
Iron	mg	1.14	4.4	.56	2.6	4.2	2.47	4	.62	4.2	.94	.66	5.1
Magnesium	mg	23	—	.27	.35	—	.28	.5	.4	.126	.22	.8	—
Manganese	mg	.518	—	.16	.07	—	.36	.12	—	2.13	.18	.0	—
Phosphorus	mg	36	.258	.64	.40	.238	.133	.17	.28	.221	.56	.72	.891
Potassium	mg	.238	.629	.490	.223	.498	.248	.131	.182	.969	.154	.260	.790
Selenium	mcg	—	—	—	—	—	—	.875	—	—	—	.8.54	—
Sodium	mg	.58	.6	.28	.25	—	.8	.7	.4	.29	.6	.2	.13
Zinc	mg	.29	—	—	—	.2	1.16	.3	—	1.34	.42	.344	1.8
LIPIDS													
Total lipid (fat)	gm	.47	.9	.14	.37	.1	.43	.12	.12	.54	.2	.3	1.1
Total saturated	gm	.06	—	.018	.05	—	.044	.02	.007	.124	.048	.06	—
Total unsaturated	gm	.261	—	.077	.211	—	.249	.084	.064	.294	.052	.126	—
Cholesterol	mg	0	—	0	0	—	0	0	0	0	0	0	—
AMINO ACIDS													
Tryptophan	gm	.027	—	.014	.015	—	—	.008	.006	.151	.038	.032	—
Threonine	gm	.098	—	.069	.078	—	.253	.044	.042	.491	.08	.096	—
Isoleucine	gm	.122	—	.1	.084	—	.251	.06	.056	.745	.138	.056	—
Leucine	gm	.155	—	.094	.119	—	.484	.056	.054	.91	.182	.09	—
Lysine	gm	.132	—	.078	.097	—	.548	.06	.056	.765	.172	.048	—
Methionine	gm	.021	—	.018	.022	—	.081	.012	.012	.116	.036	.028	—
Cystine	gm	.029	—	.01	.031	—	.257	.012	.01	.141	.018	.004	—
Phenylalanine	gm	.113	—	.053	.068	—	.34	.04	.038	.571	.122	.056	—
Tyrosine	gm	.078	—	—	.051	—	.184	.024	.022	.372	.054	.032	—
Valine	gm	.121	—	.07	.089	—	.307	.048	.048	.723	.136	.068	—
Arginine	gm	.123	—	.147	.097	—	.47	.052	.05	.775	.2	.072	—
Histidine	gm	.046	—	.027	.031	—	.198	.016	.016	.393	.072	.04	—
Alanine	gm	.111	—	—	.092	—	.274	.04	.04	.483	.102	.11	—
