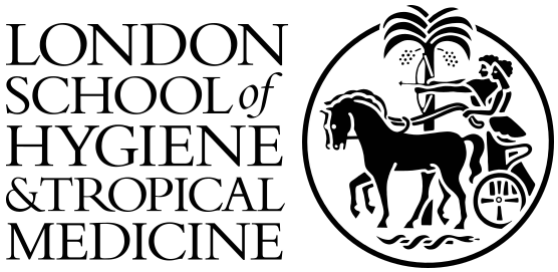

NUTRITIONAL STATUS AND FUNCTIONAL ABILITY OF OLDER PEOPLE IN RURAL MALAWI

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ABSTRACT

A cross-sectional study was undertaken in Lilongwe, Malawi to ascertain the levels of malnutrition and functional impairment among older people, examine the relationship between nutritional status and function ability and identify risk factors for poor nutritional status. Selected anthropometric measurements were taken and nutritional indices were derived using standard equations. Functional ability was assessed by questionnaire (activities of daily living [ADLs]) and tests which assess manual dexterity, handgrip strength and psychomotor function. Respondents were interviewed using a pre-tested questionnaire and a basic clinical examination was conducted.

A total of 296 respondents (97 males, 199 females) aged from 55 to 94 years were studied. Men were significantly heavier and taller than women but had smaller mid-upper arm circumferences and triceps skinfolds than women. Prevalence of undernutrition defined as body mass index (BMI) <18.5 kg/m^2, was 33.7% among males and 27.7% among females. Over 90% of all respondents were independent in ADLs and men were generally stronger and faster than women in performing functional tests except for psychomotor function. Functional ability declined significantly with age in both sexes except for manual dexterity among women. Handgrip strength emerged as the most important predictor of BMI, contributing to 15.8% and 11.6% of the variation in BMI of males and females, respectively. Low BMI was associated with poor handgrip strength, a history of smoking, fear of dependence and disability, poverty and living alone among males and among females, it was associated with poor handgrip strength, reduced food intake during the pre-harvest season and a history of anaemia

The study has demonstrated for the first time that undernutrition is a significant problem among older people in Malawi. It also confirms that poor nutritional status is associated with poor functional ability (as assessed by handgrip strength), and that it is possible to identify risk factors of nutritional vulnerability in this population. The study highlights the need to incorporate older people into existing and future nutrition and health programmes.

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DEDICATION

To my late grandmother, Virginia; my mother, Margaret; my daughter, Tiseke and to today's and tomorrow's older people of Malawi.

"Few of us will reach that lofty biblical age, but more and more of us will have life expectancies substantially beyond those of our grandparents. The real challenge is to live those increased years in a fulfilling way".

Rosenberg, 1992.

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LIST OF ABBREVIATIONS USED

ADL	Activities of Daily Living
AFI	Arm Fat Index
AMA	Arm Muscle Area
AMC	Arm Muscle Circumference
ANOVA	Analysis of Variance
BMI	Body Mass Index (using height)
BMIARM	Body Mass Index (using arm-span)
BMR	Basal Metabolic Rate
CAMA	Corrected Arm Muscle Area
EP & D	Economic Planning and Development Department (in Malawi)
FAO	Food and Agriculture Organisation
GDP	Gross Domestic Product
GOM	Government of Malawi
HSA	Health Surveillance Assistant
IADL	Instrumental Activities of Daily Living
IDD	Iodine Deficiency Disorders
LSHTM	London School of Hygiene and Tropical Medicine
MUAFA	Mid Upper Arm Fat Area
NSO	National Statistical Office
NHANES	National Health and Nutrition Examination Survey
PEM	Protein Energy Malnutrition
SPSS	Statistical Package for Social Sciences
TAs	Traditional Authorities
TEM	Technical Error of Measurement
TSF	Triceps Skinfold Thickness
UN	United Nations
UNICEF	United Nations Children's Fund
WHO	World Health Organisation

CHAPTER 1: INTRODUCTION

This chapter gives background information related to the study, and outlines the objectives of the study. A brief description of the organisation of the thesis is also provided.

1. 1 WHO ARE THE OLDER PEOPLE?

Most studies from developed countries use 60 or 65 years as cut-off points for defining the elderly (Sen et al. 1993). This study included those aged 55 years and over because in most developing countries biological ageing may begin earlier because of malnutrition, disease exposure, physical work patterns and generally harsh life conditions (Kalache, 1991) and for women, many pregnancies and lactation periods (Nordberg, 1997). It should be noted however, that older people form a heterogeneous group (Krondl et al. 1982; Sinclair, 1991; Coombes, 1995).

1.2 AGEING

Ageing is a normal biological process whereby functional capacity and the composition of the body change (Flynn, 1984) or decline (Spence, 1989). There are two schools of thought as to when the process of ageing begins. In one, ageing is believed to start from the moment of conception (Krause and Mahan, 1978); and in another, it is thought to begin with the cessation of growth and development (Munro, 1982), eventually ending with death (Spence, 1989). Thus, a study of ageing is different from the study of older groups of people (Kohrs, 1982). However, a knowledge of the processes of ageing is essential in order to understand the problems of older people. According to Armbrecht et al. (1984), ageing and nutrition are related in a complex manner. Malnutrition resulting from physiological and psychological factors may lead to a hastening of the ageing process and the worsening of age-related diseases. On the other hand, ageing and disease can in turn have an adverse effect on nutritional status (Armbrecht et al. 1984).

Thus, the knowledge of the ageing process is important in order not to confuse the effects of ageing with those of poor nutritional status. The population of older people is increasing world-wide and women tend to outlive men by seven to eight years in developed countries (Suzman et al. 1992). In 40 years time, three quarters of the elderly population will be living in developing countries (World Bank, 1994). The increase in population of older people calls for a change in focus or direction in the next century (Manandhar, 1995).

1.3 NUTRITIONAL STUDIES IN MALAWI

The problems of ageing have not been viewed as a critical issue in Malawi; the overwhelming preoccupation has been with the major nutritional and related problems of children and pregnant women. Most of the nutritional studies and nutritional programmes have tended to focus on these groups and on their main nutritional problems which include: Iodine Deficiency Disorders (IDD), Protein Energy Malnutrition (PEM), Vitamin A deficiency and nutritional anaemia (Burgess and Cole-King, 1969; Government of Malawi/UNICEF, 1987; Government of Malawi/UNICEF/Centre for Social Research, 1987; Shrestha, 1989; GOM/UN, 1993; Government of Malawi, 1984, 1992, 1994; NSO, 1994). One possible reason for this emphasis could be that child nutritional status is seen as a proxy for the nutritional status of the family (FAO, 1990) or community (Government of Malawi/UNICEF, 1987; Government of Malawi, 1992). In addition, the life expectancy is low, 43.5 years among males and 46.8 years among females in 1992. This has been interpreted as meaning that few people survive into old age. However, life expectancy at birth is heavily influenced by infant mortality rates which do not necessarily parallel mortality rates in other age groups and as such, life expectancy at birth may not give a true picture of population ageing (Atchley, 1985). In the case of Malawi, the population of the older people (55 years and over) is increasing markedly hence the need for research to give insights into their problems is imperative. In addition, since the overall objective of Malawi's food security and nutrition policy is to improve the food security and nutritional status of all households in Malawi (Government of Malawi, 1990), the inclusion of older people in the nutrition agenda will ensure that their problems are not overlooked and form an integral component of all future nutritional studies and programmes in Malawi.

1.4 STUDY QUESTIONS AND OBJECTIVES

1.4.1 QUESTIONS TO BE ANSWERED BY THE STUDY

The study was designed in order to answer the following questions: What is the nutritional status and functional ability of older people in rural areas of Malawi? What is the relationship between nutritional status and functional ability? Do people with a poor nutritional status have a lower functional ability and vice versa? Can we identify risk factors for poor nutritional status and poor functional ability among older people?

1.4.2 HYPOTHESES

The following hypotheses were tested in relation to older people in rural Malawi:

1) Poor nutritional status is associated with a lowered functional ability.
2) There are social, economic and health-related factors associated with nutritional status and functional ability which can be used to define nutritional vulnerability.

1.4.3 OBJECTIVES OF THE STUDY

1.4.3.1 General objective

To assess nutritional status and functional ability of older people in the rural areas of Malawi and to identify risk factors for poor nutritional status among older people.

1.4.3.2 Specific objectives

The specific objectives of the study were:

1. To ascertain the levels of malnutrition and functional impairment among older people in rural Malawi.
2. To examine the relationship between nutritional status and functional ability among the older people.
3. To investigate the current living arrangements and support systems of the older people and find out how these may affect the nutritional status, functional ability and hence quality of life of the older people.
4. To identify risk factors for poor nutritional status based on indicators of vulnerability identified through the analyses above.

1.5 ORGANISATION OF THE THESIS

In **Chapter 2**, literature on nutritional status and functional ability of older people is reviewed. Topics covered in the literature review include factors which may affect nutritional status and functional ability, nutritional status and functional ability assessment, changes which occur with ageing and the role of the family in caring for older people. **Chapter 3** describes the country profile, study area and methods used in conducting the study and in data analysis. In **Chapter 4**, major results of the study are presented in seven sections. Section one describes the general characteristics of the respondents and sections two to five describe results relating to anthropometry, functional ability, clinical information and bivariate analysis. Results of the multiple regression analysis are presented in section six and section seven deals with data from special respondents. In **Chapter 5**, the results are discussed based on literature reviewed. **Chapter 6** embraces the summary of the thesis as well as its major conclusions. In addition, it outlines proposed recommendations and possible future research areas which will be pursued after this study.

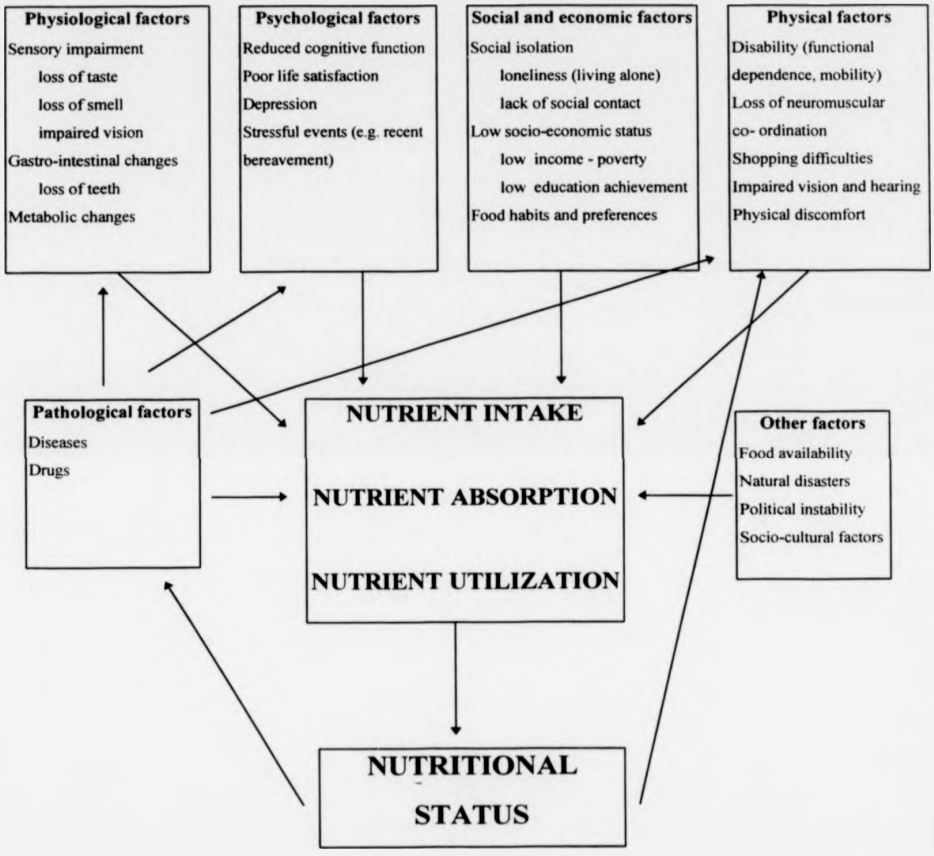
CHAPTER 2: LITERATURE REVIEW

In this chapter literature on nutritional status and functional ability of older people is reviewed. Topics covered in this review include factors which may affect nutritional status and functional ability, nutritional status and functional ability assessment, changes which occur with ageing and the role of the family in caring for older people.

2.1 CONCEPTUAL FRAMEWORK OF NUTRITIONAL STATUS OF OLDER PEOPLE

Older people are vulnerable to malnutrition for numerous reasons which may include physiological changes associated with ageing of the body and also the occurrence of chronic illnesses (Howarth, 1991; Fischer and Johnson, 1990; Guigoz et al. 1996). In addition, social, physical and psychological factors prevalent among the older people may also contribute poor nutritional status (Chandra et al. 1991; Howarth, 1991; Fischer and Johnson, 1990; Lehmann, 1989; Davies, 1984; Coe and Miller 1984; Rolls, 1994). For instance, there is evidence which shows that social isolation can strongly influence eating patterns and consequently influence intake of nutrients (Howarth, 1991; Fischer and Johnson, 1990; Davies, 1989). Kohrs et al. (1989) and McCormack (1997) have reviewed factors which may have an influence on nutrient intake and eventually nutritional status of older people, and also a study conducted in the UK (DHSS, 1979) came up with risk factors for poor nutritional status among older people. Possible factors which may substantially affect nutritional status based on the literature review are illustrated in the conceptual framework (see Figure 2.1). These risk factors do not act in isolation; their relationship with nutritional status and to each other, as the case may be is complex. It should be noted however that most of the research cited was conducted in developed countries.

Figure 2.1: CONCEPTUAL FRAMEWORK OF RISK FACTORS OF POOR NUTRITIONAL STATUS IN OLDER PEOPLE



2.1.1 PHYSIOLOGICAL FACTORS

2.1.1.1 Taste, smell and sight: Sensory impairment is one of the physiological factors which diminishes with age at varying rates (Krause and Mahan, 1978) and is likely to influence dietary intake (Chandra et al. 1991). The causes of decline in taste and smell with advancing age are unclear but the following factors have been closely associated with a decline in taste and smell: a reduction in number of taste buds with age (Dye, 1984; Atchley, 1985; Spence, 1989; Rosenberg et al. 1989; Bowman and Rosenberg, 1983; Webb and Copeman, 1996) although one recent study shows no change with age (Walls, 1992); a decrease in number of olfactory cells and a loss of neurones in the olfactory bulbs during ageing (Spence, 1989); changes in the way taste sensations are processed in the central nervous system (Hutton and Hayes-Davis, 1983; Spence, 1989); a decrease in volume of saliva secreted (Dye, 1984; Spence, 1989); smoking; diseases such as diabetes mellitus, renal failure, cancer, hypertension, nutritional deficiencies (e.g. zinc and vitamin B deficiency), denture wearing; drug use (Dye, 1984; Schiffman, 1994); and oral hygiene (Kamath, 1982). Although it is generally believed that physiological changes in taste and smell sensation can influence food intake research results tend to be contradictory. Some studies showed an association between taste and smell with nutrient intake (Schiffman, 1983), whereas others showed no association (Kamath, 1982; Howarth, 1991). If indeed reduced taste and smell sensation affect food intake, by decreasing the palatability of the food (Dye, 1984), they could have an impact on the nutritional status of older people. It should be remembered though that in addition to taste and smell, the texture and appearance of food may also influence food consumption (Walls, 1992). Worsening eyesight makes food preparation difficult (Krause and Mahan, 1978) and more assistance would be required for such a person to maintain an adequate food intake.

2.1.1.2 Age related changes in the gastrointestinal tract: Loss of teeth, a common problem among older people, leads to chewing difficulties (Gordon et al. 1985) which may affect the type of food eaten and hence nutrient intake. The tendency would be switching to soft foods, which usually have less vitamin A, C, folic acid and fibre which can lead to deficient nutrient intake and constipation. Numerous authors have reviewed the changes of the gastro-intestinal tract with advancing age (Krause and Mahan, 1978; Spence, 1989; Rosenberg et al. 1989; Webb and Copeman, 1996). With advancing age,

the mucus membrane lining the stomach tends to get thin, partly due to atrophy of mucus glands and gastric glands. As a result, there is decreased gastric secretion of hydrochloric acid, pepsin and intrinsic factor which lead to impaired protein digestion, less efficient absorption of vitamin B_{12} and a greater possibility of bacterial contamination of gastric juice. The most affected nutrients are iron, calcium, copper, zinc, folic acid, vitamin B_{12} and protein. Furthermore, there is a general atrophy of the layers composing the walls of small intestines and this reduces the surface area across which absorption occurs. There is also a gradual decline in production of most digestive enzymes and bile which makes the digestion and absorption of food slower and less efficient, especially the absorption of fat, fat soluble vitamins and calcium.

2.1.1.3 Metabolic changes

After the age of 50 years, Basal Metabolic Rate (BMR) is known to decline by 10-15% or more owing mainly to a decline in lean body mass (Krause and Mahan, 1978). Thus, a reduced BMR, a decline in lean body mass and reduced activity level may also lead to a considerable reduction in energy requirement which may in turn lead to low energy intake (Howarth, 1991; Mitchell and Lipschitz, 1982a). If foods eaten are not nutrient dense, this may have a serious effect on intake of other nutrients (Suboticanec et al. 1989).

2.1.2 PSYCHOLOGICAL FACTORS

2.1.2.1 Cognitive function: Reduced cognitive function may result in reduced nutrient intake (Goodwin et al. 1983) since people with mental problems may be unable to participate in normal activities of life, or may forget to eat. A study conducted among old patients (n=490, mean age 80.8 years) in Italy revealed that poor cognitive status was associated with a lower nutritional status (Ranieri et al. 1996). Similar findings were also reported by Ortega et al. (1997).

2.1.2.2 Depression: Depression which is common in older people, is also associated with anorexia and lack of interest in food or meal times which may in turn affect dietary intake. Miller et al. (1996), showed that people with a high number of depressive symptoms were more likely to be at a higher risk than their counterparts with less depressive symptoms. Insufficient social contact, loneliness, stressful events (recent bereavement) and both

social and physical inactivity have also been associated with poor dietary intake in old age (Howarth, 1991). However, poor nutritional status may also lead to anorexia and depression therefore setting up a vicious cycle (Kohrs et al. 1989). Availability of relatives, sharing food and being cared for can ensure that older people are happy and as long as food and resources are available, then these older people should have a better nutritional status.

2.1.3 SOCIAL AND ECONOMIC FACTORS

2.1.3.1 Living alone: Studies have shown that men living alone tend to have a lower food intake (Howarth, 1989, DHSS, 1972 & 79; Burr et al. 1982; Davis et al. 1990) or have a lower appetite (Davies, 1989) or poor nutritional status (Burr et al. 1982). Since people eat for enjoyment (Schlettwein-Gsell, 1992) and use eating time as a chance to socialise with family and friends, those who live alone may not be inclined to eat much because meal times may remind them of their loneliness (Herrmann, 1984). In a study conducted in Wales, Vitamin C and thiamin status was poorer in men who ate alone than those who shared their meals with other people but this was not the case among women in a similar scenario (Burr et al. 1982). Similarly, in Australia, a study conducted by Howarth (1989) showed that elderly men living with a spouse had a better nutrient intake than those living on their own. However, LeClerc and Thornbury (1983) and Posner et al. (1987) found no association between living alone and dietary intake among the elderly, but the relationship could have been concealed by the methodology used (24 hr dietary recall) or type of sample studied (house-bound), (Posner et al. 1987) or the small sample size (n=53, Leclerc and Thornbury, 1983). Although studies tend to have differing results, the information presented suggests that men living alone are more at risk of having a lower dietary intake than women in a similar scenario.

2.1.3.2 Poverty: Poverty or reduced income in retirement may also result in a poorer diet among older people (Krause and Mahan, 1978; Munro, 1989; Chandra et al. 1991; Marwick, 1997) and hence a poorer nutritional status (Wahlqvist et al. 1994; Miller et al. 1996). Findings from a study conducted by Ethangatta et al. (1996), in Nairobi, Kenya, showed that protein energy malnutrition (defined as < 90% of standard for body weight, mid-arm muscle circumference and triceps skinfold thickness and/or lower serum protein)

was higher among poor older people (income ≤ Cd $ 20/month) than their better off (income ≤ Cd $ 170/month) counterparts (16% vs 3%). Consistent with these results, in the US, low income was also associated with a high nutritional risk (Miller et al. 1996). Poor education among older people and being widowed particularly among women are also associated with poor income. However, in developing countries poverty is not restricted to old age. Many older people enter old age after a lifetime of deprivation, poverty and poor dietary intake.

2.1.3.3 Food habits and preferences: Most food habits and preferences which are developed in childhood tend to remain into old age (Fanelli and Abernethy, 1986; McCormack, 1997). However, special problems may arise when older people do not eat a varied diet or become uninterested in food due to other problems. This can certainly influence their dietary intake and ultimately their nutritional status.

2.1.4 PHYSICAL FACTORS

With decreased sight and physical disability, food acquisition as well as food preparation may be difficult (Krause and Mahan, 1978) and as such, nutritional status may be markedly affected (Fischer and Johnson, 1990; Chandra et al. 1991) particularly in the absence of adequate help from relatives or friends. Thus, older people with poor function are likely to be unable to grow enough food or prepare their own food and without any social support, this may affect their food intake thus precipitating malnutrition.

2.1.5 PATHOLOGICAL FACTORS

As people age, they all experience a decline in the ability to fight off disease, which is caused by a decrease in the effectiveness of the body's immune system (WHO, 1995). This is partly the reason for an increased susceptibility to diseases in the elderly (Atchley, 1985). Diseases may influence nutritional status in many ways: either by changing the intake of food through loss of appetite, the absorption of nutrients from the gastro-intestinal tract, the utilisation of nutrients by tissue, or through an excessive loss of substances from the body (DHSS, 1979; Kohrs et al. 1989; Howarth, 1991). Diseases can also affect mobility and the ability to cope (DHSS, 1979; Krause and Mahan, 1978) which can also have a profound effect on nutritional status. Drugs may also have a similar effect

as diseases (Lehmann, 1989). However, poor nutritional status can itself accelerate the progress of disease hence resulting in a vicious circle (Whitehead and Finucane, 1997).

2.1.6 OTHER FACTORS

Older people may have problems in acquiring food depending on their physical strength (as explained earlier) and availability of resources. Natural disasters such as drought and political instability may also affect food availability (Davies, 1989) since sometimes people have to leave their homes and rely on food aid for survival. Social and family relationships may be affected in times of conflict or economic depression leading to reduced support in food acquisition.

2.1.7 RISK FACTORS FOR POOR FUNCTIONAL ABILITY

Information on the risk factors for poor function is very scanty. However, possible factors which may have an influence on functional ability are briefly discussed below.

Excessive **alcohol consumption** as well as **chronic illness and general poor health** may weaken the body hence affecting functional ability directly but may also affect nutritional status and their socio-economic status which can in turn affect functional ability. Having an **occupation** and also being able to carry out income generating activities may ensure that the body is kept active which is a key to maintaining functional ability. On the other hand, if older people rely on other relatives for income, they may reduce their own activity and hence their functional activity may dwindle over time. People who are **poor** are more than likely to be weaker than those who have income and may not be motivated to work as much and this may have an influence on their functional ability. In a study conducted in the US, people with lower income had a higher prevalence of functional impairment than those with a higher income (Berkman and Gurland, 1998).

Social network: People are likely to be inactive if they receive a lot assistance from relatives or friends but if they are able to socialise within or outside their home, they are likely to maintain their function over a long time. Berkman and Gurland (1998) found that those with larger networks were more impaired that those with smaller networks . However, how they relate to their social network may determine whether they are happy

or have social problems. **Social problems** can lead to depression which can weaken the body but also can affect nutritional status which may in turn affect function.

Food intake: Food availability and food intake are essential for proper function since one can not work efficiently on an empty stomach. Studies have shown that better **nutritional status** is associated with better function (Galanos et al. 1994). Thus, people with better nutrition status are likely to be active and better able to perform domestic and other expected chores and even visit relatives outside their own villages. Thus, with better health and nutritional status, one can maintain good function over a long time and therefore manage to live independently.

2.2 NUTRITIONAL ASSESSMENT

It is important to assess the nutritional status of older people because of its role in ensuring a better quality of life and its association with functional ability. Studies have shown that people with better nutritional status (assessed by body mass index) are better able to perform instrumental activities of daily living (Galanos et al. 1994) or have better function as assessed by handgrip strength (Manandhar et al. 1997a) although causality can not be assumed due to the nature of study designs. The accurate nutritional assessment of older people is hindered by age related alterations in body composition such as height loss with age or decline in muscle mass with age (Mitchell and Lipschitz, 1982a) and this is further compounded by the lack of suitable standards (Jelliffe and Jelliffe, 1989).

2.2.1 ANTHROPOMETRIC MEASUREMENTS

Anthropometry is the physical measurement of the body. It is useful in furnishing an indirect assessment of body composition (Whitney et al. 1994a; Whitehead and Finucane, 1997). A wide range of anthropometric measurements are normally included in the nutritional assessment of the older people. They include: stature (or stature estimated from knee height, arm length and arm span); body weight, body circumferences (upper arm, calf, thighs, hips and waist) and skinfold thicknesses (biceps, triceps, sub-scapular and supra-iliac) (Chumlea et al. 1989b). Where an older person is unable to stand up, recumbent measurements can be taken because the two measurements are known to be similar as long as similar methodology is followed (Chumlea et al. 1991; Chumlea et al.

1994). Anthropometric measurements are easy and economical to carry out (Whitehead and Finucane, 1997; Rea et al. 1997) since minimal equipment is required (Whitney et al. 1994a). They are valuable in predicting mortality (Friedman et al. 1985; Campbell et al. 1990). In a study conducted in a New Zealand hospital, Friedman and colleagues found that a 90 day mortality was higher among malnourished subjects (malnutrition defined as corrected arm muscle area (CAMA) $\leq$16 cm^2 for males and $\leq$16.9 cm^2 for females) than their non-malnourished (normal) counterparts (50% vs 16.2%). However, this study was limited by the small sample size particularly in the malnourished group (only 10 subjects were malnourished compared to 191 in the non-malnourished group). Similarly, Campbell et al. (1990), also found that low CAMA (below 5th percentile) was associated with an increased risk of death in subjects aged 70 years and over in their 4 year longitudinal study (n=758). The increased risk of mortality with low CAMA is partly due to its association with a compromised immune function (WHO, 1995) which increases the susceptibility to infections.

Anthropometry is also important in determining changes in nutritional status over time and hence can be used as surveillance tool (WHO, 1995) and also in evaluating nutritional interventions (Chumlea, 1991). In addition, anthropometry has also been useful in identifying changes in body size and composition that occur with old age (Lipschitz, 1992; Chumlea et al. 1989a). Recently, several authors (Chumlea et al. 1991; Lipschitz, 1992) have reviewed literature on the changes in the body composition with age and some of the changes are highlighted in the section that follow. Noteworthy is the fact that most of studies were conducted in developed countries.

2.2.1.1 Stature: Stature (standing height and supine length) indicates tallness of an individual (Cole, 1991) and is considered an indicator of general body size and bone length (Fidanza 1991). Measuring stature accurately may be impossible in the elderly due to chronic illness, spinal curvatures (kyphosis and scoliosis), immobility (Roe, 1986; Kwok and Whitelaw, 1990), bowing of legs or a bent knee gait (Stoudt, 1981; Chumlea et al. 1991; 1994). Thus, true height measurement may be difficult to measure because of height loss as a result of postural changes. Where height can not be measured accurately, other measurements such as arm length, arm-span, demi-span and knee height can be

taken to estimate stature. This is due to the fact these long bones do not change significantly with age and are not seriously affected by postural changes.

Another problem with height measurement is that it is known to decline with age due to shortening of the spinal column (thinning of discs of the vertebral column), loss of muscle tone and osteoporosis (Mitchell and Lipschitz, 1982a; Stoudt, 1981; WHO, 1995) in addition to postural changes indicated above. Generally, it is estimated that height decreases by about 1 cm per decade after the age of 20 in both males and females (Lipschitz, 1992). It is suggested that the decline is greater in females than males due to high rates of osteoporosis in women. However, the available evidence is contradictory. Chandler and Bock, (1991) found a greater decline among females than in males but McPherson et al. (1978) reported a greater decline in males (4.2 cm every 20 years) than in females (3.4 cm every 20 years) despite the higher incidence of osteoporosis in females. They also reported more decline in blacks than whites. The difference between the two studies could be attributed to the design of the studies and sampling techniques. Chandler and Bock's study was a mixed longitudinal study (age range of the subjects 18-97) which is likely to provide better data than the cross-sectional study of McPherson et al. which was also not representative of the area studied. Both cross-sectional and longitudinal SENECA studies showed a decline in height with age (de Groot et al. 1991; de Groot et al. 1996). However, different authors have reported different changes in height with age as shown in Table 2.1.

Most of the decline in height with ageing occurs in the upper body region (van Leer et al. 1992; Yassin and Terry, 1991; Wahlqvist and Flint, 1988) (see Figure 2.2). In their 5 year longitudinal study, van Leer and colleagues (1992) reported a loss in standing height of 4.9±0.3 cm and a loss in sitting height of 3.9±0.2 cm showing that indeed most of the decline occurred in the upper body region. Similar results were reported by Wahlqvist and Flint, (1988) although their study used regression equations from younger adults which could not account for secular trend. In both studies only women were studied so it is not known whether the decline is similar or less among men bearing in mind that osteoporosis is generally higher among women. Reported correlations of height and age with the

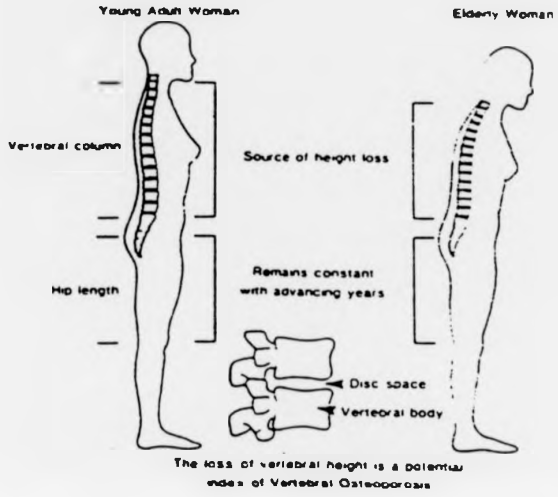
surrogate measurements of height are shown in Table 2.2. The decline in height with age makes the interpretation of height related indices difficult.

Table 2.1. Reported height changes with age

Author(s)	Sample characteristic	Decline/decade
Carmelli et al. 1991* (second study after 23 y)	n = 1150 males, 65-86y USA	0.8 cm for those aged < 50 y at their first assessment 1.2 cm for those aged ≥ 50 y at their first assessment
Wahlqvist & Flint, 1988	n = 36 young - Australia n = 54 old (70-98y) (institutionalised)	0.15 ± 0.07m (within the sample)
Dequeker et al. 1969	n = 140 women 30-94y Belgium	1.3 cm
Chandler and Bock, 1991*	n = 1785 females 18-97y n = 1544 males 18-94y Australia	by age 80, males can lose 6.0 cm and women can lose 6.6 cm
McPherson et al. 1978	n = 500 black 50-104y n = 121 white USA	4.2 cm/20y black males 3.4 cm/20y females 1.2 cm/20y white males
Yassin and Terry, 1991	n = 305 55 - 110y Malaysia	1.8 cm (sitting height)
Chumlea et al. 1991	Review	0.5 - 1.5 cm
de Groot et al. 1996*	n= 510 men n= 541 women SENECA study, Europe	1-2 cm in 4 years

* longitudinal study

Figure 2.2: Source of height loss with age



Source: Wahlqvist and Flint, 1988.

2.2.1.2 Weight is a measure of heaviness of an individual (Cole, 1991) and basically it includes the mass of body tissues and fluids (Chumlea et al. 1989b). When body weight increases, it may be an indication of an emergence of obesity or oedema whereas when it decreases, it could be a sign for existence or worsening of a disease or nutritional disorder (Lipschitz, 1992; Chumlea et al. 1989b). According to Mitchell and Lipschitz (1982a), maximum weight is reached at the age of 42 among males and at the age of 50 among females. After a period of stability, it declines gradually after the age of 65 or 70. WHO (1995) indicated that weight is gained up to the age of 65 among men and for women about a decade later after which, it is known to decline. In their study, Carmelli et al. 1991, weight declined with age at a mean rate of 0.8 kg/decade after the age of 50 among males. However, they indicated that lifestyle variables could have confounded their results since they were not controlled for. In the 4 y SENECA longitudinal study (de Groot et al. 1996), mean weights did not change in most centres but Lehmann and Bassey

(1996) reported a small but significant loss in weight in their 4 y longitudinal study of 1.56 kg ($p<0.001$) among women and 0.85 kg ($p=0.01$) among men although half of the sample actually gained weight in the 4 year period.

Table 2.2: Correlation coefficients (r) of stature estimates with age and height in the elderly

Measurement	*Correlation with Age*	*Correlation with Height*	*Reference*
Height	- 0.33, $p<0.0001$		Reid et al. 1992 (n = 141 white females, 45-71y New Zealand)
	- 0.37, $p<0.001$		Yassin and Terry, 1991 (n = 305 females, 55y+ Malaysia)
	- 0.3867, $p=0.001$		Dequeker et al. 1969 (n = 140 females, 30-94y Belgium)
Arm length		0.63, $p<0.001$ elderly subjects 0.68 $p<0.001$ young subjects	Mitchell & Lipschitz 1982b [n = 100 young males and females (mean age 24.2) and 63 elderly subjects (mean age 69.8) USA]
Demispan		0.74, $p<0.001$	Bassey, 1986 (n = 125, 20-45y England)
	- 0.21 men, -0.23 women ($p<0.05$)		Lehmann et al. 1991 (n = 532 females and 358 males, >65y UK)
Armspan	- 0.106, $p<0.05$ - 0.167, $p<0.05$	0.852, $p<0.05$ black 0.903, $p<0.05$ white	Steele & Chenier, 1990 (n = 293 black and 298 white females 35-89y USA)
	-0.12, $p<0.05$	0.71 ($p<0.001$)	Yassin and Terry, 1991 (n as above)
	0.0366 NS		Dequeker et al. 1969 (n = 140 females, 30-94y Belgium)
Knee height	NS	0.52 ($p<0.001$)	Yassin and Terry, 1991 (n as above)

NS = not significant

The decline in weight is attributed in part to the decline in body water (Steen, 1988; Baugmatner et al. 1995 and Rico et al. 1993). It is believed that the body of a younger adult contains 70% water, whereas an older adult has 60% water (Steen, 1988). In their studies, both Baumgartner et al. (1995) in the USA and Rico et al. (1993) in Spain reported a lower body water in older subjects although Baumgartner et al. (1995) showed mainly intracellular water loss.

2.2.1.3 Skinfold thickness: Skinfold thicknesses can be used singly or together to estimate body fat. Equations do exist for estimating fat from skinfolds (Gibson, 1990; Frisancho, 1990). With age, fat distribution changes considerably and as a result peripheral fat decreases whereas truncal and internal fat increases (Shimokata et al. 1989; Schwartz et al. 1990; Dawson-Hughes and Harris, 1992). In a study of post-menopausal women conducted by Dawson-Hughes and Harris (1992), fat tissue in the trunk increased by 3.43±1.12% ($p<0.01$). Similarly, in a study conducted by Schwartz et al. (1990), younger people (18-30 years) had lower intra-abdominal fat deposits (areas) than their older counterparts (60-85 years) (72.6±38.2 cm^2 vs 143.6±56.2 cm^2, $p<0.001$). In addition, older people had lower subcutaneous fat and greater hip ratios than younger subjects. Similar results were also reported by Shimokata et al. (1989) and Teh et al. (1996).

2.2.1.4 Mid Upper Arm Circumference (MUAC): MUAC is a measure of fat and muscle of the upper arm (Gibson, 1990; Kuczmarski and Kuczmarski, 1993). In fact, MUAC is an important measure in deriving mid-upper arm muscle circumference and areas and upper arm fat areas using standardised equations discussed later. With advancing age, MUAC declines steadily, reflecting a loss of both muscle tissue or fat or both (Gibson, 1990; Yassin and Terry, 1991; Herman et al. 1998). In a Malaysian cross-sectional study (Yassin and Terry, 1991), younger older people (55-59y) had a higher MUAC of 28.2±3.9 cm than older counterparts (aged 70+) who had a mean MUAC of 23.7±3.5 cm. Similarly, in Guatemala, older age-groups in both men and women had significantly lower MUACs than younger age-groups (Herman, et al. 1998). However, both studies were confounded by the effects of cross-sectional study design.

Work of James et al. (1994), in the Third world countries has shown that cut-off points of 23 cm in men and 22 cm in women can be useful for assessing nutritional status in adults aged 18-60 years, allowing nutritional status to be assessed quickly and easily particularly when resources are limited. However, these cut-offs have not been yet been validated for elderly people.

2.2.2 DERIVED MEASUREMENTS

2.2.2.1 Body Mass Index (BMI)

BMI is derived from the weight divided by the stature (or height in metres) squared. It has been used as an index of obesity and as a simple indicator of total body weight. It is used to indicate both obesity and leanness depending on the cut-off points (Garn et al. 1986; Norgan, 1990). In addition, since it is possible to estimate stature from other measurements, BMI can be used as an index of nutritional status in almost all elderly persons (Chumlea, 1991; Chumlea et al. 1986).

Recently, a BMI of less than 18.5 kg/m^2 has been proposed as a cut-off point for undernutrition in adults since a BMI of 18.5 kg/m^2 is associated with normal health in both men and women (James et al. 1988; Shetty and James, 1994; James and François, 1994; Bailey and Ferro-Luzzi, 1995) and a BMI of 12 has been shown to be a lower limit for survival in both males and females (Henry, 1990) although his study was based on literature review. WHO (1995) suggests the use of adult cut-off points (BMI < 18.5 kg/m^2 for low BMI) for those in the age group 60-69 years but there is no agreement as to which cut-off points to use to indicate nutritional status of those aged 70 years and over. Comparing older people with younger ones with the same BMI, older people are likely to have a greater proportion of body weight as fat since with age there is a decline in lean mass and an increase in fatness (Gallagher et al. 1996).

In old age, moderate body mass index has been shown to be associated with good health (Mattila et al. 1986; Potter et al. 1988; Fischer and Johnson, 1990). Potter et al. (1988), reported that increased mortality occurred at BMI values of >36 and that BMI of 26-36 was associated with better survival in hospital patients. However, a lower BMI ≤26 was

associated with greatest mortality although confounding effects of smoking and alcohol consumption were not controlled for. Problems of too much fat still persist in old age since it can be a strain on already weak muscles resulting in reduced activity (Lehmann et al. 1991). However, very low body mass index is of greater concern than a higher BMI among older people since it is a sign of both low fat and low lean mass (Norgan, 1990; Vaz et al. 1996) but also due to its association with high mortality (Mattila et al. 1986; Potter et al. 1988; Rajala et al. 1990). Results of a study undertaken by Mattila et al. (1986) showed that a greatest 5y mortality was seen in those with BMI <20 but lowest in those with BMI ≥30 among 85 year old subjects. Unfortunately, possible confounders such as smoking were not controlled for in this study and it is difficult to say whether these findings can be generalised for all old people or only those studied. It is apparent that a low BMI may jeopardise the health of older people or could be a sign of a disease which has not been diagnosed (de Groot et al. 1992). Furthermore, in Malawi, the major nutritional problem among children and adults is undernutrition as opposed to overnutrition; it is plausible therefore to assume that even in old age our main concern should be a low BMI at least for the time being.

Some studies have shown that BMI declines with advancing age (Yassin and Terry, 1991; Herman et al. 1998). In Yassin and Terry's study, BMI was negatively correlated to age ($r = -0.31$, $p<0.001$). Consistent with these findings, Rolland-Cachera et al. (1991) reported a decline in BMI after the age of 65 which they attributed to the decline in lean mass but also to survival selection since people with lower BMI tend to live longer than their obese counterparts. However, their study was limited since they relied on self-reported weights and heights which tend to be unreliable or misleading.

2.2.2.2 Mid Arm Muscle Area (AMA): AMA indicates the amount of muscle or lean tissue the body has (Roe, 1986). It is thus an index of protein reserves (Fidanza, 1991; Lukaski, 1987). It is also known to decline with age (Herman et al. 1998; Yassin and Terry, 1991 and Falciglia et al. 1988) although some authors have reported the contrary (Reid et al. 1992). In a cross-sectional study conducted in the US by Falciglia et al. (1988), the mean AMA of oldest men (80-89y) was 8% less than that of youngest men (60-69y) and among women the difference was 8.9%, reflecting a decline in muscle area

with age. Yassin and Terry (1991) found a negative correlation between AMA and age ($r = -0.28$, $p<0.001$) indicating a decline in muscle area with advancing age in females and Herman et al. (1998), reported a decline in corrected AMA in both men and women although the decline was greater in men than in women. The gender difference was speculated to be the result of differences in nutritional status, lifestyles or the ageing process. On the contrary, in their study of post-menopausal women, Reid et al. (1992), reported that AMA was not age dependent. It is possible that this was due to the fact that people with a history of osteoporosis were excluded which may have introduced a bias. Furthermore, lower muscle areas have also been associated with risk of mortality as reported earlier (Friedman et al. 1985; Campbell et al. 1990) stressing its importance as a nutritional indicator.

2.2.3 NUTRITIONAL STUDIES OF THE ELDERLY

Malnutrition among older people has been reported in developed countries (Lipschitz, 1992, Stuckey et al. 1984; DHSS, 1979; DHSS, 1972; Rea et al. 1997) and to a limited extent, in developing countries (Herman et al. 1998; Marlow et al. 1996; Ethangatta et al. 1996; Thoner; 1993; Yassin and Terry, 1991; Ramji and Thoner, 1991; Waswa et al. 1988; Ndaba and O'Keefe, 1985). In a study conducted in Ireland recently (Rea et al. 1997), 10 % of females aged > 90y had a BMI of ≤ 18.5 kg/m^2. On the other hand, Marlow et al. (1996) demonstrated that undernutrition (BMI < 18.5 kg/m^2) was very high in urban India (36.5% of the men and 44% of the women).

In Africa, studies on the well being of older people are now emerging (Allain et al. 1997; Charlton et al. 1997; Aspray et al. 1996; Angura and Anyuru, 1994; Coombes et al. 1994; Nmadu, 1994; Matuja and Ndosi, 1994; Wilson et al. 1991; Olubuyide and Solanke, 1990; Olubuyide et al. 1991; Apt, 1990, 1993; Pappoe et al. 1990; Togonu-Bickersteth, 1987; Hampson, 1985; Elk et al. 1983; Waterston, 1982; Drury, 1972) but very few have actually assessed the nutritional status of older people although malnutrition was cited as one of the causes of death among the elderly in Uganda (Drury, 1972) and Kenya (McLigeyo, 1993). Togonu-Bickersteth (1987) related self-assessed health to objective health status of rural Nigerians and found that people tended to overestimate their good health. In Tanzania, Matuja and Ndosi (1994) assessed elderly attending a hospital clinic

and found a high prevalence of chronic diseases and infectious diseases whereas Apt (1990), studied the role of family in the care of older people in Ghana. In Zimbabwe, functional and health status were studied in both urban and rural areas and a high prevalence of independence was reported (Wilson et al. 1991; Allain et al. 1997). More recently, the nutritional status of older people has been assessed in Africa (Charlton et al. 1997; Ethangatta et al. 1996; Thoner, 1993; Aspray et al. 1994; Waswa et al. 1988). A study conducted in Zimbabwe (Thoner, 1993) reported a prevalence of malnutrition (malnutrition defined as BMI < 18.5 kg/m^2) of over 50% among males and 38% among females in both pre- and post-harvest periods. Aspray et al. (1994) compared anthropometric measurements of younger people (25-40y) to that of older people (60-85y) without indicating the prevalence of undernutrition in the Gambia. Charlton et al. (1997) have recently assessed micronutrient deficiencies in South Africa and revealed a prevalence of anaemia of 13.9% in both sexes combined (11.4% in men and 16.2% in women). Waswa et al. (1988) in Kenya also reported a high prevalence of anaemia (21%) in their sample (n=75 males and 63 women aged 50 years and over) and indicated that weight for height below 80% of the standard was associated with lower socio-economic status index. However, most of the studies did not consider alternatives to measurement of height nor did they relate nutritional status to functional ability an aspect which is crucial in the well-being of older people.

It has been suggested by Durnin (1989) that anthropometric measures would be more meaningful if they are associated with some functional tests among the elderly, for instance grip strength or to general exercise capacity, or if longitudinal anthropometric data were associated with morbidity and possibly death. In addition, Kelly and Kroemer (1990) also suggested linking anthropometric measurements with activities of daily living (ADL) since anthropometry is considered to be static and needed to be related to dynamic measurements. This kind of understanding is also being advocated by WHO (1995).

Furthermore, since inter-regional and geographical differences occur in anthropometric measurements, a need for developing references for a specific ethnic group according to age and sex has been expressed (Burr and Phillips, 1984; Kubena et al. 1991; Delarue et al. 1994). Work of Kubena et al. (1991) showed that for each age-group, there were

differences in anthropometric measurements between men and women and also for MUAC between younger and older men and women. In addition, when Delarue et al. (1994), compared their French data with Americans 50th percentile values in the 70-74 years population, triceps skinfold thickness (TSF) and MUAC were higher in American women and TSF higher in men. Differences were also observed when this data was compared with Welsh data (Burr and Philips, 1984). Coming from affluent societies one would expect a lot of similarities although some of the differences could be attributed to sampling techniques or the actual methodology. For instance Delarue and colleagues took all their measurements on the right hand side of the body which is rather unusual since left hand measurements are preferred.

2.3 FUNCTIONAL ABILITY OF THE ELDERLY

Functional ability defined as the capability to live independently (Manandhar, 1995) is of great importance particularly to the quality of life of older people (Guralnik et al. 1989) and to their families and carers (Guralnik and Lacroix, 1992). Being inactive is associated with a greater susceptibility to disease which may in turn affect the nutritional status as explained earlier. Furthermore, it may lead to functional loss due to disuse. However, it should be borne in mind that old people may lose their functional ability owing to availability of assistance within their communities or within their vicinity rather than to biological causes (Travis and MacAuley, 1990). Thus, it is crucial to identify means through which functional ability could be maintained for as long as possible. Most of the studies on functional ability among older people have been conducted in developed countries, mostly in patients and those in institutions, and very little is known about the functional ability of older people in developing countries. Thus, most of studies cited in this section are from the developed countries and it is not clear whether the same applies to developing countries.

Disability is defined as the inability to carry out tasks which are essential for normal life. It is multi-dimensional and includes for instance the inability to perform ADLs (physical), memory problems (cognitive), being depressed (emotional), inability to interact effectively (social) (Rudberg et al. 1992). Disability (Wiener et al. 1990; Spitzer, 1987) together with health status (Rudberg et al. 1992) and nutritional status (Guigoz et al. 1996;

Spence, 1989) are some of the measures of quality of life which is defined as personal and social well-being and absence of disease (Butler, 1992). In line with WHO's definition of health, Butler defines personal and social well-being as the following:

"having intellectual ability; the capacity to perform ADL; freedom from pain and suffering; preservation of senses and sensuality; a social support system; an adequate financial base; mastery over one's life or independence; autonomy and choice; and a purpose outside of oneself that is a sense of usefulness; and some degree of happiness and morale."

2.3.1 MEASURING FUNCTIONAL ABILITY

Assessing physical function provides valuable information about whether the elderly live a life of vigour and are independent or if they are frail and dependent. It may also denote important later events which can be a basis for developing future interventions (Branch and Meyers, 1987) to prevent disability in old age or perhaps postpone dependence (WHO, 1984). Functional ability can be assessed through a number of ways which have been developed over the years mostly in developed countries (Guralnik and Lacroix, 1992). Most of the instruments used for assessing functional ability were initially designed for use in hospital or residential settings but are currently applied to elderly people living in communities. The most frequently used measures are assessment of self care, activities of daily living; maintenance of independence in the community, instrumental activities of daily living (IADL); and physical performance measures of functioning in which subjects are asked to perform a particular task or activity. Recently, Manandhar (1995) and Vespa (1992) reviewed some of the measures of functional ability which were also reviewed by Branch and Meyers (1987).

2.3.1.1 Activities of daily living (ADLs)

ADLs refer to the essential tasks of everyday life such as bathing, dressing, toileting, transferring, continence and eating (Katz et al. 1963; 1970; 1983; Katz and Akpom 1976; Spector et al. 1987; Fillenbaum, 1990; Institute of Medicine, 1990), which have been brought together in an index developed by Katz et al. (1963). The items are hierarchical implying that they are ranked in order of difficulty from the most to the least difficult.

The Katz index has been widely used in gerontological research with and without modification as shown in Table 2.3. It can be seen that there is a lot of variation in the ADL used in research hence results need to be interpreted with caution at all times. The Katz ADL index is known to be dependable, valid, easy to conduct and it can distinguish functional abilities among those deemed dependent or requiring assistance (Branch and Meyers, 1987). The original purpose of the Katz ADL index was to differentiate physical functional abilities among convalescing patients (Katz, 1963). However, recently, they have been used in assessing physical function of free living individuals.