Aspartic acid	gm	.186	—	—	.174	—	1.1	.1	.1	1.24	.498	.134	—
Glutamic acid	gm	.251	—	—	.28	—	.969	.126	.126	1.49	.188	.25	—
Glycine	gm	.107	—	—	.086	—	.248	.04	.04	.464	.066	.066	—
Proline	gm	.131	—	—	.082	—	.274	.036	.034	.172	—	.1	—
Serine	gm	.093	—	—	.114	—	.381	.028	.028	.723	.034	.066	—

Okra	Onions, green	Onions, mature	Parsley	Parsnips	Peas, green	Peas, split, ckd	Peppers, sweet	Peppers, hot chili	Pickles, dill	Pimientos	Pinto beans, ckd	Potato	Potato, baking, flesh & skin
1 C.	1 C.	1 C.	1 C.	1 C.	1 C.	1 C.	1 C.	½ C.	1 lge	3 med	1 C.	1 C.	1 lge
100	100	160	60	155	146	200	168	75	159	100	190	150	202
36	36	64	26	102	118	230	24	30	11	27	663	114	220
2	1.7	1.86	2.3	2.3	7.9	16	.86	1.5	.7	.9	43.5	3.2	4
7.6	5.8	11.7	5.1	23	21	41.8	5.3	7	2.2	5.8	121	25.7	32.8
.94	.84	.7	.8	.3	3.2	.8	1.2	1.36	.3	.8	.8	.86	1.2
860	5000	0	5100	50	934	80	530	578	100	2300	0	1	1
2	.07	.096	.07	.11	.307	.5	.086	.068	1	.02	1.8	.15	.15
.06	.14	.018	.16	.12	.193	.18	.05	.068	.02	.06	4	.06	.07
.2	—	.25	.098	.13	.247	—	.164	.21	.097	—	1	—	.7
0	0	0	0	0	0	0	0	0	0	0	0	0	0
—	—	1.8	.24	.15	—	—	—	—	—	—	—	—	—
1	.2	.16	.7	.2	3.05	1.8	.54	.713	1	4	4.2	2.3	2.7
246	.144	2	.18	.9	.152	—	.036	.046	—	.166	1.23	.57	1.12
56	13.8	31.8	.07	.09	95	—	16.8	17.8	—	—	41	19.2	22
21	48	13.4	103	16	58.4	—	126	182	6	95	1	30	31
—	—	4	—	—	3.1	—	—	—	—	—	—	—	—
82	60	40	122	70	36	22	6	13	26	7	257	11	14
84	08	.064	203	.17	257	.5	.1	13	—	6	—	.386	.26
8	1.86	56	3.7	8	2.14	3.4	1.2	8	1	1.5	12.2	8	1.1
56	20	16	24.5	40	46	—	14	19	12	—	—	51	75