Both cross-sectional and longitudinal studies have shown that functioning in ADLs declines with age (Barker, 1989; Haga et al. 1991; Antilla, 1991; Kua and Ko, 1994; Schroll et al. 1996; Herman et al. 1998). In a 10 year longitudinal study carried out in Japan, Haga et al. (1991) reported that 32.4% of the men and 25.6% of the women had lost competence in ADLs (Katz ADL index except continence). Although the sample was not representative owing to a poor response rate (44%), being a longitudinal study it still demonstrated that functioning in ADLs declines with age since the same people were studied prospectively therefore removing the cohort effects which cannot be disentangled in cross-sectional studies. Similarly, in the SENECA longitudinal study (Schroll et al. 1996), independence in ADLs declined by 25% in both men and women. The major limitation in this study was that both ADLs and instrumental ADLs (IADLs see page 46) were included as ADLs, making interpretation difficult. It is known that people tend to have more problems with IADLs than with ADLs a fact which could not be established from these findings. In another study conducted in Polynesia (Barker, 1989), functional impairment was strongly associated with age with 52% of those aged 75+ having 4-6 impairments compared to 21% of those aged 70-74y and 12% in the 65-69y age group (χ^2 = 15.14, $p<0.004$). However, in the same study, 26% of the older group (75+) were completely independent in all the activities assessed. It is worthy noting that the sample size was very small (age-group 65-69, n=17; age-group 70-74, n=19 and age-group 75+, n=27) and age was mostly estimated, therefore making it difficult to interpret the results. In Singapore, Kua and Ko (1994) showed that a decline in ADL was prominent after the age of 75 years. Work of Beckett et al. (1996) from their longitudinal study in the US showed that although functional ability declined with age, there was a substantial

Table 2.3: Type of activities of daily living used in research

Author	Sample	Characteristics	Activities of Daily Living								Score
			Bathing	Dressing	Toileting	Transfer	Continence	Eating	Walking	Grooming	Scale
Katz et al. 1963	1001	patients	x	x	x	x	x	x			3 point
Jette and Branch, 1981	2654	55 - 84 y, free living	x	x		x		x	x	x	2 point
Pinholt et al. 1987	44 m, 35f	patients, 70-89 y	x	x	x	x	x	x			3 point
Kaplan et al. 1988	1078	free living, 65y +		x	x			x			3 point
Gosman-Hedstrom et al. 1988	619	free living, 70 y	x	x	x	x		x			5 point
Asberg and Sonn, 1988	85	30y+ volunteers visiting occupational therapist	x	x	x	x	x	x			3 point
Barker, 1989	21 m 42 f	free living, 65-87 y	x	x	x			x		x	2 point
Jette et al. 1990	1625	free living, 65 y +	x	x		x		x	x		6 point
Stone et al. 1990	4136	free living, 65 y +	x	x	x	x		x			3 point
Kempen & Suurmeijer, 1990	78 f, 23 m	free living, 60 y +	x	x	x	x		x	x[1]	x	3 point
Travis & MacAuley, 1990	3611	institutionalised 59y +	x	x	x	x	x	x			3 point
Kane et al. 1991	5421	mixed, 65 y +	x	x	x	x		x			4 point
Antilla, 1991	284, 1978 471, 1988	free living, 75 y +	x	x	x			x		x	2 point
Haga et al. 1991	197 m, 225 f	free living, 69-71 y	x	x	x			x	x		2 point
Norstrom & Thorslund, 1991	421	free living, 75 y +	x	x	x	x		x			2 point
Osler et al. 1991*	2586	free living born 1913/18	x	x	x	x		x	x	x	4 point
Elam et al. 1991	73	Patients, 60 y +		x		x		x	x		5 point
Jagger et al. 1993	1203 baseline 503, 693 yrs later	mixed 75 y +	x	x	x	x	x	x			
Strawbridge et al. 1993	508 baseline 356 follow-up 6y	free living, 65 y +	x	x	x	x		x	x	x	5 point
Rudkin, 1994	3395	60 y +	x	x		x		x	x		2 point
Horowitz, 1994	91	Institutionalised 44-99y	x	x	x	x		x	x		4 point
Kua and Ko, 1994**	185 baseline 149 follow-up	65 y + home and day care subjects	x	x	x				x		4 point
PAHO, 1989	204 m, 37 f	free living, 65 y +	x	x	x	x		x	x	x	3 point

1 including climbing stairs. * IADLs in Table 2.4 considered as ADL. ** plus shopping and light household chores

proportion of older people who recovered from impairment while others did not lose their functional ability implying that age per se may not be a cause of loss of function and also that it is possible to reverse the decline in functional ability to some extent. The usage of ADLs in assessing functional ability of free living elderly people is of limited value since other important activities which are essential for independent living in the community are not included (Wiener et al. 1990). In addition, differences in ADLs between countries or regions may reflect variation in understanding the questions asked rather than differences in their functional ability (Fillenbaum, 1990) and perhaps cultural factors. Thus, other measures of functional ability were introduced to overcome these shortcomings.

2.3.1.2 Instrumental activities of daily living (IADLs)

IADLs developed later by Lawton and Brody (1969), refer to instrumental ADLs which may include activities such as shopping, managing money, use of public transport and use of telephone among others as shown in Table 2.4. These are activities which are more complex than ADLs but need to be fulfilled if older people are to lead an independent life within their communities (Fillenbaum, 1985; Kane and Bayer, 1991; Guralnik and Lacroix, 1992). However, the assumption that "if you can you will" which is applicable to ADLs does not apply for IADLs since with adequate help, older people may choose not to carry out these tasks (Branch and Meyers, 1987) although this may eventually lead to functional loss as a result of disuse (Travis and McAuley, 1990).

IADLs are also known to decline with age (Antilla, 1991) although their interpretation is more difficult than ADLs due to gender and cultural influences (Fillenbaum, 1990). For instance the inability to prepare meals reported by men may mean that culturally this task is performed by women and does not necessarily indicate functional impairment among men (Branch and Meyers, 1987; WHO, 1984). Such findings were observed in Sri Lanka where food preparation is seen as a woman's task (Fernando and Seneviratna, 1993). In Finland, the need for assistance with cleaning, gardening and grocery shopping increased in their 10 year study among older people aged 75 years and over (Antilla, 1991). However, this study was not a longitudinal study hence the shortcomings of cross-sectional studies may apply.

Table 2.4: Instrumental activities of daily living used in research

Author (s)	Sample	Instrumental activities of daily living								
		cooking	shopping	house keeping	laundry	transportation	telephoning	Medication	Finances	Other
Lawton & Brody, 1969	97m 168f 60y+	x	x	x			x	x	x	
Asberg & Sonn, 1988	85 volunteers visiting occupational therapist 30y+	x	x	x	x	x				
Koyano et al. 1989	7735 baseline, 7573 follow-up free living, 65 y	x	x			x	x		x	x[5]
Jette et al. 1990	1625 free living, 65 y +	x	x	x		x			x	
Kempen & Suurmeijer, 1990	78 f, 23 m 60y+	x	x	x	x					x[3]
Stone et al. 1990	4236, 65 years + free living	x	x	x	x	x	x	x	x	
Antilla, 1991	284, 1978; 471, 1988 free living, 75 years +	x	x	x	x					x[3]
Osler et al. 1991	2586, born 1913/18	x	x	x	x		x	x	x	
Norstrom & Thorslund, 1991	421, 75 years +	x	x	x	x				x	x[3]
Kane et al. 1991	5421, 65 years or older	x	x	x	x					
Strawbridge et al. 1993	508 baseline, 356 follow-up free living 65 y +	x	x	x						
PAHO, 1989	204 m, 337 f 65 y + free living	x		x		x		x		
Barberger-Gateau et al. 1993	1804 free living, 65 y +					x	x	x	x	
Ashworth et al. 1994	44 older subjects mean 70y 46 younger subjects mean 27y	x	x	x	x	x		x	x	
Fernando & Seneviratna, 1993	1200 60 y + free living	x	x			x			x	

Key

1 heating water **3** climbing stairs

2 bed making **4** gardening **5** Post office (visits)

ADLs and IADLs and health outcomes

Information available mostly from developed or industrialised societies suggests that dependency in ADLs and IADLs identify those with increased likelihood of short term mortality (Donaldson et al. 1980; Donaldson and Jagger, 1983; Spector, et al. 1987; Kaplan et al. 1988; Koyano et al. 1989; Scott et al. 1997). In analysing data from three studies, Spector et al. (1987) indicated that dependence in both ADLs and IADLs were associated with increased death ($p<0.05$). In Japan, studying the association between IADLs and mortality, in their one-year longitudinal study, Koyano et al. (1989) found that there was a significant increase in mortality among respondents dependent in IADLs although the causes of death were not established owing to unavailability of data. Similarly in Israel (Kaplan et al. 1988), dependency in three ADLs (eating, toileting and dressing) was associated with a mortality risk three times higher than those deemed independent (RR 3.6 vs 1.0, n=1078). This study was a five year longitudinal study but only 3.2% of the sample were actually dependent. After controlling for potential confounding variables, ADL-IADL scale emerged as one of the predictors of mortality among older people (≥ 65 years) in a 5 year longitudinal study (n=5,320) (Scott et al. 1997). Furthermore, dependencies in both ADLs and IADLs are each differentially associated with an increased likelihood of using health services frequently (Manton et al. 1987; Spector et al. 1987). In assessing data from 4 countries (Republic of Korea, Philippines, Fiji and Malaysia), Manton et al. (1987) reported that people with ADL (eating, dressing, grooming, walking and bathing) and IADL (telephoning, shopping, cooking and money management) problems reported using health services more frequently than their independent counterparts. However, older people tend to report fewer problems with ADLs than with IADLs as reported in Netherlands (Kempen and Suurmeijer, 1990) and Sri Lanka (Fernando and Seneviratna, 1993).

Over the years, numerous scales have been developed to assess functional abilities among older people living in institutions and those recovering from illness. Thus, in addition to the ADLs and IADLs described above, other indices which are used include the OARS (Older Americans Resources and Service Procedures) which assesses ADLs (eating, dressing, grooming, walking, transfer, bathing, continence and toileting) mental health, physical health, social and economic resources; PULSES (physical condition, upper limbs,

lower limbs, sensory, excretory and social function), Kenny Self Care Evaluation Scale which assesses bed activities, transfer, locomotion, continence, dressing and feeding and the Barthel Index which assesses feeding, grooming, transfer, toileting, dressing, bathing, stair climbing, walking/locomotion and continence (Collin et al. 1987; Shah et al. 1989) and these indices have reviewed by Branch and Meyers (1987).

2.3.1.3 Physical performance measures

Other measures of functional ability include physical performance tests in which the subjects are required to actually carry out particular tasks and performance is judged upon completion of an activity using standardised procedures (Guralnik et al. 1989). These methods have been widely reviewed by Branch and Meyers, (1987); Guralnik et al. (1989); Vespa, (1992) and Manandhar, (1995). Theoretically, according to Guralnik et al. (1989), these tests are reproducible, valid, sensitive to changes and the effect of poor cognitive function, culture, language, and education on these tests is much less. However, they tend to be more time-consuming, require more space and equipment and demand special training of examiners. Furthermore, there could be a possibility of injuries and ability to carry out simple tests may not mean ability to carry out difficult tasks encountered in daily life (Guralnik et al. 1989). The physical performance tests are designed to assess self care activities, mobility, flexibility, manual ability, psychomotor function and muscle strength.

Mobility can be defined as the ability to travel from one place to another (Fillebaum, 1990). It is also known to decline with age. In a study conducted recently in Guatemala (Herman et al. 1998), impaired mobility was higher in older age-groups particularly after the age of 70.

Manual dexterity: With this measurement, respondents are asked to fasten and unfasten a series of fasteners which are often used in daily life. They may include buckles, hook and eyes, slide bolts, lock and key *inter alia* (Manandhar, 1995). Several studies have been conducted using manual dexterity as a measure of function and have yielded interesting results. Ostwald et al. (1989) found that elderly sisters living in nursing homes performed poorly in manual dexterity (assessed as opening eight doors and closing seven doors) than

those in retirement homes and those living in the community (n=128). In another study (Williams et al. 1994), poor manual dexterity (assessed by a 27 item battery; opening nine doors and closing eight doors with bolt latch, screen-door latch, padlock, 5 hand skills in the dominant and non-dominant hand) was associated with an increased risk of death after controlling for age, gender, race and number of prescribed medication. However, they concluded that using shorter version of the 27 item battery may also yield similar results.

Psychomotor function refers to the ability of an individual to process and respond to specific external information or how the brain controls movement involving motor co-ordination and reaction. A variety of tests of psychomotor function exist which try to assess the time taken between an initiation of movement and the actual movement for instance simple and choice reaction times, tapping, moving the limb from one point to another, or crossing out symbols with a pencil or pen (Spirduso, 1980). The plate tapping test is one of the popular tests whose performance hinges entirely on psychomotor skill and not on strength (Bassey, 1990a). This is also known to decline with age (Era and Rantanen, 1997).

Hand grip strength

Handgrip strength is measured either in kg or Newton by squeezing a handgrip dynamometer with one's maximum strength (Chumlea et al. 1995; Bassey 1990b). It requires the action of several muscles in both the hand and forearm (Bassey and Harries, 1993) and it is vital for day to day activities of normal life such as using tools, transferring etc. (Manandhar, 1995; Skelton et al. 1994). Weak hand grip strength is related to low functional ability and to malnutrition. It has also been found to be related to mortality (Phillips, 1986; Milne and Maule, 1984). In studying 82 female patients, Phillips (1986) showed that lower handgrip strength was significantly associated with a high risk of death and a cut-off point of $\geq$ 5 kg was a demarcation between survival and death. Moreover, a weaker handgrip strength has been associated with an increased risk of falling (Wickham et al. 1989), inability to perform ADL (Gosman-Hedstrom et al. 1988), increased IADL dependence (Judge et al. 1996), increased risk of post-operative complications (Klidjian et al. 1980) and a lower manual dexterity (Hughes et al. 1997) as also demonstrated by Hyatt et al. (1990)($r^2 = 0.21$, $p<0.001$). In their study, Gosman-Hedstrom et al. (1988), reported

that people with ADL problems had muscle strength of 14% and 15% less than their normal counterparts among women and men. Most of these studies are cross-sectional which tend to be limited due to cohort effects and selective survivorship.

Recently, Kallman et al. (1990), from their cross-sectional and longitudinal studies indicated that grip strength increases into the 30s and after the age of 40, it declines at a faster rate. In addition, the study also demonstrated that 15% of the subjects older than 60 years did not experience a decline in grip strength in the 9y study period. They therefore concluded that a decline in muscle mass only partially explained the decline in strength suggesting that there were other factors which contributed to the decline in muscle strength apart from a decline in muscle mass. Reduction in muscle mass is a result of reduction in number of muscle fibers with age (Grimby and Saltin, 1983; Grimby, 1995) and also reduction in size of the muscle fibers (Lexell, 1995). Bassey and Harries (1993) attributed the decline in handgrip strength to reduced activity since muscle mass did not change that much. Webb et al. (1989), showed that handgrip strength declined in a non-linear manner although the study was unrepresentative since only volunteers were studied. It should be noted that genetic variability also has an influence on the handgrip strength of older people (Reed et al. 1991).

The major problem with hand grip strength measurement is that results may be affected by the level of alertness and encouragement, the subject's understanding of the procedure, and the general surroundings (Vespa, 1992). In addition, authors use different procedures (see Table 2.5) thus results should be interpreted with caution. In the past, studies showed that there was no significant difference between measures taken from left and right hand (Webb et al. 1989) but recently Bassey and Harries (1993) have revealed that the right hand is significantly stronger than the left in both men and women. Similar findings were reported by Harries (1985) although only two people were studied on several occasions.

The discussion above suggests that although there is diminution of functional ability with age, there is still a group of elderly people who remain functionally active. The aim therefore is to understand the mechanisms that contribute to the decline in functional ability so as to develop strategies which will slow down this process to ensure that the

Table 2.5: Equipment and measurement techniques for muscle strength

Author (s)	Sample Characteristic	Equipment		Hand used				Results used	
		Dynamometer (kg or N)	Sphygmomanometer (mmHg)	Dominant	Non-dominant	Right	Both	Average	Best
MacLennan et al. 1980	158 m, 112 f, free living 65y +	x				x		x (of 3)	
Kallman et al. 1990	847 volunteers, 20-100 y	x					x		x[1]
Skelton et al. 1994	50 m free living, 50 females	x					x		x
Hyatt et al. 1990	92 elderly day care and hospital, 30 young controls	x		x					x
Pearson et al. 1985a and 1985b	100 f, 84 m free living 65-90 y	x					x		x
Suboticanec et al. 1989	50 f, 50 m Institutionalised 65-80 y	x					x	x (of 2)	
Milne and Maule 1984	215 m 272 f, 62-90 y free living		x			x			x
Phillips, 1986	82 f patients, 35 f controls 61-93 y	x					x		x
Shukla et al. 1987	54m, 56f surgical patients 20-70 y	x			x			x (of 3)	
Martin et al. 1985	17 f, 18 m, normal 18-70 years 16m 15f patients	x					x	x (of 3)	
Jayarajan & Shetty 1992	18 healthy volunteers (adults)		x	x				x	
Bassey & Harries, 1993	359m, 561f, free living, 65 y +	x					x		x
Rantanen et al. 1994	95-101 m, 178-186 f, 75 y free living	x		x					x
Rikli et al. 1986	60 f volunteers, 21.1-68.9y (means)	x lafeyette		x					x
Reed et al. 1991	344 m 59-70 y volunteers	x lafeyette		x					x
Gosman-Hedstrom et al. 1988	619, 70 y free living	vigorimeter				x			x
Webb et al. 1989	247, 16-95 y healthy subjects, 90 patients (volunteers)	x			x				x
Webb et al. 1989	119 volunteers	x		x					x
Guo et al. 1996	127 patients mean age 54 203 healthy subjects mean age 49	x			x				x

Key

1 Sum of the best values for each hand

elderly people remain active and lead an independent and enjoyable life. This will certainly be beneficial to millions of elderly and their families in many ways since the elderly contribute significantly to family welfare particularly in developing countries (Manandhar, 1995; Coombes, 1995).

Most of the studies cited above have tended to assess functional ability of the elderly in relation to age, mortality, institutionalisation, diseases, use of health services *inter alia*. However, the trend now is to relate functional ability to nutritional status. Very few studies have been conducted so far with such objectives (Galanos et al. 1994, Manandhar et al. 1997a; Vellas et al. 1990; Harries, 1985). Harries (1985) showed that handgrip strength was positively associated with arm muscle area in Nigeria but his study only included 6 older people aged 55-64 and the rest were young adults (18-54y). In studying the relationship between nutritional status and falls among the elderly, Vellas et al. (1990) showed that fallers had a poorer nutritional status than non-fallers. This study was however limited since data for men and women were combined and therefore the findings could have been confounded by sex differences. In addition the sample size was very small (n=20 fallers and 20 non-fallers).

2.4 THE ROLE OF THE FAMILY IN THE CARE OF OLDER PEOPLE

Not much work has been done in the developing countries to identify the vulnerable amongst the elderly; it is assumed that they are all well taken care of by the extended family. In reality, the elderly may be even more vulnerable in the nineties in the wake of increased emigration of young able bodied family members to urban centres and the increasing number of young deaths due to the HIV/AIDS epidemic. The elderly in the rural areas in particular are left unprotected and are often in charge of much younger children themselves.

Family life is very important for the well-being of the elderly (Apt, 1990; Munro, 1982; Cantor, 1991; Sorensen, 1986) and in most developing countries the elderly depend entirely on their family for support and long-term care (WHO, 1984; 1989). Tout, in 1989, indicated that extended family phenomenon was still operating in the developing countries. In South East Asia, 75% of those aged 60+ live with their children in extended

families (Suzman et al. 1992) while in Jamaica 70% of the elderly live with their daughters, sons or spouse (Mesfin et al. 1989). In Uganda, only 40% of the elderly live with their children (Angura and Anyuru, 1994). In a study conducted in India, 98% of the elderly lived with other family members or friends (Manandhar et al. 1997b). According to a review by Apt (1990), there is some evidence suggesting that the traditional extended family unit is disappearing especially in urban areas where preference is for the nuclear type of families. It is believed that the tradition is dying due to modernisation, industrialisation and urbanisation and is further compounded by lack of adequate resources to care for the elderly (Chidzonga, 1984; WHO, 1989; Apt, 1990; Pappoe et al. 1990; Angura and Anyuru, 1994; Evans, 1990). With rapid migration of young adults to urban areas, the elderly people in rural areas are left to fend for themselves (Gore, 1990; WHO, 1984). Goldstein et al. (1993), however, argues that families have problems supporting the elderly people adequately as a result of the increasing poverty when the elderly must compete with other family members for limited financial resources, and not as a result of modernisation changes per se as suggested by others. In view of the problems outlined above, Macfadyen (1990) indicated that the possibility of maintaining the traditional support systems for the elderly people in the future should be challenged. Thus, for families to continue taking care of their elderly relatives they need support or alternatively, ways need to be devised so that older people can live independently for longer.

2.5 COPING STRATEGIES OF OLDER PEOPLE

In most developing countries, the elderly rely mostly on their families for support, since there are no institutions for the elderly as is common in developed nations (Scrimshaw, 1989; Rudkin, 1994), and Malawi is no exception. In addition, pension systems are uncommon, thus although some elderly are able to fend for themselves through farming and other income generating activities, children are known to help their parents particularly when their physical abilities diminish (Sorensen, 1986; Goldstein and Ku, 1993; Rudkin, 1994; Shi, 1994). Those who do not have children may rely on other relatives for help. However, the type of support tends to be varied and information available does not tell us whether the support given to the elderly is adequate for survival and for their well-being. In a study conducted in Ghana, Apt (1993) indicated that

although most children reported providing financial assistance to their elderly parents, their contributions were insufficient and infrequent. Similarly, in a study conducted in Zimbabwe (Hampson, 1985), only 20% of the sample were assisted financially or in kind by their children and yet 75% of the sample had children working in the formal sector. A question to be raised here is what about those whose children do not work or those who do not have children at all? These few studies underline the importance for the elderly to remain active in order to live independently for as long as possible.

In conclusion, understanding the problems of older people in developing countries is a matter of urgency and effort should be made to include older people on the agenda for government policies and programmes. Moreover, more research should be conducted and results should be properly disseminated to relevant organisations for decision-making, particularly in formulating strategies to ensure that older people lead an enjoyable life.

CHAPTER 3: STUDY DESIGN AND METHODS

This chapter gives a brief description of Malawi, its geography, economy and demographic characteristics. The chapter also describes the study population, study design and the methodology used in conducting the study and analysing the data.

3.1 COUNTRY PROFILE

3.1.1 GEOGRAPHY

Malawi is a land locked country, bordered to the north and north-east by Tanzania, to the east, south and south-west by Mozambique and to the west by Zambia (see Figure 3.1). The country is 901 kilometres long, while its width ranges from 80 to 161 kilometres. The total area of the country is 118,484 square kilometres of which 94,276 square kilometres is land area (NSO, 1994), the remainder being Lake Malawi.

Administratively, the country is divided into three regions: Northern, Central and Southern. There are a total of twenty-four districts, five in the Northern Region, nine in the Central Region and ten in the Southern Region. In addition, each district is divided into Traditional Authorities (TAs or Chiefs) which are further subdivided into villages, the smallest administrative unit (NSO, 1994).

3.1.2 ECONOMY

Agriculture is the backbone of Malawi's economy. Nearly 90% of the rural population derives its livelihood from agriculture, either directly or indirectly. In fact, about 90% of export earnings and approximately 75% of total employment arise from the agricultural sector although its contribution to the GDP is only 40 per cent. The major staple crop is maize although cassava and rice are also considered as major staple crops in some parts

Figure 3.1: Map of Malawi

of the country. Tobacco, tea and sugar are the major export crops. Other important crops which are grown include groundnuts, cotton, potatoes and beans. Agriculture is almost entirely rain-fed with a few irrigation schemes (GOM/UN, 1993). The government's basic objectives of the medium-term economic development strategy are to reduce poverty, ignorance and disease by achievement of sustained economic growth and improved income distribution and stability of welfare. High on the agenda is the concern to increase productivity of the assets available to the poor, mainly labour and land, and to reduce population growth.

3.1.3 DEMOGRAPHIC CHARACTERISTICS

The total population of Malawi in 1987 was 7.99 million and in mid-1992, it was estimated at 9.0 million excluding over 1 million Mozambican refugees (NSO, 1994). The total population is projected to increase to 12 million by the year 2000 although the AIDS epidemic is expected to cause a significant increase in mortality. The epidemic is expected to slow down the population growth rate to 2.1 % per annum (from 3.2%) by the same year 2000. The older people aged 55 years and over comprised only 8.1% of the 1987 population. However, since the population of the older people has been increasing over the last three decades (see Figure 3.2) both the number and the proportion are likely to increase in the decade ahead. It is worth noting that over 90% of these older people reside in the rural areas (GOM; 1967, 1980, 1988).

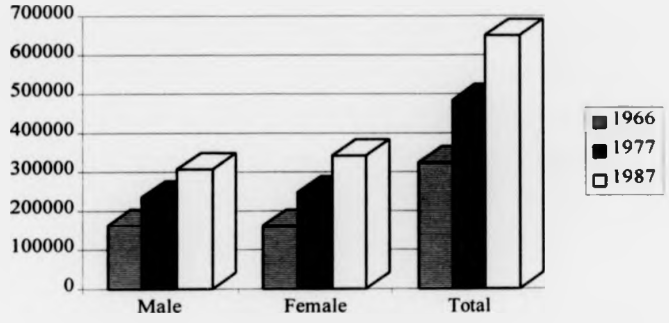
3.2 THE STUDY POPULATION AND DESIGN

3.2.1 DESCRIPTION OF THE STUDY AREA

The study was conducted among older people aged 55 years and over in selected rural areas of Lilongwe district in Malawi. The selected areas were three Traditional Authorities (TA) namely: Chiseka, Mazengera and Kabudula. In each TA, one health centre was selected at random: Mitundu rural hospital in TA Chiseka, Mtenthera health centre in TA Mazengera and Nsaru health centre in TA Kabudula.

Figure 3.2

Population of the Elderly (55 years +) in Malawi by Year and Sex



Lilongwe district is situated in the Central region (see Figure 3.1) and it embraces the capital of Malawi. The study areas (TAs) are situated within 35-50 km from the city and hence represent rural area. Specifically, the location of the health centres is as follows: Mitundu is situated 36 km south, Mtenthera is situated 35 km south-east and Nsaru is situated 45 km north-west of the city.

3.2.2 DESCRIPTION OF THE STUDY POPULATION

The study population comprised a total of 296 subjects, 97 men and 199 women aged from 55 to 94 years. The subjects were recruited using a multi-stage cluster sampling technique (District - Traditional Authority - Health centre - Village). Three TAs were selected proportion to size and then one health centre was selected randomly from each TA in order to provide a random sample from the chosen district. Four villages were then selected from each health centre to participate in the study. The villages were selected according to their proximity to the health centre since initially, it was felt that the study would be conducted at health centres.

A mini-census was conducted in each selected village to determine the number of old people in the villages. A total of eleven (11) villages from the three TAs were eventually visited in order to reach the required sample size.

3.2.3 JUSTIFICATION FOR THE CHOICE OF STUDY DESIGN

The design of the study was chosen for logistic reasons. It would have been appropriate to use a simple random design but due to financial and time constraints, this was not possible. However, it was felt that the sample would still provide the answers to the questions posed.

The choice of villages based on proximity to a health centre could have been a possible source of bias in the sense that only those residing close to health centres were selected. However, it became apparent that even what was considered to be a short distance, would still be too far for the subjects, hence they were interviewed in their own villages. The issue of bias is unlikely to be a major concern because it became apparent during the study that not many old people go the hospital anyway and as such, it is very unlikely that this had any serious repercussion on the data collected.

3.3 SAMPLE SIZE

The sample size of the study was calculated using equations for studies which aim at estimating a quantity of interest with a specified precision (Kirkwood, 1988). The study's first specific objective was used in determining the sample size.

Assumptions

1. According to a survey conducted in 1992, 10.1% of Malawian rural adult women had BMI values less than 18.5 kg/m^2. For sample size calculations, it was assumed that among the older people the risk would be the same in both males and in females.

2. After much consideration, it was decided that we wanted to estimate low BMI within ± 5% that is we wanted our 95% confidence interval to be no wider than ± 5%. As the width of this confidence interval is ± 1.96 s.e. (standard error), this

meant that we wanted to study enough older adults to give a standard error as small as 2.55% (0.0255).

The sample size was obtained using the following formula as described by Kirkwood (1988, p 197):

$$n = \frac{\pi(1-\pi)}{e^2}$$

where π = was the estimated proportion

e = required size of standard error

$$n = \frac{0.101(1-0.101)}{0.0255^2}$$

$$= 140$$

This was multiplied by two (a worst-case 'design effect') to allow for the cluster sampling methodology used. It was also felt that the prevalence of impairment would be similar to undernutrition since a lot of studies have indicated rates of 10-20% depending on type of function. Thus a sample of 296 respondents was considered adequate for the assumptions made.

3.4 CRITERIA FOR SELECTION OF SUBJECTS

3.4.1 INCLUSION CRITERIA

All subjects who were in the age category of 55 years and above were included in the study. However, it was difficult to ascertain peoples' ages so a mini-census was carried out to register all old people in the selected villages and local historical events and a secondary series of questions about age at birth of first surviving child and child's age were used to estimate their ages.

It was not possible to conduct a door-to-door census of the selected villages due to financial constraints, so people were asked to gather at a chief's house for interviews. It is speculated that the process of biological ageing occurs earlier and proceeds faster in

developing countries than in most developed countries due to hardships of life, long-term malnutrition, disease exposure and physical work patterns so that individuals may be biologically old at a chronological age lower than 60 years (Kalache, 1991; Nordberg, 1997). Thus, adults aged 55 years and over were included in the sample. Nevertheless, more women than men in the age group 55-59 were interviewed since women were more forthcoming in participating in the study than men. It is also possible that men in the age group 55-59 did not consider themselves old or were engaged in employment outside the villages, and hence, were not available for the study.

3.4.2 EXCLUSION CRITERIA

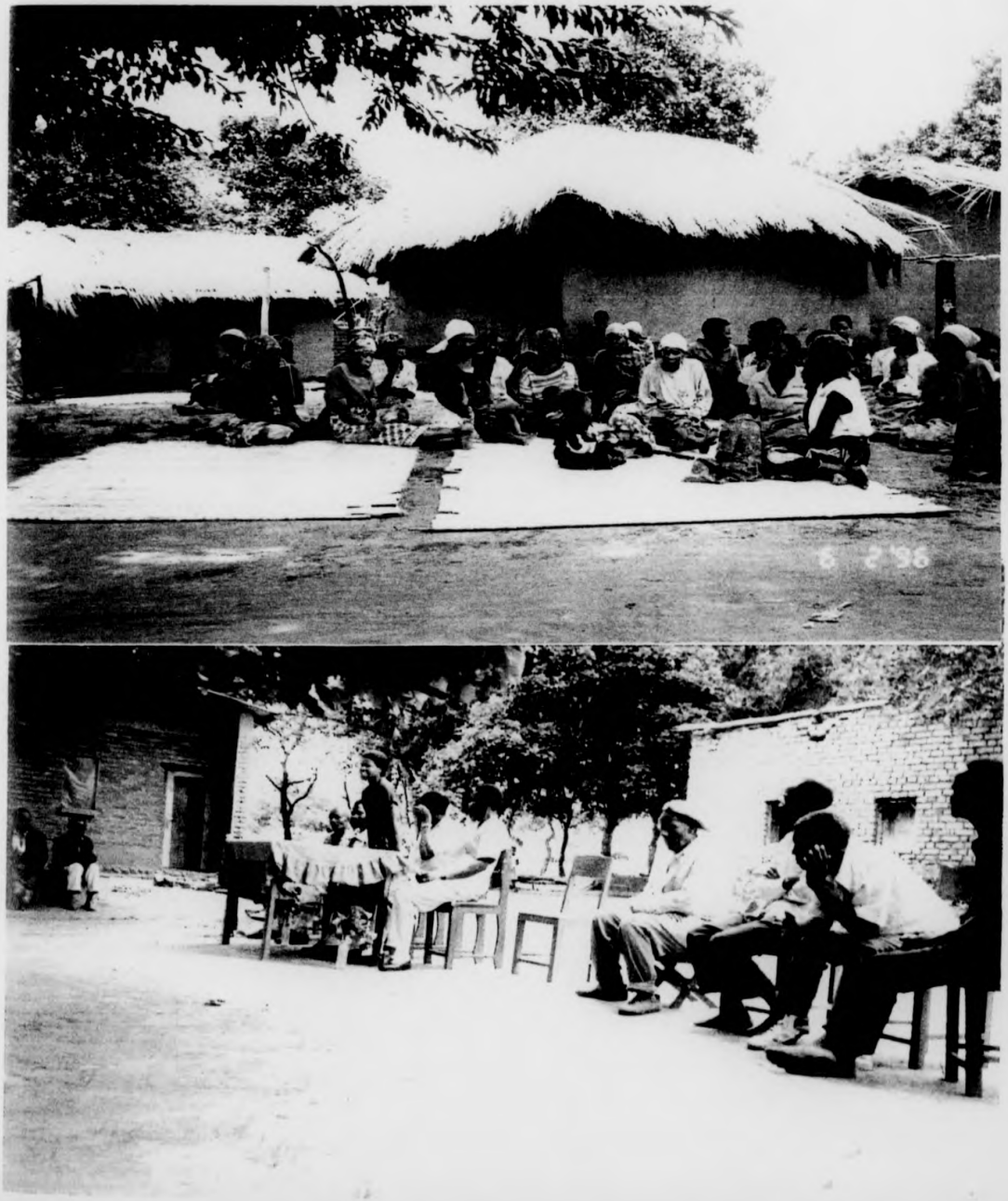
Those that were critically ill or were unwilling to participate were excluded from the study. In addition, those whose estimated age was later discovered to be less than 55 years of age were also excluded (n=10).

3.5 PREPARATORY PHASE

The study was approved by the Ethics Committee of the London School of Hygiene and Tropical Medicine, University of Malawi and the Ministry of Health and Population, Malawi. In addition, verbal informed consent was obtained from the respondents before commencing the study.

Meetings were conducted by the principal researcher with officials in the Ministry of Health and Population at headquarters, district and local levels. Furthermore, meetings were held at village level with the local Chiefs first then with the people to brief them about the project prior to commencing the study (plate number 3.1). The Ministry of Health sent circulars to the District Health Officer and to the participating health centres soliciting their co-operation and also bringing to their attention the whole study before the visits were made by the principal researcher. In some cases, the letters were carried by the principal researcher to the participating health centres during the familiarisation tour. The study fell under the umbrella of the Ministry of Health and Population and as such Health Surveillance Assistants (HSAs) were actively involved in the preparatory phase, particularly in notifying the village headmen and introducing the principal researcher to

plate number 3.1, Briefing session with local people



people in the villages. Not only were meetings held during the preparatory phase, but also accommodation arrangements were made for the research assistants.

3.5.1 STAFF RECRUITMENT

One graduate and three diplomates from Bunda College of Agriculture and one from Kamuzu College of Nursing were employed and trained as research assistants. The training ensured efficient performance of staff and also that tasks were carried out correctly and in a standardised way. Training of staff included translating the questionnaire, discussions and piloting the study. The pilot study was conducted in a village close to Bunda College of Agriculture where the principal researcher was based. A total of five subjects were studied and modifications were then made where necessary.

All staff had a social background (had done sociology courses) hence had experience in dealing with people although not necessarily with old people. Co-operation did not pose a barrier because the subjects were very open and willing to participate in the study. The graduate research assistant acted as a field supervisor in addition to taking all anthropometric measurements throughout the study period. One of the staff was a nurse who performed the clinical assessments. In each health centre, research assistants resided close to the study villages for logistic purposes.

3.5.2 IDENTIFICATION OF SUBJECTS

After the mini-census, subjects were notified by their chiefs through a Health Surveillance Assistant (HSA) about the forthcoming interviews. Dates were arranged and all subjects were asked to assemble at a particular place for the interviews. When more people turned up than could be interviewed, some were sent home and asked to report again the following day.

3.5.2.1 Response rate

According to 1987 census data, the average number of older people per village in the three selected TAs was 46 and since eleven villages were included in the study, it was estimated that the total population of older people in the villages studied was 506. Since 296 respondents were studied, this gave a total response rate of 58.5%. The response rate was

higher among women than among men. Men were generally less willing to participate in the study, possibly because of employment. Also those aged under 60 years did not consider themselves old and therefore were not available for the study.

According to population census report in 1987, the sex ratio for those aged 55 years and over was 91 males per 100 females. In this study, there were more females than males. This could be because men were busy working elsewhere or that the women were more forthcoming than men. Generally, most surveys conducted in Malawi have tended to focus on women hence making it more acceptable for women to participate in this study.

Problems were encountered when a rumour circulated that we were taking blood from subjects. In one village, subjects did not turn up for interviews until a demonstration was conducted with the chief and a few volunteers as respondents. Although many people turned up after that, there is a strong chance that others did not due to fears related to the circulated rumours.

3.5.2.2 Age determination

Accurate determination of age was very difficult among the subjects. Thus, for those who could not remember their exact ages, age was estimated by matching memory with particular historical events, such as the famous famine (1949) and also relating these events to whether they were married, had matured or had children at that time etc. In situations where age estimated using different events differed, an average was taken to represent the final age.

3.6 DATA COLLECTION

Data were collected at a central point (in a village) and home visits were done for those who were unable to reach the designated areas. Data were collected over a four month period from April to July, 1996. Four to five respondents were interviewed per day. After each interview, respondents were given a drink and a snack as a token of appreciation for their participation. Interviews were not conducted when there were funerals or on public holidays.

Data collected fell into six main categories:

a) Demographic, socio-economic and other general information gathered by questionnaire
b) Assessment of functional ability
c) Anthropometric measurements
d) Functional tests
e) Cognitive function
f) Clinical assessment

3.6.1 Demographic, socio-economic and other general information

In each area, subjects were interviewed using a pre-tested questionnaire. The questionnaire covered issues such as demographic information e.g. name, sex, age, marital status, living arrangements, socio-economic status e.g. educational level, sources of income, social network and support, attendance of meetings (religious and or with friends), assistance received, visits, stressful events (bereavement in the last 12 months) and fears and concerns (e.g. whether they were satisfied with life and if not why not). Also, issues relating to food access were examined. Questions asked included food patterns and practices for instance, number of meals consumed in the pre- and post-harvest periods (see appendix 1 and 2 for the English and Chichewa versions of the questionnaire).

The questionnaire was designed following a review of literature on factors which are likely to have an influence on both nutritional status and functional ability and thereby rendering older people vulnerable (see chapter 2). In addition, reference was made to other studies with similar interests (Manandhar et al. 1997b).

3.6.2 Functional ability (ADLs and IADLs)

Activities of daily living (ADLs) which included bathing, dressing, toileting, continence, transferring and eating were assessed by asking the subjects whether they were able to perform these activities in the previous week without any help (coded 2), or with some assistance (coded 1), or if they were unable to do the activity at all (coded 0). These questions developed and validated by Katz et al. (1963) and used mostly in developed

countries are now also being used sometimes with modifications in developing countries (see chapter 2). IADLs which refer to activities which are essential to an individual living in a community for instance cooking, shopping, managing money, using public transport *inter alia* were assessed by asking what other activities they were able to carry out within the home and around their communities.

3.6.3 Anthropometric measurements

A total of six anthropometric measurements (weight, height, demi-span, armspan, arm circumference and triceps skinfold thickness) were taken using methodologies described by Chumlea, (1991), Fidanza, (1991), Gibson, (1990), Kwok and Whitelaw, (1990), Durnin, (1989), Martin et al. (1988), Bassey, (1986), McPherson et al. (1978) and Dequeker et al. (1969). All measurements were taken twice except for triceps skinfold thickness which was measured in triplicate. Any oedema, kyphosis (spinal curvature) or bent legs which could affect some of the measurements were noted by the nurse as well as the person taking anthropometric measurements. Relevant measurements for those with oedema were considered missing for these subjects in the analysis of data but for the kyphotics and those with bent legs, height was estimated from armspan using regression equations as explained later.

3.6.3.1 Weight

Weight was measured on an electronic weighing scale (Soehnle Electronic scale, model 7305.00) calibrated in 100 g units and with a maximum weight of 150 kg. The scales were placed on flat level ground and against a wall, where possible, and feet were clearly drawn on the standing position. Subjects were asked to remove any shoes or slippers, any heavy items from their pockets, and any coats or sweaters so that they were weighed with minimum clothing. Weight was recorded to the nearest 0.1 kg.

3.6.3.2 Height

Height was measured using a portable height stadiometer (height gauge) with a metal base. The stadiometer was placed on a flat ground against a straight wall and subjects were asked to stand on the base without shoes or any head gear and with the head in a Frankfurt plane position. The subjects were then asked to take a deep breath in order to

straighten the spine and the head piece was brought down until it was resting firmly on top of the highest part (crown) of the head. Height was then recorded to the nearest 0.1 cm.

3.6.3.3 Armspan

This measurement was taken using a flexible steel tape (with a metal tip). In order to take the measurement, the subjects were asked to stand erect against a wall as in height measurement with both arms raised and outstretched laterally and maximally at the level of the shoulder with the palms facing forward. The measurement was then taken by passing the flexible steel tape in front of the clavicles and measuring from the longest fingertip to the longest fingertip. Arms were supported where necessary at the elbow and two people were required to take this measurement. Where there was a contracture or a deformity or where subjects were unable to stretch both arms fully, the measurement was obtained by measuring from fingertip to the sternal notch (halfspan) and then doubling the figure (McPherson et al. 1978 ; Dequeker et al 1969) and where this was not possible, the measurement was declared missing. Armspan was recorded to the nearest 0.1 cm.

3.6.3.4 Demispan

This measurement is similar to armspan but only one arm is used and the length of fingers is excluded. Demispan was measured from the sternal notch to the dip between the middle and fourth finger (ring finger) while the subject was in a similar position as when taking armspan measurement (Bassey, 1986; Kwok and Whitelaw, 1990) and using the same flexible steel tape. All values from subjects with problems in stretching their arms were declared missing.

3.6.3.5 Mid Upper Arm Circumference (MUAC)

MUAC was measured on the mid point of the upper arm between the tip of the olecranon process of the elbow and the acromion process on the shoulder blade with the arm hanging loosely by the side of the body using a fibre glass Harpenden anthropometric tape measure to the nearest 0.1 cm. The mid point was identified by bending the left arm of the subjects at the elbow to a right angle with the forearm placed across the trunk with the head in Frankfurt plane, then taking the measurement between the tip of the olecranon and acromion process and dividing it by two. The circumference of the arm was measured at

the mid-point. Care was taken to ensure that the tape was wrapped gently round the arm without compressing the tissues or making the tape too loose.

3.6.3.6 Triceps skinfold thickness

To measure triceps skinfold thickness, a Holtain skinfold caliper was used to take the measurement at 1 cm above the mid point marked for the MUAC measurement to the nearest 0.2 mm. Three measurements were taken and the caliper was released for each measurement. If the measures did not agree within 1 mm, then the series was repeated.

For all anthropometric measurements, pre-set limits were used as a safeguard against imprecision as shown in Table 3.1. If the difference between two measures was more than the pre-set limit, then the measurement was repeated.

Table 3.1: Acceptable limit for duplicate measurements

Measurement	*Acceptable limit*
Weight (kg)	0.2
Height (cm)	0.5
Armspan (cm)	1.0
Demispan (cm)	1.0
Arm circumference (cm)	0.5
Triceps skinfold thickness (mm)	1.0

3.6.4 Functional tests

Four physical performance tests were carried out: handgrip muscle strength measurement (Bassey, 1990b), plate tapping test (for psychomotor function), lock and key test (for manual dexterity) (Bassey, 1990a) and memory test (for cognitive function, see section 3.6.5). These tests have been used widely in developed countries (see chapter 2) but are now being applied in developing countries with modifications as reported by Manandhar (1995).

3.6.4.1 Handgrip strength

An electronic grip strength dynamometer (TKK 5101, Grip-D) was used to measure hand grip strength. The dynamometer measured up to a maximum force of 100 kg force. After a demonstration, each subject held the dynamometer in the hand with the arm held across the body and squeezed to maximum force. Four trials were given on the dominant hand and three trials on the other hand (alternately). Subjects were given a lot of verbal encouragement by the assessors to achieve maximal effort. Muscle strength was recorded to the nearest 0.1 kg. The best score of all the trials was used in the analysis.

3.6.4.2 Psychomotor function

The plate tapping test was used to measure the speed and co-ordination of psychomotor skills among the subjects. Firstly, the table was set by fixing two circular discs each 20 cms in diameter and green in colour securely on a table top (80 cms apart). A rectangular plate (10 cms x 20 cms) pink in colour was later placed between the circular discs and equidistant from each disc. Subjects were then asked to stand in front of the table with feet slightly apart and with the non-preferred hand placed on the rectangular plate. They were asked to move their preferred hand from one circle to another as quickly as possible for 25 times. This movement was timed using a quantum stop watch and was repeated after the muscle strength measurements. The fastest movement was used in the analysis.

3.6.4.3 Manual dexterity

A lock and key test was used to test the manual ability (hand skill and flexibility of fingers) of the subjects. Subjects were asked to pick up a key and open a padlock. The ability to pick up and to hold the key was assessed as well as the time taken from picking the key to opening the padlock recorded in seconds using a quantum stop watch.

3.6.5 Cognitive function

This was assessed in two ways. Firstly, the subjects were asked if they remembered which day of the week it was and also which year it was. This was part of the general questionnaire. Secondly, as part of functional tests, a tray with 10 objects normally used in the communities was presented and subjects were given one minute to look at the objects and were later (after all the functional tests were completed) asked to recall the

objects in one minute. The 10 objects which were used for the memory test included a cup, money (coin), a box of matches, a safety pin, a nail, a comb, a bottle, a spoon , a key and a button.

3.6.6 Clinical assessment

The clinical examination was carried out by a nurse to identify those with ailments and/or with oedema and also other health related questions.

3.6.6.1 General clinical assessment

The pre-tested questionnaire included questions to assess self reported health of the respondents, medical conditions, chronic illnesses, smoking and drinking habits, availability of care as well as whether they sought any medical help. In addition, the nurse also assessed general health of the respondents and their status during interviews.

3.6.6.2 Blood pressure

A mercury sphygmomanometer (model number 610) and a stethoscope were used to measure blood pressure of the subjects in mmHg (millimetres of mercury). The soft rubber of the cuff of the sphygmomanometer was inflated around the upper arm until it was tight enough to stop blood flow in the main artery and then the cuff was gradually deflated until, by listening through a stethoscope, the blood could first be heard as a beat forcing its way along the artery and this was recorded as systolic pressure. The cuff was then deflated further until the blood flowed steadily through the open artery giving diastolic pressure (James and Pecker, 1994; WHO, 1996).

Those that were identified as being ill or having high blood pressure (>90 mmHg diastolic and >140 mmHg systolic blood pressure, WHO, 1996) were referred to the nearest hospital (see appendix 3 for a sample referral letter) and depending on the extent of the illness, they were not required to perform the physical tests.

3.7 SUPERVISION AND DATA QUALITY CONTROL

The principal researcher had primary responsibility for controlling the quality of the data to be collected in the field. This was achieved by ensuring that all procedures were

followed and also by reviewing carefully all completed questionnaires. The field supervisor (BSc graduate from Bunda) was responsible for day to day running of the project in the field (liasing with local leaders and HSAs) and was also responsible for supervising staff in the field. He was also involved in checking, coding and editing completed questionnaires as well as giving progress report to the principal researcher. The principal researcher visited the study areas everyday at the beginning of the study and subsequently, regular visits were done to supervise and also to ensure smooth running of the project. Spot checks as well as random visits were done by the principal researcher. Research assistants were re-trained before starting a new area to ensure that data was collected according to standardised techniques.

Field meetings (group as well as individual meetings) were held once a week between supervisor and interviewers as well as between field supervisor and the principal researcher to discuss progress and problems faced during data collection as well as to boost the morale of the interviewers.