66	—	2	.563	.75	500	—	14	176	—	—	—	.394	.483
84	32	46	36	96	157	178	22	34	21	17	968	60	101
202	256	248	436	.867	357	.592	196	255	300	—	1870	611	782
—	—	2.5	—	—	—	—	40	—	—	—	—	—	—
8	4	4	27	12	7	26	4	5	1428	—	18	5	6
.8	.44	28	44	8	1.8	—	.18	23	.27	—	9	.58	.85
.1	.14	.42	.4	8	.56	.3	.46	.15	4	5	2.3	2	2
.026	.024	.07	—	.067	.1	—	.088	.018	—	—	—	.04	.05
.036	.074	.144	—	.212	.323	—	.272	.08	—	—	—	.068	.09
0	0	0	0	0	0	—	0	0	—	—	—	0	0
.018	.02	.028	.022	—	.054	—	.012	.02	—	—	—	.048	.073
.066	.068	.044	—	—	.298	—	.03	.056	—	—	—	.1	.17
.07	.074	.068	—	—	.285	—	.028	.048	—	—	—	.12	.168
.1	.1	.066	—	—	.472	—	.044	.079	—	—	—	.186	.279
.082	.088	.09	.132	—	.463	—	.036	.087	—	—	—	.19	.283
.022	.02	.018	.01	—	.12	—	.01	.018	—	—	—	.05	.073
.02	—	.34	—	—	.047	—	.016	.029	—	—	—	.04	.059
.066	.056	.048	—	—	.292	—	.026	.047	—	—	—	.136	.206
.066	.05	.048	—	—	.165	—	.018	.032	—	—	—	.1	.172
.082	.078	.044	—	—	.343	—	.036	.063	—	—	—	.178	.263
.084	.128	.262	—	—	.625	—	.042	.072	—	—	—	.14	.214
.032	.03	.03	—	—	.156	—	.016	.031	—	—	—	.066	1
.074	.078	.052	—	—	.35	—	.026	.062	—	—	—	.096	.143
.146	.162	.1	—	—	.723	—	.124	.215	—	—	—	.76	1.14
.272	.36	.3	—	—	1.66	—	1	.196	—	—	—	.52	.78
.044	.066	.06	—	—	.288	—	.032	.056	—	—	—	.094	.137
.046	.1	.078	—	—	.253	—	.026	.065	—	—	—	.1	.166
.044	.078	.056	—	—	.264	—	.034	.06	—	—	—	.136	2

APPENDIX 4.0

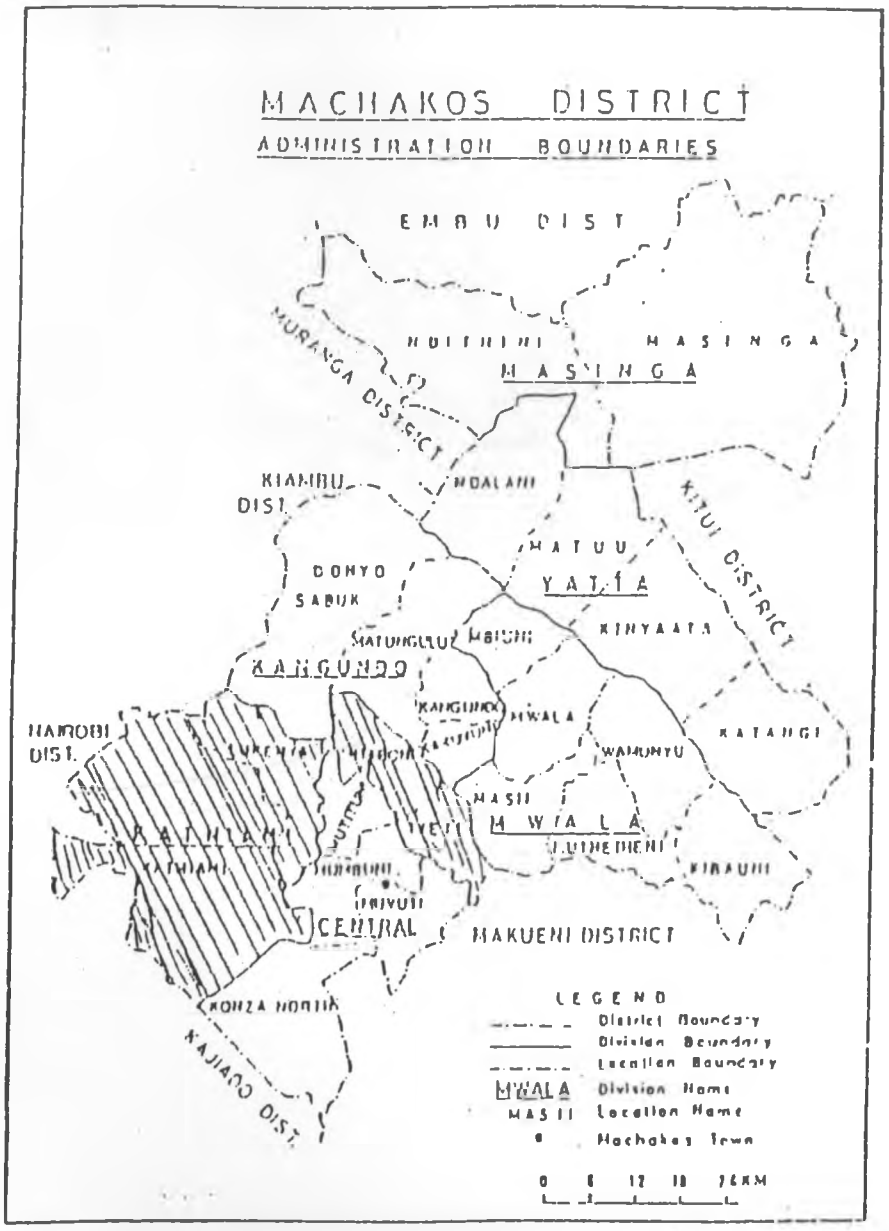

Figure 3.1 Map of Machakos District (Kenya), with Kathiani Division shaded.
Source: GoK, *Machakos District Development Plan*, 1996.