A random sample of 31 respondents (about 10% of the sub-sample) were re-measured by the principal researcher in order to check for accuracy and precision of the measurements and also to ensure that the required procedures were followed. In addition, the sub-sample were also re-measured by the research assistant for the calculation of technical error of measurements (TEM) for intra-observer errors, since all the anthropometry was done by one research assistant. In addition, inter-observer errors were calculated to compare the measurement between the research assistant and the principal researcher. **TEM** is defined as the square root of the sum of the squared differences of replicate measurements divided by twice the number of pairs (Mueller and Martorell, 1988; Ulijaszek and Strickland, 1993). Reliability is defined as the proportion of inter-subject variance which does not contain any measurement errors (Ulijaszek and Lourie, 1994). Inter- and intra-observer errors and reliability of the results (formulas shown below) are shown in Table 3.2.

$$TEM = \sqrt{(\sum d^2) / 2N}$$

Where d^2 is the square of differences between replicates and N is the number of pairs

In a situation where more than two measurements were taken for a particular variable, in this case triceps, and for calculating inter-observer errors, the following formula was used:

$$TEM = \sqrt{\sum_{i=1}^{N}\left[\sum_{j=1}^{K} x_j^2 - (\sum_{j=1}^{k} x_j)^2 / K\right] / N(K-1)}$$

where K is number of measurements taken per subject

x_j^2 is the squared value of the jth replicate (j = 1- k)

N is the number of subjects

$$S^2 = \frac{(\Sigma x^2 - (\Sigma x)^2/n)}{n-1}$$

$$R = 1 - (TEM^2 / S^2)$$

where

R is the coefficient of reliability that ranges from 0 to 1 (the coefficient indicates the degree to which a given measurement is error free)

TEM^2 is the square of the technical error of measurement

S^2 is the inter-subject variance and n is the number of observations

Table 3.2: Technical error of measurement for the anthropometric measurements

Measurement	Intra-observer error		Reliability R		Inter-Observer error	Reliability R
	Assistant	PR	Assistant	PR		
Weight (kg)	0.04	0	0.9999	1.00	0.25	0.9989
Height (cm)	0.10	0.09	0.9999	0.9999	0.28	0.9991
Armspan (cm)	0.13	0.15	0.9998	0.9998	0.68	0.9958
Demispan (cm)	0.10	0.14	0.9996	0.9991	0.70	0.9780
MUAC (cm)	0.09	0.07	0.9991	0.9994	0.40	0.9820
Triceps (mm)	0.22	0.21	0.9981	0.9985	0.85	0.9730

PR = principal researcher

Table 3.2 shows that reliability for all the measurements for both intra- and inter-observer errors was high (R > 0.97). Technical errors of measurement were highest for triceps skinfold thickness. Thus, all the measurements were over 97% error free or the variance in the measurements were due to factors other than measurement errors. The measurement errors were within acceptable limits of greater than 0.95 as reported by Ulijaszek and Lourie (1994). The technical error of measurements for height, MUAC and triceps were certainly below the maximum accepted levels as reported by Ulijaszek and Lourie (1994) in Table 3.3.

To minimise instrument bias, the weighing scale was calibrated weekly against a cast iron weight of 5 kg. Recording error was minimised by daily checking the recording forms by the field supervisor and also by the principal researcher. All mistakes were corrected and other doubtful measures were repeated later.

Table 3.3: Maximum levels for technical error of measurement at two levels of reliability for either intra- or inter-observer errors for anthropometric measurements

Measurement	*TEM Males*		*TEM Females*	
	18-64.9	*65+*	*18-64.9*	*65+*
Reliability = 0.95				
Height (cm)	1.52	1.52	1.39	1.35
MUAC (cm)	0.73	0.74	0.98	0.98
Triceps (mm)	1.38	1.29	1.94	1.86
Reliability = 0.99				
Height (cm)	0.68	0.68	0.62	0.60
MUAC (cm)	0.33	0.33	0.44	0.44
Triceps (mm)	0.62	0.58	0.87	0.83

Source: Ulijaszek and Lourie (1994)

3.8 DATA ENTRY

The data were entered by a data entry clerk and the principal researcher using the data entry software of Statistical Package for Social Sciences (SPSS) version 4.0 (SPSS, 1987). The data were then stored on computer diskettes.

3.9 DATA ANALYSIS

Data were cleaned using computerised range and consistency checks as well as ongoing analyses of data. Identified problems were clarified by going back to the original questionnaires. Data for oedematous respondents were analysed separately. Data analysis was done by the principal researcher under the guidance of the supervisor (Dr Suraiya Ismail) and a statistician (Mr Tom Marshall). SPSS (Statistical Package for Social Sciences) version 5.0 and version 6.1 (windows version) were used in the analysis of data (Norusis, 1991, 1992, 1995, 1997).

3.9.1 DERIVED MEASUREMENTS

For respondents with visible kyphosis (n = 49), height was estimated from armspan using regression equations developed from non-kyphotic respondents within the sample. This was an attempt to derive their actual height since with a spinal curvature and bent knees, people appear shorter than they normally should have been without the kyphosis. The equations used were are indicated below but worth noting is the fact that age did not enter the regression equations.

Males **Estimated Height** (cm) = 51.5 + 0.64 (armspan)

Females **Estimated Height** (cm) = 45.9 + 0.66 (armspan)

Other derived measurements were:

i. **Body Mass Index (BMI)** using height = weight(kg)/height $(m)^2$

ii. **Body Mass Index (BMIARM)** using armspan = weight(kg)/armspan $(m)^2$

The cut-off points for BMI shown in Table 3.4 were used to indicate nutritional status according to Shetty and James, (1994) and James et al. (1988).

iii. **Mindex** (females) = weight (kg)/demispan (m)

iv. **Demiquet** (males) = weight (kg)/demispan $(m)^2$

Mindex and demiquet are directly analogous to body mass index but the range of values are different (Lehmann et al. 1991; Lehmann and Bassey, 1996).

Table 3.4: BMI Classification

BMI	***Nutritional Status***
< 16.0	Severely malnourished
16.0 - 16.9	Moderately malnourished
17.0 - 18.4	Mildly malnourished
18.5 - 24.9	Normal
25.0 - 29.9	Grade I Obesity (overweight)
≥ 30.0	Grade II & III Obesity

v. **Arm Muscle Circumference** (AMC) was computed using the following formula:

$$AMC = MUAC\ (cm) - \frac{\pi \times triceps\ (mm)}{10}$$

Where MUAC is mid upper arm circumference

vi. **Mid Arm Muscle Area (AMA)** was calculated as below:

$$AMA\ (cm^2) = \frac{(AMC)^2}{4\pi}$$

vii. **Corrected Mid Arm Muscle Area (CAMA)** was computed as below:

$$\text{male CAMA } (cm^2) = \frac{(AMC)^2}{4\pi} - 10$$

$$\text{female CAMA } (cm^2) = \frac{(AMC)^2}{4\pi} - 6.5$$

CAMA is arm muscle area corrected for bone area according to sex.

viii. **Mid-upper arm fat area (MUAFA)** was determined as below:-

$$\textbf{MUAFA } (cm^2) = TUA - AMA$$

where

$$\textbf{TUA} \text{ is the Total Upper Arm Area} = \frac{(MUAC)^2}{4\pi}$$

ix. **Arm Fat Index (AFI)** (% of fat in the upper arm) = $\frac{\text{MUAFA}}{\text{TUA}} \times 100$

(Source: Frisancho, 1990)

3.9.2 FUNCTIONAL IMPAIRMENT

Relative functional impairment was defined as being in the lowest 25th percentile for handgrip strength and number of objects recalled and in the highest 25th percentile for manual ability and psychomotor function (timed tests). These definitions are based on standard epidemiological practice since there are no standard cut-off points for functional impairment. However, means and percentile distributions from this study are compared with those reported in the literature in the discussion section of this thesis. The cut-off points used based on the criteria described above are shown in Table 3.5. In addition, if an individual was unable to perform or complete a test, he/she was classified as 'impaired' for that test.

Table 3.5: Cut-off points used to define relative functional impairment

Test	*Males*	*Females*
Handgrip strength (kg)	24.7	18.9
Key time (secs)	8.7	14.8
Plate tapping time (secs)	20.7	21.0
Number of recalled objects	< 5	<6

An impaired ADL score was defined as dependency or requiring assistance in at least one ADL (bathing, dressing, toileting, transferring, continence and eating) while impaired mobility was defined as the inability to walk or requiring assistance in walking a distance of 1 km or requiring assistance in movement as observed by the enumerator.

3.9.3 UNIVARIATE AND BIVARIATE ANALYSES

The data were subjected to a series of univariate and bivariate analyses. For the anthropometric measurements and functional ability tests, means, standard deviations and percentiles were calculated. In order to determine if there were any significant differences

in continuous variables between sexes and among age-groups, parametric tests such as t-tests and analysis of variance (ANOVA) were conducted. Tukey B multiple comparisons were done to find which means were significantly different as a *post hoc* test. Variables which had a skewed distribution were transformed prior to any parametric tests and for some, non-parametric test namely Kruskal-Wallis was conducted. In addition, a modification of t-test known as a Welch test was done when the variances of males and females were significantly different using the Levene test. For categorical variables, in order to determine if there were any associations between variables, non-parametric tests such as chi-square (χ^2) through cross-tabulations were employed (Armitage and Berry, 1987; Kirkwood, 1988; Altman, 1991; Bryman and Cramer, 1994; Norusis, 1991, 1995 and 1997).

3.9.4 MULTIVARIATE ANALYSIS

Multiple linear regression was employed with nutritional status and functional ability indicators as dependent variables and all other social and clinical variables as independent variables. When nutritional status indicators were dependent variables, functional ability variables were entered in the analysis as independent variables and vice versa.

Prior to the analysis, a correlation matrix was developed for all the variables to ensure that the entered variables were not highly related to one another to avoid the problem of multicollinearity. A stepwise procedure was employed level by level of the hierarchical model described fully in chapter 4 (multiple regression analysis section). This method entails that variables which are highly related to the dependent variable are included in the equation in steps depending on their contribution to the explained variance and those that do not meet the program's statistical criteria for inclusion in the analysis are eliminated from the analysis. However, since stepwise method accords priority to the statistical criteria as opposed to theoretical ones, its use is still subject to debate (Bryman and Cramer, 1994; Norusis, 1991, 1995, 1997; Feinsten, 1996). Thus, by using a hierarchical model, a theoretical causal pathway was used in the analysis. Listwise deletion of cases was used whereby all cases with a missing value for any one of the variables specified in the block were not included in the multiple regression analysis. Inevitably, this means that

oedematous subjects (whose weights, MUACs, skinfolds and derived measurements were missing) were excluded.

CHAPTER 4: RESULTS OF THE STUDY

This chapter describes the results of the study in six parts which are:- general information, clinical information, anthropometry, functional ability, relationship between nutrition and function and finally, results of multiple regression analysis.

PART A 4.1 GENERAL INFORMATION

4.1.1 SAMPLE CHARACTERISTICS

Out of 308 interviewed, 2 had incomplete data, 10 were judged to be below 55 years of age and were hence excluded from the analysis. A total of 296 respondents (97 males and 199 females) aged from 55 to 94 years, were therefore studied. The sex ratio of the respondents was 49 males per 100 females (1:2). Oedema was seen in 4.1% (n=12, 3 males and 9 females) of the total sample and their results are discussed separately. Thus, the following discussion is for non-oedematous respondents (284 respondents, 94 males and 190 females).

4.1.2 DEMOGRAPHIC CHARACTERISTICS

The demographic characteristics of the respondents are presented in Table 4.1.

4.1.2.1 Age

Among males, the mean age was 68.9 years (SD 8.1, range 55-94) and among females, the mean age was 63.3 years (SD 6.1, range 55-85). Men were significantly older than women ($t = 6.02$ $df = 147.45$, $p < 0.001$). Proportionately, there were significantly more older men than women in the study (pearson $\chi^2 = 31.5$, $df = 2$, $p < 0.001$) as shown in Figure 4.1 and Table 4.1.

Table 4.1: Demographic characteristics of the respondents, number (%)

Characteristic	*Males (n=94)*	*Females (n=190)*	*Total(n=284)*
Marital status			
Married	78 (83.0)	78 (41.1)	156 (54.9)
Separated/divorced	5 (5.3)	22 (11.6)	27 (9.5)
Widowed	11 (11.7)	90 (47.4)	101 (35.6)
Living arrangement			
Alone	4 (4.3)	21 (11.1)	25 (8.8)
With other people	90 (95.7)	169 (88.9)	259 (91.2)
House-bound	4 (4.3)	3 (1.6)	7 (2.5)
Educational level attained			
None	32 (34.0)	108 (56.8)	140 (49.3)
Standard 1-4	27 (28.7)	48 (25.3)	75 (26.4)
Standard 5-8	30 (31.9)	27 (14.2)	57 (20.1)
Above standard 8	4 (4.3)	3 (1.6)	7 (2.5)
Couldn't remember	1 (1.1)	4 (2.1)	5 (1.8)
Age group			
55-59	12 (12.8)	51 (26.8)	63 (22.2)
60-69	40 (42.6)	111 (58.4)	151 (53.2)
70+	42 (44.7)	28 (14.7)	70 (24.6)
Average number of children per respondent	10.7	8.4	9.2

4.1.2.2 Marital status

Nearly 55% of the respondents were married, significantly more men (83.0%) than women (41.1%). In contrast, more women than men were either separated/divorced or widowed, 11.6% vs 5.3% and 47.4 vs 11.7%, respectively (see Figure 4.2) (pearson χ^2 = 45.2, df = 2, p< 0.001). For those who were married, 34.9% of the men and 52.9% of the women had been married once, while 65.1% of the males and 47.1% of the females had been married more than once. Among women, widowed respondents were significantly older than those married or separated or divorced (mean ages were 61.1 years for the married, 62.3 years for the separated/divorced and 64.6 years for the widowed, f= 4.63 and p = 0.01). However, no such age differences were observed among men.

Figure 4.1

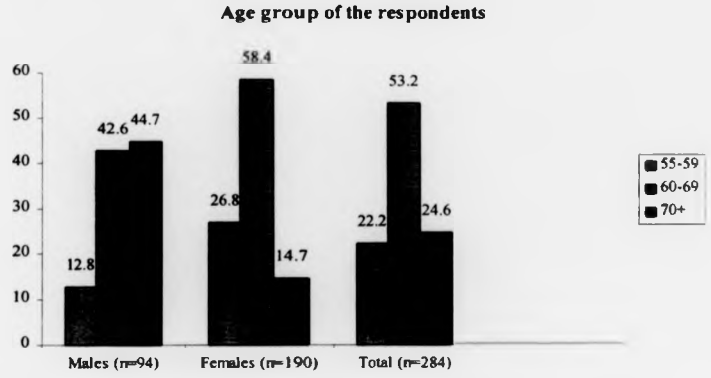
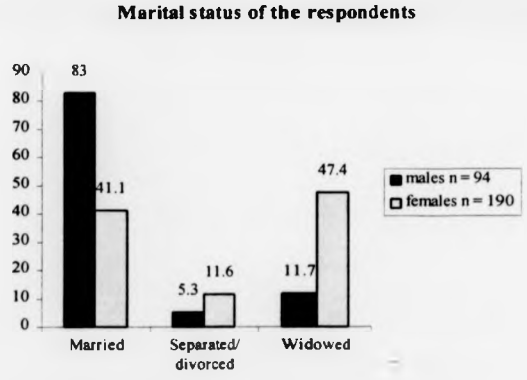


Figure 4.2



4.1.2.3 Living arrangement

Living arrangement were similar for males and females, with few people living on their own. However, relatively more women (11.1%) lived on their own than men (4.3%). Living with other people was defined as living with any relative (not just son, daughter or spouse). Altogether, 2.5 % of the respondents were house-bound (4.3% (n=4) of the males and 1.6% (n=3) of the females).

4.1.2.4 Household composition

Among males, the median number of people in the household was 5.0 (range 1-16) and among females, it was 4.0 (range 1-12).

4.1.2.5 Number of children

On average, males (n = 90) had had 10.7 children as opposed to 8.4 children for females (n = 179). All males had living children while 96.8% of the females had living children. With respect to the total number of children alive, males had 3.0 and 3.7 living sons and daughters respectively, while females had 2.0 and 2.3 living sons and daughters, respectively. It should be noted that two male respondents were polygamous.

4.1.2.6 Educational level attained

Literacy levels were low among the subjects, with about 50% of respondents without any education at all. However, the situation was worse among women than men (56.8% vs 34%). Thus, over 60% of the men had some education as opposed to less than half of the women.

4.1.3 HOUSEHOLD HEAD AND OCCUPATIONAL STATUS

Table 4.2 shows the household head and occupational status of the household head as reported by respondents. Overall, the majority of the households were headed by males (61.1%). In addition, since more women reported to be living alone, or being separated or widowed, more reported heading their own households.

As shown in Table 4.2, most of the household heads (over 80%) were engaged in agricultural activities, with a few involved in either business or other employment. One percent of household heads from male respondents and 2.6% from female respondents, had more than one occupation. Tobacco and maize were major crops grown by most households. Other crops grown included sweet potatoes and groundnuts. A few household heads also practised dairy farming. Business ventures included beer brewing (particularly among women), carpentry, and one respondent had a grocery.

Table 4.2: Household head and occupational status of household head

Head	*Males (n=94)*	*Females (n=190)*	*Total (n=284)*
Male (respondent or husband)	89 (94.7)	86 (45.3)	175 (61.6)
Female (wife or respondent)	3 (3.2)	88 (46.3)	91 (32.0)
Brother	0	2 (1.1)	2 (0.7)
Daughter	0	6 (3.2)	6 (2.1)
Son	1 (1.1)	3 (1.6)	4 (1.4)
Son/Daughter in-law	1 (1.1)	2 (1.1)	3 (1.1)
Granddaughter	0	3 (1.6)	3 (1.1)
Occupation			
None	7 (7.4)	16 (8.4)	23 (8.1)
Farming	78 (83.0)	161 (84.7)	239 (84.2)
Builder	3 (3.2)	1 (0.5)	4 (1.4)
Tinsmith	0	1 (0.5)	1 (0.4)
Carpenter	0	1 (0.5)	1 (0.4)
Watchman	2 (2.1)	3 (1.6)	5 (1.8)
Business	2 (2.1)	1 (0.5)	3 (1.1)
Clerk/messenger	0	1 (0.5)	1 (0.4)
Reverend	1 (1.1)	1 (0.5)	2 (0.7)
Farming and business	1 (1.1)	4 (2.1)	5 (1.8)
Farming and clerk/messenger	0	1 (0.5)	1 (0.4)

4.1.4 PAST AND PRESENT OCCUPATION

Table 4.3 shows the past and present occupation of the respondents. The results of the study show that an overwhelming majority of the respondents were engaged in agricultural activities both in the past and at present. However, there were other occupations which were prominent among men but were rare among women.

Table 4.3: Past and present occupation of the respondents

Occupation	*Past Occupation*		*Present Occupation*	
	Males n=94	*Females n=190*	*Males n=94*	*Females n=190*
None	0	4 (2.1)	7 (7.4)	15 (7.9)
Farming	64 (68.1)	177 (93.2)	82 (87.2)	171 (90.0)
Business	7 (7.4)	28 (14.7)	6 (6.4)	24 (12.6)
Watchman	5 (5.3)	0	5 (5.3)	0
Cook/housemaid/garden boy/baby-sitter	15 (16.0)	8 (4.2)	0	0
Ward attendant/labourer	3 (3.2)	1 (0.5)	0	0
Meat /tobacco grader/butcher	5 (5.3)	0	0	0
Road works	4 (4.3)	0	0	0
Carpentry/ timber boy, sawyer	5 (5.3)	0	2 (2.1)	0
Teba/mining	9 (9.6)	0	0	0
Army/policeman	3 (3.2)	0	0	0
Builder/construction	4 (4.3)	0	2 (2.1)	0
Clerical duties	12 (12.8)	2 (1.1)	0	0
Driver/mechanic	3 (3.2)	0	0	0
Plumber	2 (2.1)	0	0	0
Clinical Officer	1 (1.1)	0	0	0
Reverend	0	0	1 (1.1)	0
Casual labour	0	0	0	2 (1.1)

In addition, 49.7% of the males and 15.8% of the females had more than one past occupation while 11.6% females and 11.8% males had more than one present occupation. Furthermore, it appears that there was a shift among males towards more agricultural work, whilst among females, more women were involved in business activities now than in the past. Beer brewing featured highly both in the past and at present as a major business venture although other activities were cited among other respondents. These included tailoring, mat making, building houses, firewood sales, moulding bricks, making baskets, making hoes and plumbing.

A key finding was that very few of the older people in the sample (less than 8%) had no current occupation. This percentage is likely to be even lower if a higher participation rate had been achieved, especially among men.

4.1.5 SOURCE OF INCOME

Respondents relied upon numerous sources of income as evident in Table 4.4. The majority of the respondents (82% of the males and 65.5% of the females) relied heavily on agricultural sales as a source of income. Agricultural production also provides food for family consumption. Other prominent sources of income were business activities mentioned above and contributions from children. More importantly, it should be noted that 19.3% males and 25.5% females had more than one source of income.

Table 4.4: Source of income

Source	*Males n=94*	*Females n=190*
None	0	1 (0.5)
Agricultural sales	77 (81.9)	125 (65.8)
Business	11 (11.7)	42 (22.1)
Children	14 (14.9)	50 (26.3)
Builder	1 (1.1)	0
Watchman	6 (6.4)	0
Casual labour	2 (2.1)	7 (3.7)
Other people	0	3 (1.6)
Son/daughter in-law	0	2 (1.1)
Spouse	0	1 (0.5)
Brother/sister	0	3 (1.6)
Carpentry	1 (1.1)	0
Grandchildren	1 (1.1)	3 (1.6)
Pension scheme	1 (1.1)	0

4.1.6 INCOME

The average monthly income for males was K227/month (out of 22 respondents) and for females, it was K197/month (out of 27 respondents). Seventy seven percent (76.6%) males and 85.8% females did not know their monthly income. Similarly, the average annual income for males was K2,233/year (out of 30 respondents) and for females, it was K3,512.4/year (out of 17 respondents). Sixty eight percent of the males and 91% females did not know their annual income.

4.1.7 SOCIAL NETWORK

Social network was assessed by asking questions relating to the frequency of attending religious functions, frequency of meeting friends outside their homes, the ability to visit relatives and other people, being visited and also the type of assistance they obtained from relatives and other people within their communities.

4.1.7.1 Attendance of religious meetings

Results of the study show that about a third of the female respondents and over 40% of the males did not attend religious meetings at all. However, for those that reported attending religious meetings, frequency of attendance varied among individuals considerably as documented in Table 4.5.

Table 4.5: Social interaction

Category	*Males n=94*	*Females n=190*	*Total n=284*
Attendance of religious meetings			
Never	42 (44.7)	59 (31.1)	101 (35.6)
Less than once a week	6 (6.4)	23 (12.1)	29 (10.2)
Once a week	26 (27.7)	76 (40.0)	102 (35.9)
More than once a week	20 (21.3)	32 (16.8)	52 (18.3)
Able to visit	81 (86.2)	165 (86.8)	249 (86.6)
Meeting friends outside home			
Very often, every few days	71 (75.5)	118 (62.1)	189 (66.5)
Less than once a week	3 (3.2)	6 (3.2)	9 (3.2)
Very rarely (occasionally)	9 (9.6)	29 (15.3)	38 (13.4)
Never	11 (11.7)	37 (19.5)	48 (16.9)
Visited at home	91 (96.8)	179 (94.2)	270 (95.1)
Assistance received	76 (80.9)	158 (83.2)	234 (82.4)

It is evident that the majority attended religious meetings once a week and also a substantial proportion attended these meetings more than once a week implying that they were actively involved in religious activities.

4.1.7.2 Frequency of meeting friends outside home

Of the people who reported meeting friends outside their homes, the majority (66%) enjoyed meeting friends frequently (every few days), while 15% of the females and just 10% of the males met friends outside the home occasionally (see Table 4.5). Table 4.5 also reveals that there was a substantial interaction between the respondents and the society at large. Over 80% of the respondents were able to visit children or other relatives whereas over 90% were visited by children and other people. Furthermore, they were also in receipt of some kind of assistance from children and other people.

4.1.7.3 Assistance received

The type of assistance respondents were receiving, from whom and the frequency of receiving the assistance are shown in Table 4.6. It is evident that the majority of the respondents received money and clothes frequently from their children although the actual value was difficult to assess. The results also reveal the importance of having children but also the significant contribution made by the community people in assisting older people.

4.1.7.4 Visits

The majority of the respondents were visited either by children or other people (relatives and the community) although the children's visits were less frequent. However, village life entails a lot of interaction which should also be acknowledged. The respondents were also able to visit children and other people as indicated in Table 4.7, although the frequency varied greatly among the respondents.

Table 4.6: Number (%) of respondents who received assistance, type, source and frequency of assistance received

Type of assistance	*Number (%) assisted*	*Who provided assistance**		*Frequency of getting assistance***		
		1	*2*	*1*	*2*	*3*
Clothes						
Males	37 (39.4)	32 (86.5)	5 (13.8)	18 (48.6)	19 (51.4)	0 (0)
Females	83 (43.7)	70 (84.3)	13 (15.7)	14 (16.9)	60 (72.3)	9 (10.8)
Total	120 (42.3)	102 (85.0)	18 (15.0)	32 (26.7)	79 (65.8)	9 (7.5)
Money						
Males	47 (50.0)	42 (89.4)	5 (10.6)	8 (17.0)	36 (76.6)	3 (6.4)
Females	112 (58.9)	95 (84.8)	17 (15.2)	17 (15.2)	81 (72.3)	14 (12.5)
Total	159 (56.0)	137 (86.2)	22 (13.8)	25 (15.7)	117 (73.6)	17 (10.7)
Food						
Males	22 (23.4)	17 (77.3)	5 (22.7)	0 (0)	7 (31.8)	15 (68.2)
Females	69 (36.3)	57 (82.6)	12 (17.4)	5 (7.2)	34 (49.3)	30 (43.5)
Total	91 (32.0)	74 (81.3)	17 (18.7)	5 (5.5)	41 (45.1)	45 (49.5)
Soap						
Males	6 (6.4)	6 (100)	0 (0)	2 (33.3)	1 (16.7)	3 (50.0)
Females	30 (15.8)	27 (90.0)	3 (10.0)	4 (13.3)	19 (63.3)	7 (23.3)
Total	36 (12.7)	33 (91.7)	3 (8.3)	6 (16.7)	20 (55.6)	10 (27.8)
Farming						
Males	22 (23.4)	21 (95.5)	1 (4.5)	3 (13.6)	4 (18.2)	15 (68.2)
Females	35 (18.4)	24 (68.6)	11 (31.4)	3 (8.6)	8 (22.9)	24 (68.6)
Total	47 (20.1)	45 (95.7)	12 (25.5)	6 (12.8)	12 (25.5)	39 (83.0)
Household chores						
Males	27 (28.7)	20 (74.1)	7 (25.9)	0 (0)	0 (0)	27 (100)
Females	84 (44.2)	54 (64.3)	30 (35.7)	0 (0)	6 (7.1)	78 (92.9)
Total	111 (39.1)	74 (66.7)	37 (33.3)	0 (0)	6 (5.4)	105 (94.6)

* who provided assistance
1 Son/daughter and in-laws
2 Other (relatives, friends, other people)

** Frequency of getting assistance
1 Rarely (<1 month)
2 Often (≤ once a week)
3 Very frequently (> once a week)

4.1.7.5 Relationship with other family members

In general, 90% of the respondents (93.6% of the males and 88.4% of the females) had good relationships with other family members. However, 2.1% of the females respondents appeared to have bad relationships with other family members while 4.3% of the males and 5.3% of the females expressed concern that their relationships were good to some extent implying that they had some reservations.

Table 4.7: Number (%) of respondents who were visited and were able to visit children and other relatives

Visits and visitations	*Number (%)*	*Frequency*		
		1	*2*	*3*
Visited by children				
Males	64 (68.1)	7 (10.9)	36 (56.3)	21 (32.8)
Females	120 (63.2)	15 (12.5)	57 (47.5)	48 (40.0)
Total	184 (64.8)	22 (12.0)	93 (50.5)	69 (37.5)
Visited by other (relatives & other people)				
Males	75 (79.8)	6 (8.0)	18 (24.0)	51 (68.0)
Females	138 72.6)	17 (12.3)	42 (30.4)	79 (57.2)
Total	213 (75.0)	23 (10.8)	60 (28.4)	130 (61.0)
Able to visit children				
Males	51 (54.3)	10 (19.6)	28 (54.9)	13 (25.5)
Females	97 (51.1)	19 (19.6)	45 (46.9)	33 (34.0)
Total	148 (52.1)	29 (19.6)	73 (49.3)	46 (31.1)
Able to visit other (relatives & people)				
Males	66 (70.2)	9 (13.6)	20 (30.3)	37 (56.1)
Females	138 (72.6)	24 (17.4)	46 (33.3)	68 (49.3)
Total	204 (71.9)	33 (16.2)	66 (32.4)	105 (51.5)

Frequency of visits

1 Rarely (<1 month)
2 Often (≤ once a week)
3 Very frequently (> once a week)

4.1.8 MEALS

The number of meals eaten in a day have a bearing on the probability of meeting ones' nutritional requirement. Among the respondents, the number of meals eaten varied from one to three in the pre-harvest period and from one to more than three in the post-harvest season. As seen in Table 4.8, a substantial number of people reported consuming only one meal on any day during the pre-harvest period compared to the post harvest period. This could be due to food shortage or reduced time for adequate meal preparation because of agricultural activities. On average, reported number of meals per day were 1.9 and 1.7 among males and females respectively in the pre-harvest period and 2.5 in the post-harvest period for both sexes. The difference between the seasons was significant ($p < 0.001$).

Table 4.8: Meals

	Males n=94	*Females n=190*	*Total n=284*
Number of meals			
Pre-harvest			
One	23 (24.5)	83 (43.7)	106 (37.3)
Two	54 (57.4)	75 (39.5)	129 (45.4)
Three	17 (18.1)	31 (16.3)	48 (16.9)
Missing	0	1 (0.5)	1 (0.4)
Post-harvest			
One	4 (4.3)	2 (1.1)	6 (2.1)
Two	38 (40.4)	84 (44.2)	122 (43.0)
Three and above	52 (55.3)	104 (54.7)	156 (54.9)
With whom they ate their meals			
Alone	12 (12.8)	20 (10.5)	32 (11.3)
Spouse	31 (33.0)	26 (13.7)	57 (20.1)
Son	21 (22.2)	22 (11.6)	43 (15.1)
Daughter	4 (4.3)	48 (25.3)	52 (18.3)
Son/daughter in-law	0	4 (2.1)	4 (1.4)
Grandchildren	35 (37.2)	107 (56.3)	142 (50.0)
Brother/sister	1 (1.1)	3 (1.6)	4 (1.4)
Other relatives	2 (2.1)	5 (2.6)	7 (2.5)
Friends	1 (1.1)	0	1 (0.4)
Other people	2 (2.1)	1 (0.5)	3 (1.1)
When they most enjoyed their meals			
When with other family members	10 (10.6)	22 (11.6)	32 (11.3)
When taken at regular intervals	19 (20.2)	31 (16.3)	50 (17.6)
When food is given when feeling hungry/with an appetite	32 (34.0)	61 (32.1)	93 (32.8)
When given preferred food	15 (16.0)	20 (10.5)	35 (12.3)
Other reason	11 (11.7)	25 (13.2)	36 (12.7)
Didn't know	6 (6.4)	30 (15.8)	36 (12.7)
Missing	1 (1.1)	1 (0.5)	2 (0.7)

Other people included in-laws, cousins, friends, workers
Other reasons included when they were not ill or worried or tired, when food was in abundance, after finishing garden work, after drinking some beer, harvesting period, rainy season, as long as she was satisfied.

Respondents were also asked about their meal time practices to determine if they had meals with other people, and if so, whom. Essentially, eating is considered to be one of the pleasures of life and eating time is taken as a social event hence giving an opportunity to the people to share experiences and have conversations with family or friends. As documented in Table 4.8, the majority of the male respondents shared their meals with grandchildren, sons and their spouses while female respondents shared their meals mostly with grandchildren and daughters. Twelve percent of males and 20% of females had meals with more than one group of people. There were, however, a substantial number of respondents (32, 11.3%) who ate alone.

In addition to asking the respondents whom they shared their meals with, they were also asked about when they most enjoyed their meals. Results of this query are presented in Table 4.8. The results show that majority of the respondents enjoyed their meals most when they had their food when they were hungry and when their appetite was good.

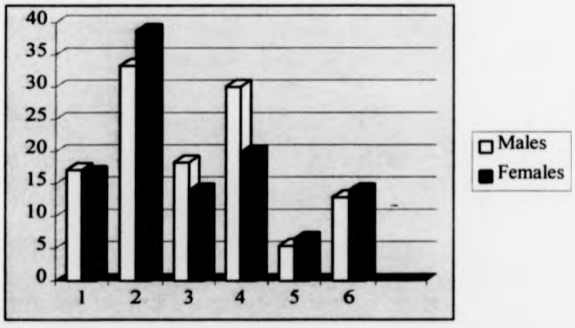
4.1.9 CONCERNS AND FEARS

4.1.9.1 Major life concerns

Older people like any other human beings have considerable fears and concerns. In this study, major concerns for the majority of both males and females appeared to be health and diet (33.0% of the males, 37.9% of the females) followed by money and property (29.8% males and 19.5% females) as illustrated in Figure 4.3 and summarized in Table 4.9.

Figure 4.3

Major life concerns of the respondents



Type of concern	
Preparation for death and spiritual life	1
Health and diet	2
Disability and increasing dependence	3
Money and property	4
Other family members	5
Other	6

Others were more concerned about preparation for death and spiritual life, disability and increasing dependence. From Table 4.9, it can be seen that a substantial number of respondents had other varied concerns which included farming problems, living alone, firewood problems, too many deaths and waning of energy. It should be noted that 21.4% of the respondents had more than one concern.

Table 4.9 : Major life concerns

Type of concern	*Males n=94*	*Females n=190*	*Total n=284*
Preparation for death and spiritual life	16 (17.0)	31 (16.3)	47 (16.5)
Health and diet	31 (33.0)	72 (37.9)	103 (36.3)
Disability and increasing dependence	17 (18.1)	26 (13.7)	43 (15.1)
Money and property	28 (29.8)	37 (19.5)	65 (22.9)
Other family members	5 (5.3)	12 (6.3)	17 (6.0)
Other	12 (12.8)	26 (13.7)	38 (13.4)
Missing	1 (1.1)	4 (2.1)	5 (1.8)
Number of concerns			
0	7 (7.4)	41 (21.6)	48 (16.9)
1	67 (71.3)	101 (53.2)	168 (59.2)
2 and above	20 (21.3)	48 (25.3)	68 (24.1)
Missing	1 (1.1)	4 (2.1)	5 (1.8)

Other concerns included farming problems, living alone, firewood problems, too many deaths, waning of energy.

4.1.9.2 Life satisfaction

Table 4.10 shows how subjects rated life satisfaction and also reasons for being dissatisfied with life. It shows that over 40% of the males and nearly 50% of the females were dissatisfied with life. The reasons for being dissatisfied with life varied greatly among respondents. The most prominent reason was health for both males and females as shown in Figure 4.4 and Table 4.10. Over 70% of males and females indicated that a health problem was the main reason for their being dissatisfied with life and this was followed by food and economic problems. Varying numbers of respondents mentioned other reasons for dissatisfaction. Clothing problems were seen to be a more common concern among females than among their males counterparts (30.0% vs 9.5%, $\chi^2 = 6.37$, $p = 0.01$). This also applied to social problems ($\chi^2 = 3.95$, $p = 0.05$).

Major life concerns and reasons for being dissatisfied with life are some of the reasons why people may become depressed or psychologically disturbed. From the results, health, food and economic problems were major problems cited by many respondents. Thus, programmes designed to address health issues, food security and good sanitation would certainly have a great impact on the welfare of older people.

Table 4.10: Life satisfaction and reasons for being dissatisfied with life

Satisfied with present life	***Males n=94***	***Females n=190***	***Total n=284***
Very dissatisfied	1 (1.1)	0	1 (0.4)
Dissatisfied	41 (43.6)	90 (47.4)	131 (46.1)
Satisfied	49 (52.1)	90 (47.4)	139 (48.9)
Very satisfied	2 (2.1)	1 (0.5)	3 (1.1)
Didn't know	1 (1.1)	7 (3.7)	8 (2.8)
Missing	0	2 (1.1)	2 (0.7)
Reasons for being dissatisfied with life	***Males n=42***	***Females n=90***	***Total n=132***
Economic problem	11 (26.2)	34 (37.8)	45 (34.1)
Health problem	33 (75.6)	65 (72.2)	98 (74.2)
Housing problem	4 (9.5)	11 (12.2)	15 (11.4)
Food problem	12 (28.6)	39 (43.3)	51 (38.6)
Transportation problem	4 (9.5)	9 (10.0)	13 (9.8)
Clothing problem	4 (9.5)	27 (30.0)	31 (23.5)
Social (activities/relations) problems	2 (4.8)	16 (17.8)	18 (13.6)
Other problems	7 (16.7)	12 (13.3)	19 (14.4)
Missing	1 (2.4)	0	1 (0.8)
Number of reasons for being dissatisfied with life			
1	26 (61.9)	37 (42.2)	63 (47.7)
2	6 (14.3)	16 (7.8)	22 (16.7)
3 and above	9 (21.4)	37 (41.1)	46 (34.8)
Missing	1 (2.4)	0	1 (0.8)

Other reasons for being dissatisfied with life included lack of care by children, lack of proper beddings, lack of water, thieves, living alone, too many deaths and lack of energy

4.1.9.3 Younger generation's attitude towards older people

Table 4.11 shows the attitude of the younger generation towards older people. It is evident that a large proportion of the older people thought that younger people had no respect for them at all (44.7% of the males and 40% of the females) or did not like or consider them important (13.8% of males and 6.8% females). Less than a quarter of the sample were happy with the young generation's attitudes and thought that they were respectful.

Figure 4.4

Reasons	
Economic problem	1
Health problem	2
Housing problem	3
Food problem	4
Transportation problem	5
Clothing problem	6
Social (activities/relations) problems	7
Other problems	8

Table 4.11: Younger generation's attitude towards older people

Attitude	*Males n=94*	*Females n=190*	*Total n=284*
Respect and help old people	19 (20.2)	46 (24.2)	65 (22.9)
Have no respect at all	42 (44.7)	76 (40.0)	118 (41.5)
Don't like old people/think that old people are not important	13 (13.8)	13 (6.8)	26 (9.2)
Think old people are witches/wizards	0	2 (1.1)	2 (0.7)
Didn't know	20 (21.3)	53 (27.9)	73 (25.7)

4.1.9.4 Deaths

Stressful events such as losing relatives or friends may result in depression which may have serious effects on the general well-being of older people, particularly if the people involved are closely related to them. Respondents were asked if they had lost any

relative(s) in the previous 12 months. Results of the study show that 72.3% of the males and 80.4% of the females had lost one or more relatives in the previous year. The relationship of the people who died to the respondents are presented in Table 4.12. While a large number of respondents had lost a brother or a sister in the previous year (62.1% of the males and 44.4% of the females), a substantial number also had lost a child (son or daughter) or grandchild.

Table 4.12: Relative(s) who died in the previous 12 months

Relative(s)	*Males n=66*	*Females n=151*
Spouse	5 (7.6)	4 (2.6)
Son	3 (4.5)	13 (8.6)
Daughter	2 (3.0)	15 (9.9)
Son/daughter in-law	0	5 (3.3)
Grandchild	7 (10.6)	33 (21.9)
Brother/sister	41 (62.1)	67 (44.4)
Other relatives	33 (50.0)	63 (41.7)

Other relatives included uncle, cousin, nephew/niece, aunt, parents, in-laws, great grand children and grand parents

Other respondents had lost a spouse, in-laws and other relatives. On average, each respondent male and female had lost 1.8 and 1.5 relatives in the last 12 months, respectively. Nearly 60% of males and 40% of women reported to have lost more than one relative. In addition to losing relatives, most respondents had also lost some friends. On average, males (n = 49) had lost 3.4 friends and females (n = 85) 3.8 friends in the previous 12 months.

PART B 4.2 CLINICAL INFORMATION

4.2.1 GENERAL HEALTH OF THE RESPONDENTS

Results of the general health of the respondents are shown in Table 4.13. The overwhelming majority rated their health as being either somewhat reduced or poor. This was also consistent the nurse's assessment although quite a large proportion was seemingly in good health.

Table 4.13: General health information

Condition	*Males n=94*	*Females n=190*	*Total n=284*
Self reported health			
Good	25 (26.6)	39 (20.5)	64 (22.5)
Somewhat reduced	58 (61.7)	127 (66.8)	185 (65.1)
Poor	11 (11.7)	23 (12.1)	34 (12.0)
Missing	0	1 (0.5)	1 (0.4)
General Health as assessed by a Nurse			
Good health	46 (48.9)	75 (39.5)	121 (42.6)
Minor health problems	46 (48.9)	112 (58.9)	158 (55.6)
Ill health	2 (2.1)	3 (1.6)	5 (1.8)
Type of health problem			
a) Short duration problem			
Malaria	12 (12.8)	21 (11.1)	33 (11.6)
Respiratory problems	16 (17.0)	34 (17.9)	50 (17.6)
Diarrhoea	1 (1.1)	13 (6.8)	14 (4.9)
Headache	2 (2.1)	12 (6.3)	14 (4.9)
b) Chronic condition			
Joint and muscular problems	29 (30.9)	44 (23.2)	73 (25.7)
Heart problems	0	7 (3.7)	7 (2.5)
Backache	5 (5.3)	7 (3.7)	12 (4.2)
Eye problems	1 (1.1)	6 (3.2)	7 (2.5)
High blood pressure	1 (1.1)	0	1 (0.4)
Diabetes	0	1 (0.5)	1 (0.4)
Teeth problems	2 (2.1)	0	2 (0.7)
Other problems*	1 (1.1)	2 (1.1)	3 (1.1)
% with more than one problem	10 (10.6)	24 (12.6)	34 (12.0)
No health problem	34 (36.2)	69 (36.3)	103 (36.3)
Where treatment was sought	*Males n=46*	*Females n=81*	*Total n=127*
Hospital/clinic	22 (47.8)	43 (53.1)	65 (51.2)
Traditional healer	0	3 (3.7)	3 (2.4)
Purchase from grocery	21 (45.8)	27 (33.3)	48 (37.8)
Self (traditional)	1 (2.2)	6 (7.4)	7 (5.5)
Other (water)	2 (4.3)	2 (2.5)	4 (3.1)

*Other problems included sore finger, hernia and paralysis

Respondents were asked if they were ill in the previous fortnight. The results show that slightly over 60% (63.8% of the males and 63.7% of the females) of the respondents were indeed ill during that period. The kind of illnesses that people suffered from are shown in Table 4.13. It is evident that in both males and females, the most prevalent health problems were joint and muscular pains, respiratory problems and malaria. A total of 10.6% males and 12.6% females had suffered from more than one illness in the previous two weeks, some of which were chronic complaints. However, 36.2% of males and 36.3% of females had neither experienced an illness in the previous fortnight nor suffered from a chronic complaint.

For those that were ill, 76.7% of the males and 66.9% of the females indicated that they sought treatment for the problems they had been suffering from. Both males and females sought treatment from hospital or clinic as well as purchasing medicine from local shops.

4.2.2 MENTAL STATUS

4.2.2.1 Cognitive screen

A cognitive screen is used to identify individuals with mental problems such as confusion, memory loss and disorientation. Changed or diminished cognitive status may be indicative of nutritional problems (Kuczmarski and Kuczmarski, 1993). In this study, results of the cognitive screen as assessed by questionnaire are shown in Table 4.14. It is evident that an overwhelming majority of the respondents (over 90%), remembered instantly what day of the week it was when they were asked to do so. However, relatively few subjects (46.8% males and 13.2% females) could remember immediately what year it was and 41.5% of the males and majority of the females (83.2%) did not know what year it was (see Table 4.14). A further component of the cognitive screen is the object recall test, administered as part of the functional ability tests. The results of this are given in section D of this chapter.

Table 4.14: Cognitive screen

Response	*Day of the week*		*Year*	
	males n=94	*females n=190*	*males n=94*	*females n=190*
Correct response	84 (89.4)	182 (95.8)	44 (46.8)	25 (13.2)
Incorrect response	7 (7.4)	5 (2.6)	11 (11.7)	7 (3.7)
Didn't know	3 (3.2)	3 (1.6)	39 (41.5)	158 (83.2)

4.2.2.2 Depression

Only 1.1% of the males and 4.7% of the females were diagnosed as not being alert during interviews and only 2.1% of the males and 7.7% of the females were visibly depressed during the interviews. One female respondent appeared worried because she had just lost her daughter.

4.2.3 MEDICAL CONDITIONS

Table 4.15 lists some of the medical conditions reported by the respondents. The medical conditions reported related to vision, hearing, memory, sleeping pattern, teeth problems, chewing problems and swallowing problems. Regarding hearing, about 80% of the males and about 70% of the females reported that their hearing was good. It appears that more women had difficulties with hearing than men (32.7% vs 21.3%).

Over 40% of both males and females indicated that they did not have any vision problems. However, over half the respondents reported having sight problems some of which were serious, and 4.3% of the men and 1.6% of the women regarded themselves as being blind. Major sight problems were related to short and long sightedness, double vision, dizziness and cataracts. For some respondents, the problems were present in one eye only. Nearly 90% of all respondents had lost some teeth and 3.2% of the males and 4.7% of the females had lost all the teeth. Nevertheless, only 2.3% of the males and 1.2% of the females had dentures. Some of the reasons why dentures were unpopular were cost or ignorance about their existence. However, others felt that they did not need dentures since losing teeth was natural in old age. It was further ascertained that 35% (34.1% males, 35.1% females) of all respondents had adapted to their problems by

Table 4.15: Reported medical conditions by sex

Medical condition	*Males n=94*	*Females n=190*	*Total n=284*
Hearing good			
Yes	74 (78.7)	126 (66.3)	200 (70.4)
Has some difficulties	19 (20.2)	59 (31.1)	78 (27.5)
Has great difficulties	1 (1.1)	5 (2.6)	6 (2.1)
Sight good			
Yes	40 (42.6)	78 (41.1)	118 (41.5)
No	1 (1.1)	0	1 (0.4)
Somewhat reduced	40 (42.6)	101 (53.2)	141 (49.6)
Much reduced	9 (9.6)	8 (4.2)	17 (6.0)
Regard self as blind	4 (4.3)	3 (1.6)	7 (2.5)
Teeth missing			
Yes , all	3 (3.2)	9 (4.7)	12 (4.2)
Yes, some	84 (89.4)	163 (85.8)	247 (87.0)
No, still have all teeth	7 (7.4)	18 (9.5)	25 (8.8)
Worsening of memory in the last 6 months			
Yes	46 (48.9)	132 (69.5)	178 (62.7)
No	48 (51.1)	58 (30.5)	106 (37.3)
Sleeping problems lately			
Yes	18 (19.1)	75 (39.5)	93 (32.7)
Sometimes	10 (10.6)	31 (16.3)	41 (14.4)
No	66 (70.2)	83 (43.7)	149 (52.5)
Missing	0	1 (0.5)	1 (0.4)
Chewing problems			
Yes, always	9 (9.6)	16 (8.4)	25 (8.8)
Yes, sometimes	43 (45.7)	94 (49.5)	137 (48.2)
No	42 (44.7)	80 (42.1)	122 (43.0)
Swallowing problems			
Yes	0	5 (2.6)	5 (1.8)
No	94 (100)	185 (97.4)	279 (98.2)
Obvious disability	8 (8.5)	11 (5.8)	19 (6.7)
Type of disability (8 m and 11 f)			
Blind	6	5	11
Lame	1	1	2
Other	1	5	6

Other disabilities included knock knees, blind (one eye only), abnormal fingers, hunch back, squint.

excluding some hard foods from their diets and another 12.1% of the males and 8.3% of the females had excluded many hard foods (for instance roasted maize) from their normal diets. Over half of the respondents experienced chewing problems. For some (about 10%), they experienced the problems always and for others (about half), it was

experienced occasionally. Swallowing of food was not a problem among males but it was seen to be a problem among 2.6% of the female respondents.

Almost half of the males and 70% of the females indicated that they had experienced worsening of memory in the previous 6 months. Among men, only about a third of the respondents experienced sleeping problems as opposed to 56.1% of the females. However, for some, the problem was experienced only occasionally. For females that had sleeping problems, 6.4% were taking sleeping pills to overcome the problem and for males, only 3.7% were taking sleeping pills to overcome the problem, occasionally. Among the males, only one respondent indicated that he took some pills but he could not remember how often he took the pills. As for women, the frequency of taking these pills varied among the respondents considerably. The majority, 85.7% took the pills at least once a week and another 14.3% took the pills once or twice a month. Eight percent of the men and 5.5% of the women were classified as having obvious disability. The type of disability varied among the respondents but included lameness and blindness.

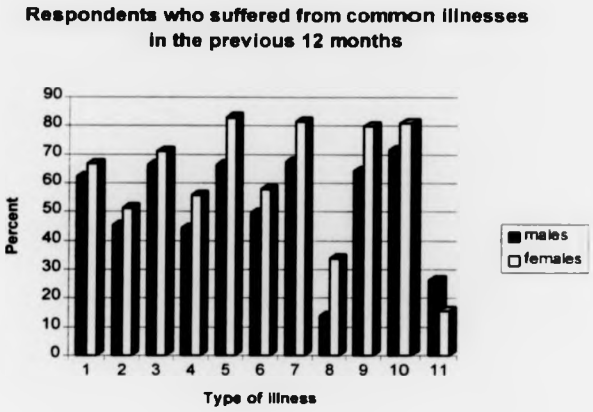
4.2.4 CHRONIC ILLNESSES

Among men and women, major complaints in the previous 12 months were backache, headaches, coughing, malaria and joint pain as shown in Figure 4.5. This was reported by over 70% of the female respondents and over 60% the male respondents. In addition, over 60% of men and women reported having painful legs in the same period (actual figures presented in appendix 4).

Respondents were also asked about whether they had suffered from other diseases previously. Anaemia* was reported to be a major problem in both men and women. Tuberculosis, arthritis and high blood pressure were also reported by a few respondents (see Figure 4.6 and appendix 5). Regrettably, 127 respondents could not give a definite answer to the question asked for various reasons. Firstly, 44.1% (out of the 127) had not been to any hospital recently and secondly, 33.1% were not examined and another 22.8% were examined and treated but were never told what the problem was.

* Anaemia is normally assessed clinically (but sometimes haematologically) at a health centre and patients are told that they do not have adequate blood in their bodies.

Figure 4.5



Type of illness	
Painful legs	1
Stomach problems	2
Joint pain	3
Stiff joint	4
Headache	5
Chest pains	6
Backache	7
Heart problems (palpitation)	8
Malaria	9
Coughs	10
Other illnesses	11

Other illnesses included gout, teeth problems and anxiety

4.2.5 BLOOD PRESSURE MEASUREMENTS

The results for blood pressure measurement are shown in Table 4.16. There were no significant differences between sexes in both diastolic and systolic blood pressure measurements. Defining hypertension as ≥140 mmHg systolic and/or ≥90 mmHg diastolic blood pressure (James and Pecker, 1994; WHO, 1996), 64.7% females (123 respondents) and 66% males (62 respondents) were classified as hypertensive, over half of which had mild hypertension (140-180 mmHg SBP or 90-105 mmHg DBP as suggested by WHO, 1996). In one exceptional case, blood pressure could not be

measured because the respondent was either too fat or the cuff was too small to fit the respondent's arm.

Table 4.16: Blood Pressure measurements of the respondents: range, mean, SD, SE and tests for significance

Type of measurement	*Cases*	*Minimum*	*Maximum*	*Mean*	*SD*	*SE*	*Test for significance*
Systolic(mmHg)							
males	94	80	230	136.5	23.1	2.4	t=-0.83, df=282,
females	190	100	200	138.9	22.4	1.6	p=0.41
Total	284	80	230	138.1	22.6	1.3	
Diastolic (mmHg)							
males	94	60	130	86.8	11.0	1.1	t=0.10, df=282,
females	190	60	120	86.6	10.9	0.8	p=0.92
Total	284	60	130	86.7	10.9	0.6	

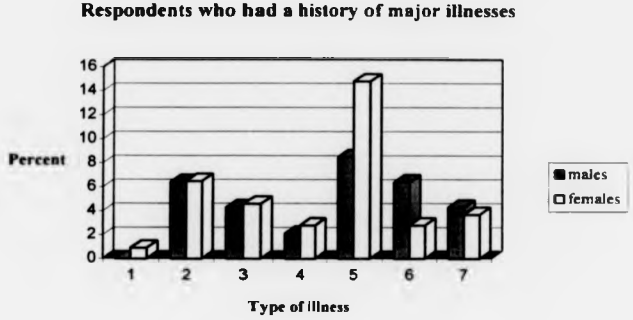
4.2.6 REFERRALS

Sixteen percent of the males and 23.2% females were referred to the nearest hospital/clinic due to ill health. These included those whose blood pressure readings were >140 mmHg systolic and >90 mmHg diastolic. Others were advised to report to the nearest hospital should they experience any blurred vision, headaches and heart palpitation.

4.2.7 MEDICATIONS

Subjects were asked whether they were taking any medicine at the time of interview and if so, for what purpose. The results show that 9.6% of the males and 8.4% of the females were on some kind of medication which suggested they had some ailments at the time of interview. The type of medicine were mainly painkillers (aspirin, panadol, indocid), anti-malarials (quinine), antibiotics (penicillin, tetracycline), anti-hypertensives (bendofluazimide, butalizolidine), insulin (lent), cough lozenges and cough syrups, eye ointment, iron tablets, phenobarbitone, traditional medicine and other unclassified medicines (capsule and pills).

Figure 4.6



Type of illness	
Diabetes	1
High blood pressure	2
Heart attack	3
Broken Hip	4
Anaemia	5
Tuberculosis	6
Arthritis	7

4.2.8 SOCIAL SUPPORT

4.2.8.1 Care

Respondents were asked whether they felt that their relatives were taking care of them properly or not. Surprisingly, 80.9% of the males but only 44.7% of the females felt that they were taken care of properly and another 11.7% of the males and 25.3% of the females felt were cared for to some extent.

4.2.8.2 Most important person in their lives

Respondents were asked to mention the most important person in their lives and as expected among men, spouses (38.4%) and to some extent sons (23.4%) were considered important while among women, daughters (32.6%) were considered important (see Table 4.17). A further analysis of women's data showed that daughters were considered important by both those that were married (35.9%) and those without a spouse (30.4%). Among the married women, only 17.9% indicated that their spouses were important (see appendix 6).

Table 4.17: The most important person in their lives

Person	*Males n=94*	*Females n=190*	*Total n=284*
None (self)	2 (2.1)	26 (13.7)	28 (9.9)
Spouse	37 (39.4)	14 (7.4)	51 (18.0)
Son	22 (23.4)	33 (17.4)	55 (19.4)
Daughter	11 (11.7)	62 (32.6)	73 (25.7)
Son/daughter in-law	1 (1.1)	2 (1.1)	3 (1.1)
Grandchild	0	14 (7.4)	14 (4.9)
Brother/sister	7 (7.4)	14 (7.4)	21 (7.4)
Other relatives	4 (4.3)	8 (4.2)	12 (4.2)
Friends	2 (2.1)	4 (2.1)	6 (2.1)
Other people	1 (1.1)	2 (1.1)	3 (1.1)
Male and female children	6 (6.4)	10 (5.3)	16 (5.6)
Spouse, children and all relatives	1 (1.1)	1 (0.5)	2 (0.7

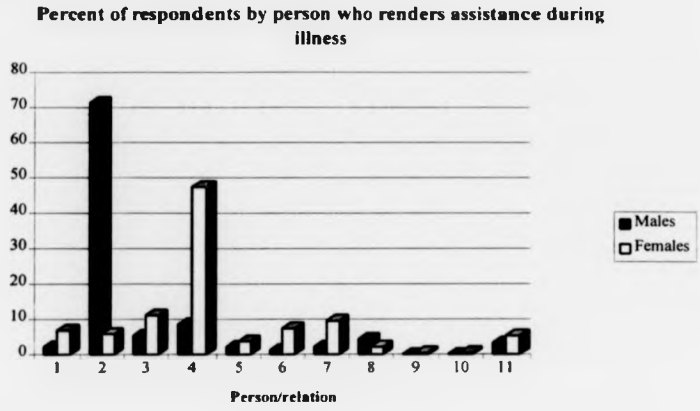
4.2.8.3 Assistance during illness

As shown in Figure 4.7 (Table in appendix 7), men (71.3%) are generally assisted by their spouses while females (47.4%) are assisted mostly by their daughters. Moreover, 3.2% of the males and 5.0% of the females indicated that they were normally assisted by both male and female children.

4.2.9 ALCOHOL CONSUMPTION AND SMOKING HABITS

The results of the study show that both males and females have been extensively involved in smoking tobacco and drinking alcoholic beverages. Smoking in the past was reported by 64.9% of men and 42.6% of women. Currently, 58.5% of the males and 51.1% of the females smoke tobacco. Among the 103 respondents who reported to be smoking, 77.7% sniffed their tobacco and the remainder smoked local and/or purchased cigarettes. Regarding alcohol consumption, the respective percentages of alcohol drinkers among men and women were 54.3% and 36.8% in the past and 54.3% and 41.1% at present. Among men, there was no difference between current and past drinking habits whereas among women, there was an upward trend in the drinking and smoking. The frequency of smoking and drinking was very difficult to determine. Very few people remembered or tried to give an estimate of how often they drank alcohol or smoked tobacco and the actual number of cigarettes smoked. On average, it seemed that men smoked about 4 (3.7) cigarettes as opposed to 3 (2.5) cigarettes per day among women.

Figure 4.7



Who assists when they are ill	
Alone (self)	1
Spouse	2
Son	3
Daughter	4
Son/daughter in-law	5
Grandchild	6
Bother/sister	7
other relatives	8
Daughter and other people	9
Grandchildren and other relatives	10
Both male and female children	11

Other relatives included mother, aunt and in-laws

The frequency of drinking alcohol was 4.1 times and 1.5 times per week, among men and women, respectively. In a month, men estimated that they drank alcohol 17 (16.7) times and among women the estimated frequency was 5 times. However, other respondents indicated that they drank beer only when it was available or occasionally.

PART C: 4.3 ANTHROPOMETRY

4.3.1. ANTHROPOMETRIC MEASUREMENTS

Tables 4.18 and 4.19 show results of all the anthropometric measurements taken during the study as well as derived indicators. The results give the number of subjects measured, mean, standard deviation and tests of significance for differences between the sexes (see appendix 8 for the range of the measurements).

Anthropometric measurements were not taken for all respondents that were very ill or bedridden (n = 1). In addition, missing values for armspan and demispan (n = 12) relate to difficulties respondents had in stretching their arms properly. Height was estimated from armspan using regression equations (see chapter 3) for all respondents with kyphosis (n = 49; 18 males and 31 females). Respondents with oedema (n = 12) were analysed separately because oedema distorts most body measurements (Kuczmarski and Kuczmarski, 1993).

4.3.2. ANTHROPOMETRIC CHARACTERISTICS

The distributions of all anthropometric measures other than triceps skinfold were almost normal. Triceps skinfold measurements and all measures derived from triceps skinfold were positively skewed in both males and females hence the logarithm transformation of triceps skinfold was used to normalise distribution (Altman, 1991; Kirkwood, 1988 and Bryman and Cramer, 1994). Results of the transformed data are shown in appendix 9. Interquartile ranges for all the measurements is presented in appendices 10 and 11.

Men were heavier and taller than women. Interestingly, armspan exceeded height significantly in both sexes (by 11.7 (sd 4.5) cm in males, $t = 23.95$, $df = 85$, $p < 0.001$ and in females by 9.6 (sd 3.7) cm, $t = 35.49$, $df = 184$, $p < 0.001$). The difference between armspan and height is in part due to the fact armspan exceeds height among blacks (Reeves et al. 1996a and 1996b) and in part owing to a reduction in height from adulthood without a parallel decline in armspan with age (Dequeker et al. 1969, Kwok and Whitelaw, 1990; 1991). As expected, the pattern of demispan measurements was

similar to that of height and armspan in the sense that men had significantly higher values than females.

Table 4.18: Sex-specific means (SD) for anthropometric measures of the respondents

Measurement	Males		Females		Test for significance (sex differences)
	n	Mean (sd)	n	Mean (sd)	
Weight (kg)	93	54.1 (7.3)	190	49.0 (8.0)	t=5.21, df=281, p<0.001
Height (cm)	92	165.7 (5.9)	188	155.2 (5.3)	t=14.83, df=278, p<0.001
Armspan (cm)	86	177.4 (6.4)	185	164.8 (6.8)	t=1.56, df=269, p <0.001
Demispan (cm)	86	80.1 (2.9)	185	74.0 (3.1)	t=15.21, df=269, p<0.001
BMI (kg/m^2)	92	19.8 (2.5)	188	20.3 (3.0)	t*=-1.59, df=212.14, p=0.11
Demiquet (kg/m^2)	86	84.5 (11.3)	-	-	-
Mindex (kg/m)	-	-	185	66.4 (10.0)	-

* t-test for unequal variances

Females had a higher mean BMI than men, although the difference was not statistically significant. Since it was possible to estimate height for the kyphotic respondents (n=49), it was also possible to calculate BMI from the estimated height.

Results of mid-upper arm circumference (MUAC), arm muscle circumference (AMC), arm muscle area (AMA), corrected arm muscle area (CAMA), triceps skinfold, mid-arm fat area (MUAFA) and arm fat index (AFI) are presented in Table 4.19. Results of triceps and MUAC measurements show that females had significantly larger triceps skinfolds and MUACs than their male counterparts.

As for AMC, women had significantly lower values than men. Similarly, for AMA derived from AMC, males had larger AMAs than their female counterparts. After correcting AMA for cross-sectional bone area according to sex (Heymsfield, 1982), there were no significant differences between the sexes.

Table 4.19: Means (SD) for selected anthropometric measures of the respondents

Measurement	Males (n = 93) Mean (sd)	Females (n = 190) Mean (sd)	Test for significance (sex differences)
MUAC (cm)	25.0 (2.4)	25.9 (3.2)	t*=-2.46, df=232.17, p=0.02
Triceps (mm)	7.3 (3.4)	12.6 (5.7)	t*=-10.66, df=221.47, p<0.001
AMC (cm)	22.7 (2.1)	21.9 (2.1)	t=3.21, df=281, p=0.001
AMA (cm^2)	41.5 (7.6)	38.7 (7.3)	t=3.21, df=281, p=0.001
CAMA* (cm^2)	31.5 (7.6)	32.0 (7.3)	t=-0.52, df=281, p=0.60
MUAFA (cm^2)	8.8 (4.6)	15.5 (8.1)	t*=-9.31 df=230.19, p<0.001
AFI (%)	17.1 (6.2)	27.3 (8.9)	t=-11.51, df=281, p<0.001

* **t-test** for unequal variances

Results of mid-upper arm fat area (and triceps skinfolds) demonstrated that females were fatter than their male counterparts. The mean arm fat area of the women was nearly double that of the men. This was also confirmed by the percent of fat in the arm area as indicated by arm fat index (AFI) which was significantly higher in females than in males as shown in Table 4.19 above.

4.3.3. ANTHROPOMETRIC AND DERIVED MEASUREMENTS BY AGE

Table 4.20 shows the means (sd) for anthropometric and derived measurements according to age-groups for men and women separately. Older men and women had lower values than younger groups for most of the measurements except for demispan among women and fat indicators (triceps skinfold and AFI) among men. Most age related differences however, were not statistically significant. However, there was a significant non-linear trend in CAMA and AMA with age-group in females (f=3.73, p=0.05). Interestingly, for CAMA, after combining the sexes (since there were no significant differences between males and females for CAMA) and collapsing the first two groups, there was a marked decline after the age of 70 years (see Figure 4.8) which was significant (32.4 cm^2 vs 30.3 cm^2, t=1.96, df=281, and p = 0.05) (means and standard deviations for other derived measurements by age-group are shown in appendix 12).

Table 4.20: Means (sd) for anthropometric and derived measurements by age group and sex

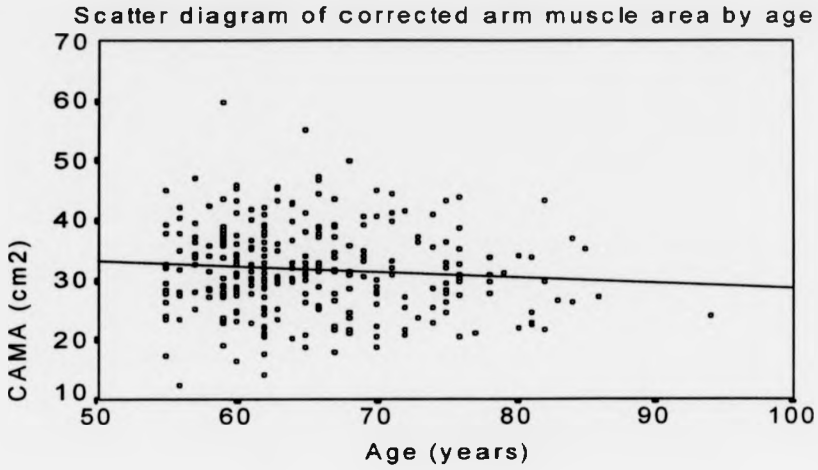
Measurement	Age group	Males n	Males Mean (sd)	Test for significance	Females n	Females Mean (sd)	Test for significance
Weight (kg)	55-59	12	56.8 (7.5)		51	48.7 (6.7)	
	60-69	40	53.7 (7.1)	f=0.95,	111	49.6 (8.8)	χ^2 =2.2,
	70+	41	53.8 (7.4)	p=0.39	28	47.1 (6.7)	p=0.33
Height (cm)	55-59	12	168.1 (5.2)		51	155.5 (5.4)	
	60-69	40	164.9 (5.7)	f=1.39	111	155.3 (5.4)	f=0.12,
	70+	40	165.7 (6.2)	p=0.26	26	154.8 (5.1)	p=0.87
Armspan (cm)	55-59	11	179.2 (6.0)		51	165.4 (6.8)	
	60-69	36	177.7 (7.0)	f=0.78,	111	164.5 (6.9)	f=0.31,
	70+	39	176.6 (5.8)	p=0.46	24	164.8 (6.4)	p=0.74
Demispan(cm)	55-59	11	81.5 (2.9)		51	74.1 (3.2)	
	60-69	36	80.0 (3.2)	f=1.49,	110	73.9 (3.2)	f=0.06,
	70+	39	79.8 (2.7)	p=0.23	24	74.0 (3.0)	p=0.94
BMI (kg/m^2)	55-59	12	20.1 (2.0)		51	20.2 (2.7)	
	60-69	40	19.8 (2.5)	f=0.10,	111	20.6 (3.3)	f=1.37,
	70+	40	19.7 (2.7)	p=0.90	26	19.5 (2.3)	p=0.26
Demiquet (kg/m^2)	55-59	11	85.0 (7.8)		-	-	
	60-69	36	83.7 (11.1)	f=0.17,	-	-	-
	70+	39	85.2 (12.6)	p=0.84	-	-	
Mindex (kg/m)	55-59	-	-		51	65.7 (8.5)	
	60-69	-	-		110	67.1 (10.8)	f=1.31,
	70+	-	-		24	63.6 (9.1)	p=0.27
MUAC (cm)	55-59	12	26.0 (2.7)		51	25.8 (2.8)	
	60-69	40	24.9 (2.3)	f=1.06,	111	26.1 (3.4)	f=1.72,
	70+	41	24.9 (2.5)	p=0.35	28	24.9 (2.9)	p=0.18
CAMA* (cm^2)	55-59	12	35.1 (10.4)		51	31.6 (6.9)	
	60-69	40	31.2 (7.0)	f=1.53,	111	32.8 (7.5)	f=2.17,
	70+	41	30.8 (7.2)	p=0.22	28	29.6 (6.6)	p=0.12
Triceps (mm)	55-59	12	7.3 (2.8)		51	12.5 (4.7)	
	60-69	40	7.0 (2.8)	f=0.18,	111	12.8 (6.1)	χ^2 =1.12,
	70+	41	7.5 (4.1)	p=0.84	28	11.8 (5.9)	p=0.57
AFI (%)	55-59	12	16.9 (5.7)		51	27.7 (7.7)	
	60-69	40	16.8 (5.4)	f=0.14,	111	27.4 (9.2)	f=0.41,
	70+	41	17.5 (7.1)	p=0.87	28	26.5 (9.9)	p=0.66

* = 70 years + significantly different from the two age groups combined, p =0.05 (sexes combined), * t-test for unequal variances

f = Analysis of variance for differences in means according age and sex

χ^2 = Kruskal-Wallis 1-way ANOVA, non-parametric test for weight and triceps among females by age-group (variances different), median for weight and triceps among females were 48.5 kg and 11.2 mm, respectively and median for triceps among males was 6.3 mm (medians for the other age-groups shown in appendix 11)

Figure 4.8



Correlation of anthropometric measures with age also show that most of the measurements were not significantly correlated with age as shown in Table 4.21.

Table 4.21: Correlation coefficients (r) of anthropometric and derived measurements with age

Measurement	*Males*	*Females*
Weight	-0.16	-0.02
Height	-0.10	-0.04
Armspan	-0.19	-0.02
Demispan	-0.17	-0.01
MUAC	-0.14	-0.03
Triceps	-0.06	-0.03
AMC	-0.14	-0.05
AMA	-0.15	-0.05
CAMA	-0.15	-0.05
MUAFA	-0.08	-0.04
AFI	-0.02	-0.03
BMI	-0.10	0.01

4.3.4. ANTHROPOMETRY BY MARITAL STATUS AND LIVING ARRANGEMENT

In both sexes, being either separated/divorced or widowed was associated with lower values for most measures particularly among females where significance was reached for weight, height, armspan, demispan, MUAC, AMC, AMA and CAMA ($p < 0.05$) (see appendices 13 and 14). It is possible that this association could be confounded by other factors such as age. Anthropometric measurements as well as derived measurements were not significantly different between those living alone and those living with others after controlling for sex or with the sexes combined. Among male respondents, there were no differences in both anthropometric measurements and derived measurements between those that were house-bound and those that were not. In females however, being house-bound was associated with larger values in triceps skinfold, mindex and AFI. It should be noted however that only three female respondents in the study were actually house-bound hence statistical tests could not be performed.

4.3.5. INDICATORS OF UNDERNUTRITION

For younger adults, established BMI cut-offs exist to indicate degrees of undernutrition (James et al. 1988; Shetty and James, 1994). These cut-offs have been applied to older adults up to the age of 69 (WHO, 1995). Beyond this age, changes in body composition bring into question the interpretation of cut-offs established for younger adults. However, no alternatives have as yet been proposed. More recently, cut-offs for adult MUACs have been suggested, but again their use for elderly people is questionable. In the absence of valid alternatives, established BMI and MUAC cut-offs will be used to present the result of this study. This issue will however be discussed further in Chapter 5 where the results of this study will be compared with those of other studies using percentile distributions or means where possible.

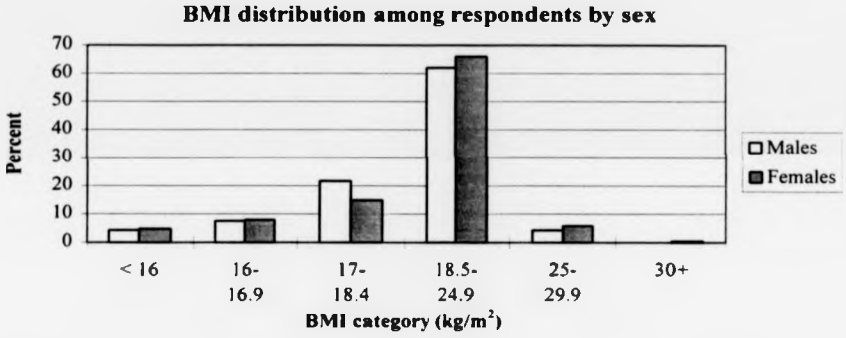
4.3.5.1 Mid -Upper -Arm -Circumference (MUAC)

Using a cut-off point of 22 cm in females and 23 cm in males as suggested by James et al. (1994), a substantially larger proportion of males had smaller MUACs than their female counterparts (20.4% males vs 10% females).

4.3.5.2 Body Mass Index (BMI)

BMIs according to Shetty and James (1994) and James et al. (1988) are displayed in Figure 4.9 and are summarised in Table 4.22. Height not only declines with age (de Groot et al. 1996), but is also difficult to measure accurately since many old people have problems standing upright and many walk with a slight bend at the hip and knees (Atchley, 1985). Furthermore, for individuals with obvious kyphosis an accurate height measurement is practically impossible.

Figure 4.9



Thus, BMI using actual height for non-kyphotics and height estimated from armspan for kyphotic respondents was preferred. Using this BMI, the prevalence of undernutrition, defined as BMI < 18.5 kg/m^2, was 33.7% (95% CI: 23.8 - 43.6) among males and 27.7% (95% CI: 21.2 - 34.2) among females.

4.3.6 UNDERNUTRITION BY AGE

The prevalence of undernutrition (BMI < 18.5 kg/m^2) increased with age particularly among women as shown in Figure 4.10. Among men, the smaller sample sizes may explain the absence of the trend which was apparent among women. However, the undernutrition was more prevalent among older respondents than their younger counterparts. A similar pattern was observed when MUAC was used (see Figure 4.11) although the actual prevalence rates were different. This is discussed in Chapter 5.

Table 4.22: Distribution of BMI by sex, number (%)

BMI Category [1]	*Male*	*Female*	*All*
< 16	4 (4.3)	9 (4.8)	13 (4.6)
16 - 16.9	7 (7.6)	15 (8.0)	22 (7.9)
17 - 18.4	20 (21.7)	28 (14.9)	48 (17.1)
18.5 - 24.9	57 (62.0)	124 (66.0)	181 (64.6)
25 - 29.9	4 (4.3)	11 (5.9)	15 (5.4)
≥ 30	0	1 (0.5)	1 (0.4)

1 The following cut-off points for BMI were used to indicate nutritional status (James et al 1988; Shetty and James, 1994)

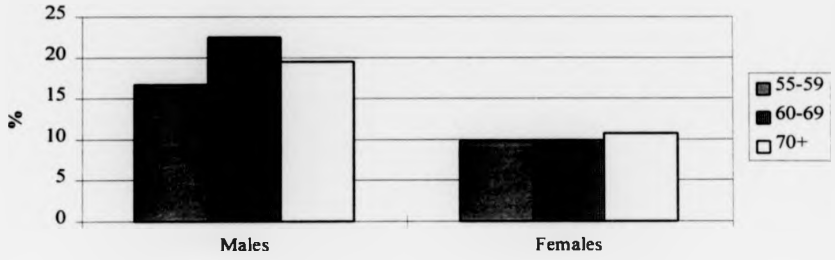
BMI category	Nutritional status
< 16.0	Severely malnourished
16.0 - 16.9	Moderately malnourished
17.0 - 18.4	Mildly malnourished
18.5 - 24.9	Normal
25.0 - 29.9	Grade I Obesity (overweight
≥ 30	+ Grade II & III Obesity

Figure 4.10

Prevalence of undernutrition (BMI < 18.5 kg/m^2) by age-group

Figure 4.11

Prevalence of undernutrition (MUAC < 23 cm for males and <22 cm for females) by age-group



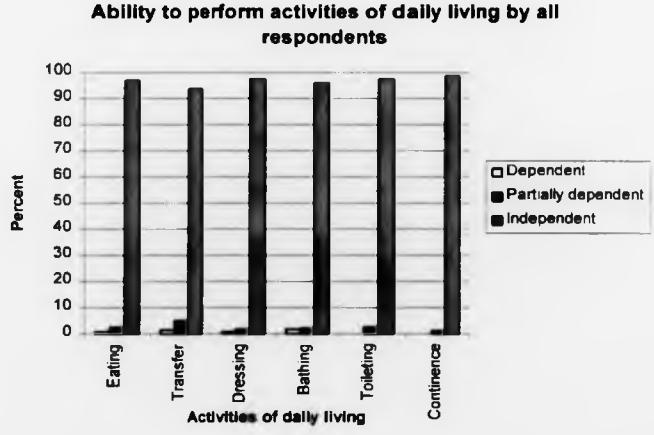
PART D 4.4 FUNCTIONAL ABILITY

Functional ability was assessed by questionnaire: activities of daily living (ADL), instrumental activities of daily living (IADL), other activities; and by functional tests: manual ability (lock and key test), psychomotor function (plate tapping test) and muscle strength (hand grip strength), cognitive function (memory test).

4.4.1 ACTIVITIES OF DAILY LIVING (ADLs)

Results of ADLs for men and women are shown in Figure 4.12. A similar pattern is observed for both males and females. Overall, 89.8% (84% males, 92.6% females) of all the respondents were able to perform all activities without any assistance. In other words, most were independent in all ADLs, requiring no assistance. The activity which appeared to be most difficult was transferring (getting up or down).

Figure 4.12



An ADL score was later derived by collapsing the two dependent categories (dependent and partially dependent). Those that were independent in all activities were coded as 0 and those that were dependent or partially dependent in at least one of the ADLs were

coded 1. Chi-square results for the ADL score show that significantly more males were dependent in ADLs than females (16.0% vs 7.4%, p=0.02). Additionally, those aged 70 years and over had higher rates of dependency than their younger counterparts (18.6% for those aged 70 + compared to 9.5% and 6.6% for those aged 55-59 and 60-69, respectively). This was only significant in the total sample.

4.4.2 MOBILITY

Mobility defined as the ability to get around in one's environment was assessed by asking whether they were able to walk a distance of 1 km and also by observation by the enumerator. Respondents that required assistance in walking a distance of 1 km or were unable to walk that distance or required assistance in movement as observed by the enumerator were deemed to have impaired mobility. Thirty three percent of males and 24.7% of females needed some assistance with walking and 13.8% of males and 7.4% of females needed some assistance when moving around their homes. Overall, 35.1% of males and 25.3% of females were classified as having impaired mobility. In relation to age, mobility problems tended to increase with age particularly among men. The prevalence of impaired mobility was 8.3%, 15.5% and 59.5% ($p < 0.001$) among men and 17.6%, 25.2% and 39.3% (not significant) among women for the three age groups as above.

Very few subjects were either completely or partially dependent in ADLs and mobility. Reasons given for dependence varied among the respondents and also among the different types of activities. The reasons given included illnesses, old age and lack of energy (see appendix 15).

4.4.3 INSTRUMENTAL ACTIVITIES OF DAILY LIVING (IADLs)

The ability to carry out IADLs, necessary for continued independent living in the community, differed markedly between males and females. Women were more involved in domestic activities while men were involved in work outside the home reflecting cultural practices relating to division of labour. This presents a problem in trying to compare the sexes and to further interpret the IADLs. Activities mentioned by women included: cooking, washing dishes, laundry, fetching water, sweeping, fetching

firewood, pounding maize, going to a maize mill, travel (using public transport), business activities (making clay pots, brewing beer) and agricultural activities. Child care was not cited as one of the activities probably because women did not perceive it as an activity, but rather considered it to be part of their normal life. Among males, types of activities mentioned included the following: agricultural related activities, making baskets, mats and granaries, sweeping, cutting grass, collecting firewood, washing their own clothes and business ventures (building houses, carpentry). Only two male respondents indicated that they cooked meals (see appendix 16).

The ability to travel outside the village was the main IADL which tended to decline with age in both sexes. For age-groups 55-59, 60-69 and 70+, the respective percentages for respondents who had problems travelling outside the village were 8.3%, 15.0% and 38.1% (χ^2 = 7.85, p=0.02) among males, and 17.6%, 24.3% and 59.3% (χ^2 = 16.7, p<0.001) among females. Among females however, the ability to perform the several other activities was also reportedly lower among the older subjects compared to their younger counterparts. These activities included cooking, pounding maize, sweeping and drawing water. It is possible that as older people age, they receive more help hence their indicating not performing particular activities.

4.4.4 PHYSICAL PERFORMANCE TESTS

4.4.4.1 General physical performance measures

Table 4.24 shows the results of the physical performance tests which were performed by the respondents. The majority of the respondents were right handed (83.9% of the males and 91.0% of the females). Thus, right hand was the preferred one in performing the functional tests for the majority of the respondents. The distribution of handgrip strength and number of objects recalled was almost normal whereas key time and plate tapping time were skewed and thus a logarithm transformation was done which normalised the data (Altman, 1991; Kirkwood, 1988 and Bryman and Cramer, 1994). Results of the transformed data are shown in appendix 9 (interquartile range for functional tests is shown in appendix 17).

Table 4.23: Means (sd) for physical performance tests by age-group and sex

Test	Age group	Males n	Range	Mean (sd)	Test for significance	Females n	Range	Mean (sd)	Test for significance
Plate tapping time (secs)	55-59	12		16.1 (2.4)[a]		49		18.2 (3.0)[a]	
	60-69	38		18.0 (4.1)[a]	f^{l}=7.99,	107		19.9 (4.4)[b]	f^{l}=5.17,
	70+	38		20.7 (4.6)[b]	p=0.001	23		21.9 (7.1)[b]	p=0.007
	All	88	11.7-35.2	18.9 (4.5)		189	13.3-41.5	19.7 (4.6)	t=-1.63, df=265, p=0.105
Handgrip strength (kg)	55-59	12		32.3 (5.5)[a]		51		22.9 (4.0)[a]	
	60-69	40		29.0 (6.1)[a]	f=7.10,	111		21.7 (4.9)[a]	χ^2=10.68,
	70+	42		25.9 (5.1)[b]	p=0.001	28		19.7 (3.2)[b]	p=0.005
	All	94	15.1-41.1	28.0 (5.9)		190	7.5-31.7	21.7 (4.5)	t*=9.04, df=148.33, p<0.001
Key time (secs)	55-59	12		4.0 (2.1)[a]		51		9.6 (5.2)	
	60-69	40		6.5 (3.9)[ab]	f^{l}=5.30,	111		11.7 (7.9)	f^{l}=1.48,
	70+	40		8.9 (8.0)[b]	p=0.007	27		12.5 (7.5)	p=0.23
	All	92	1.5-39.6	7.2 (6.1)		189	2.3-50.5	11.2 (7.3)	t=-5.92, df=279, p<0.001
Objects	55-59	12		6.7 (1.2)[ab]		51		7.1 (1.3)[a]	
	60-69	40		6.6 (1.6)[a]	f=3.18,	111		6.6 (1.5)[ab]	f=4.60, p=0.01
	70+	41		5.9 (1.5)[b]	p=0.05	27		6.0 (2.1)[b]	
	All	93	1-9	6.2 (1.6)		189	0-10	6.6 (1.6)	t=-2.04, df=280, p=0.04

Tests for significance: t = t-test for sex differences and ***t-test** for unequal variances

f = Analysis of variance for differences between means according age and sex, means with similar letters are not significantly different. A mean with ab is not significantly different from the other two means.

f^{l} = Analysis of variance done on transformed data

χ^2 = Kruskal-Wallis 1-way ANOVA, non-parametric test for handgrip strength among females by age-group (variances different), median for handgrip strength among females 21.9 kg (medians for the other age-groups shown in appendix 17).

With respect to psychomotor function (plate tapping test), the fastest time taken to complete 25 laps of plate tapping did not differ significantly between men and women. However, there were some respondents who could not perform this test for a number of reasons which included:- malaria (n=1), sore finger (n=1), being bed-ridden (n=1), and for others, (n=10), there was no place or table for the plate tapping test. Two respondents could not finish the required 25 laps due to general body pains.

Handgrip strength was significantly stronger among males than females (for all age-groups and in general). The test assesses upper arm muscle strength and is thus a useful indicator of the ability to carry out manual labour.

The ability to pick-up keys was very good in both sexes: 92.6% of females and 97.9% of males were able to pick-up the keys without any difficulty. Similarly, holding the key was also done without any problems by the majority of the respondents, 92.6% and 96.8% among females and males, respectively. Most of the respondents who failed to do the test had either general eye problems or reported to be blind (n=2). In an exceptional case, one respondent reported unfamiliarity with the padlock hence had problems opening it. The time taken to open the padlock differed significantly between males and females, with males being faster than their female counterparts. This test assessed manual ability.

Results of the memory test conducted by asking the respondents to recall viewed objects showed that on average, males remembered relatively fewer objects than females, 6.3 and 6.6 objects, respectively ($p = 0.04$). Two blind respondents did not perform this test.

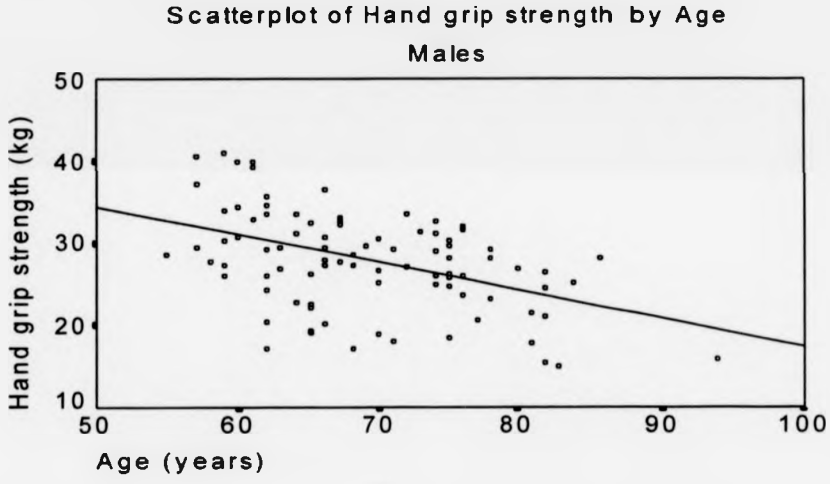
4.4.4.2 Physical performance tests by age

The relationship between functional tests with age are also depicted in Table 4.23. It is evident that there was a significant decline in psychomotor functioning (plate tapping) with age in both sexes. This was shown by longer mean time taken to finish the 25 laps among older individuals than younger individuals. Similarly, handgrip strength also declined significantly with age in both males and females. Hence, younger subjects

were significantly stronger than their older counterparts as depicted in Figures 4.14 and 4.15.

The lock and key test also showed a similar trend: time taken to a open a padlock increased with age. However, this increase was significant only in males. As for the memory test, there was also a significant tendency for older subjects to remember fewer objects than their younger counterparts in both sexes.

Figure 4.13



The results of the relationship between functional tests and age are further illustrated in Table 4.24 which shows the correlation coefficient (r) of the various tests against age. As age increases, significantly more time was required to finish the plate tapping tests and also to open the padlock in both males and females. However, this did not reach significance among females for the lock and key test. Similarly, hand grip strength and the number of objects recalled declined significantly as age of the respondents increased.

Figure 4.14

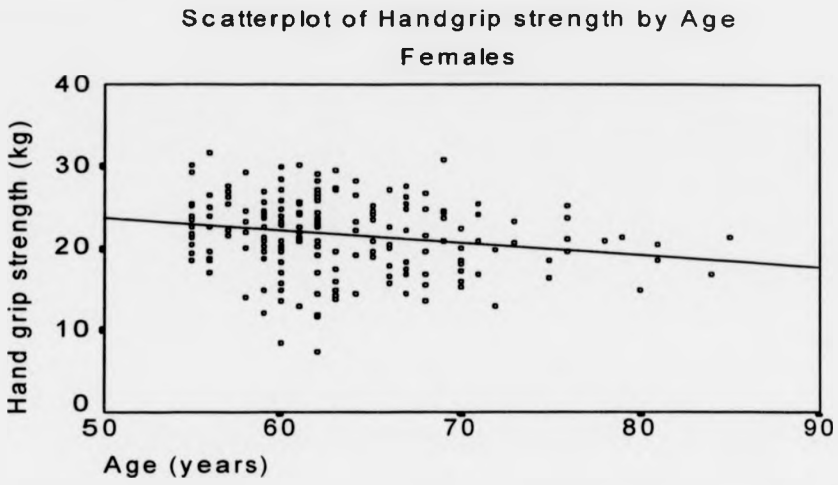


Table 4.24: Correlation coefficients and their significance for physical performance tests with age

Functional test	Males			Females		
	n	*r*	*p value*	*n*	*r*	*p value*
Hand grip strength (kg)	94	-0.46	.000	190	-0.20	0.005
Key time (sec)	92	0.28	.007	189	0.02	0.734
Plate tapping time (sec)	88	0.44	.000	179	0.25	0.001
Objects	93	-0.25	.016	190	-0.20	0.006

Furthermore, the rate of relative impairment defined as less than 25th percentile of the whole male or female samples for handgrip strength and number of objects recalled and greater than 75th percentile for manual ability and psychomotor function, increased significantly with age (Table 4.25). However, among the males, it was significant for plate tapping test and mobility while among females, the significance was evident in handgrip strength, plate tapping test and the memory test. Among the males, significance may have been obscured by limited sample size.

Table 4.25: Percent of respondents functionally impaired according to age-group

	Males				*Females*			
Variables	***55-59***	***60-69***	***70+***		***55-59***	***60-69***	***70+***	
Handgrip[1]	0	25	31	n.s	13.7	25.2	42.9	**p=0.02**
Key time[2]	8.3	20	38.1	n.s(p=.06)	15.7	27	35.7	n.s
Plate tapping time[2]	0	20	40.5	**p=.01**	11.8	29.7	50.5	**p=.001**
Objects[1]	8.3	12.5	28.6	n.s	11.8	19.8	35.7	**p=.04**
Mobility[3]	8.3	17.5	59.5	**p=.00004**	17.6	25.2	39.3	n.s

1 Poor handgrip denotes < 25th percentile, 24.7 kg for men, 18.9 kg for women; Impaired memory test denotes < 25th percentile, < 5 objects recalled by men and less than 6 objects recalled by women

2 Impaired lock and key time and plate tapping test means > 75 th percentile, for plate tapping, 20.7 seconds and 21 seconds for men and women respectively; 8.7 seconds and 14.8 seconds for the lock and key test for males and females respectively.

3 Impaired mobility means dependent or requiring assistance in walking a distance of 1 km or dependence or requiring assistance in movement as observed by the enumerator

4.4.4.3 Physical performance tests by marital status and living arrangement

Results of the relationship between functional tests and marital status are shown in Table 4.26: means and standard deviations for each marital status grouping. The results show that among women, being married was associated with better function (handgrip strength, plate tapping test and number of objects recalled) but no such an association appeared among men. The results are possibly confounded by other factors such as age and also small sample size particularly among men. Among women, those widowed were older than those that were married (mean age 61.5 years vs 63.5 years, p=0.01) and therefore may have performed poorly in most of the physical performance tests. This will be discussed further in multiple regression section.

With regard to living arrangement, females that were living alone remembered fewer objects than their counterparts (5.9 vs 6.7 objects, df = 1, f = 6.0531, p = 0.01). However, for other tests, there was no association between living arrangement and physical performance tests. It should be noted that only 21 women and 4 men reported that they lived alone. Similarly, physical performance tests were not associated being

house-bound. It should also be noted that only 2.5% (n=7) of the respondents were actually house-bound.

Table 4.26: Means for physical performance tests by marital status and sex

Test	Marital status	Males		Test for	Females		Test for
		n	Mean (sd)	significance	n	Mean (sd)	significance
Plate tapping time	Married	72	18.8 (4.2)		74	18.9 (4.7)	
	Separated/divorced/ Widowed	16	19.2 (5.5)	t=-0.27, p=0.79	105	20.3 (4.5)	t=-2.13, p=0.03
Handgrip strength	Married	78	27.9 (5.7)		78	23.0 (3.9)	
	Separated/divorced/ Widowed	16	28.4 (7.2)	t=-0.31, p=0.76	112	20.7 (4.7)	t=3.46, p=0.001
Key time	Married	76	7.4 (6.1)		78	11.1 (8.4)	
	Separated/divorced/ Widowed	16	6.6 (6.7)	t=0.46, p=0.65	111	11.3 (6.4)	t=-0.15, p=0.88
Objects	Married	77	6.4 (1.7)		78	6.9 (1.4)	
	Separated/divorced/ Widowed	16	5.6 (1.1)	t=1.6, p=0.11	112	6.4 (1.6)	t=2.25, p=0.03

PART E: 4.5 BIVARIATE ANALYSIS

This section examines bivariate relations between indicators of nutritional status and functional ability, between nutritional status and other variables, and between functional ability and other variables. These analyses are an important precursor of multivariate analyses and are recommended by a number of authors (Durnin, 1989; Kelly and Kroemer, 1990; WHO, 1995).

4.5.1 RELATIONSHIP BETWEEN NUTRITION AND FUNCTION

Nutritional status indicators were more strongly correlated with handgrip strength than with the other physical performance tests in both males and females (Tables 4.27 and 4.28). Among the males, BMI, MUAC, MUAFA and AMA were all positively correlated to handgrip strength, explaining from 10.9% to 20.3% of the variation in the handgrip strength. This implies that as nutritional status improves so does the hand grip strength. In addition, BMI, AMA and MUAC were also weakly but negatively correlated to plate tapping time. This indicates that as BMI, AMA and MUAC values increase, performance in the plate tapping time improved. However, nutrition indicators were not significantly correlated to key time and the number of objects recalled.

Table 4.27: Correlation coefficient, r (r^2) (cases) for nutritional status indicators and physical performance tests among males

	Nutritional status indicators			
Functional Tests	**BMI**	**AMA**	**MUAC**	**MUAFA**
Handgrip strength	0.40 (.160) (92) **p=.000**	0.39 (.152) (93) **p=.000**	0.45 (.203) (93) **p=.000**	0.33 (.109) (93) **p=.001**
Plate time	-0.21 (.044) (87) **p=0.05**	-0.24 (.058) (88) **p=0.023**	-0.27 (.073) (88) **p=0.010**	-0.14 (.020) (88) p=0.89
Key time	-0.02 (.0004) (90) p=0.847	-0.03 (.001) (91) p=0.759	-0.03 (.001) (91) p=0.782	-0.01 (.0001) (91) p=0.927
Objects	-0.06 (.004) (91) p=.565	0.02 (.0004) (92) p=.630	0.03 (.001) (92) p=.750	-0.07 (.005) (92) p=.504

Table 4.28: Correlation coefficient r (r^2) for nutritional status indicators and physical performance tests among females

Functional Tests	*Nutritional status indicators* BMI	AMA	MUAC	MUAFA
Handgrip strength	0.34 (.116) (188) **p=.000**	0.37 (.137) (190) **p=.000**	0.38 (.144) (190) **p=.000**	0.31 (.096) (190) **p=.000**
Plate time	-0.09 (.008) (179) p=0.223	-0.11 (.012) (179) p=0.126	-0.12 (.014) (179) p=0.123	-0.12 (.014) (179) p=0.109
Key time	-0.13 (.017) (187) p=0.07	-0.12 (.014) (189) p=0.107	-0.13 (.017) (189) p=0.081	-0.13 (.017) (189) p=0.066
Objects	0.07 (.005) (187) p=.426	0.14 (.020) (189) p=.058	0.11 (.012) (189) p=.127	0.07 (.005) (189) p=.306

Similarly among the females, BMI, MUAC, MUAFA and AMA were all positively correlated to handgrip strength, explaining from 9.6% to 14.4% of the variation in the hand grip strength. On the other hand, the correlation between nutrition indicators and other functional tests namely: plate tapping time and key time were negative and insignificant. No significant correlations were found between the number of objects recalled and nutritional status, although all coefficients were positive.

4.5.2 RELATIONSHIP BETWEEN NUTRITION AND OTHER VARIABLES

Variables which were significantly associated with undernutrition (defined as BMI < 18.5 kg/m^2) are presented in Table 4.29. A past or current smoking habit was associated with high prevalence of undernutrition in both sexes. In addition, among males, those who reported having stiff joints in the previous 12 months had also increased undernutrition.

As for the social variables, loss of a spouse or sibling, lack of care, having one meal per day in the pre-harvest period, having one source of income only and the inability to sweep around the house, were all associated with higher prevalence of low BMI. Most

of these variables were significant among females and in the total sample but not among males (Table 4.29).

Table 4.29: Factors which were significantly associated with increased undernutrition (BMI < 18.5 kg/m^2)

Variables	*Males*	*Females*	*Total*
General health			
Stiff joint	x^2	n.s.	n.s.
History of smoking tobacco	x^3	n.s.	x^1
Present smoking habit	n.s	x^1	x^2
A history of anaemia	*	*	x^1
Stressful events			
Loss of a spouse/sibling	n.s.	x^1	n.s.
Socio-economic status			
Having one source of income only	n.s.	x^1	x^1
Social network/isolation			
Lack of family care	*	x^1	n.s
Food availability			
Having one meal/day in the pre-harvest period	n.s.	x^2	x^1
Other activities			
Inability to sweep around the house	*	x^1	n.s
Inability to wash dishes	*	x^1	x^1

$x^1 = p<0.05$, $x^2 = p<0.01$, $x^3 = p<0.001$
* = Cross tabulation not done, > 20% of cells had frequencies of < 5
n.s. = not significant

4.5.3 RELATIONSHIP BETWEEN FUNCTION AND OTHER VARIABLES

Relative impairment defined as the handgrip strength < 25th percentile (< 24.7 kg for men and < 18.9 kg for women) was selected as a measure of function due to its strong association with nutritional status. Furthermore, the respondents that were classified as impaired using this criterion were significantly slower in performing the lock and key test as well as in the plate tapping test. Additionally, in the total sample, those that were dependent in ADLs had higher prevalence of impairment in handgrip strength compared to those that were independent. Finally, among males, having mobility problems was also associated with a higher prevalence of relative impairment (poor handgrip strength)

as shown in Table 4.30. In terms of age, those that were older had higher impairment than the younger ones as shown in Table 4.25 although this was significant only among women.

The prevalence of the following clinical problems entailed higher rates of poor handgrip strength: inability to remember current year; having had malaria, chest pain and other illnesses in the previous 12 months; poor or reduced self reported health; poor health as reported by the nurse; a history of alcohol consumption, and poor access to health services. On the other hand, having a normal blood pressure (< 90 mmHg diastolic and < 140 mmHg systolic pressure) was also associated with higher impairment in the total sample ($\chi^2 = 4.34$, $p = 0.04$). This could be attributed to the fact that most of the people with normal blood pressure were thinner and hence most of them had poor handgrip strength.

As for the social factors, a high prevalence of impairment in handgrip strength was associated with a lack of education, being separated/divorced or widowed; receiving assistance in the form of food, the inability to visit friends and relatives, the inability to perform IADLs (particularly cooking, laundering, pounding maize), lack of a current occupation and limited ability to travel outside the village. Thus, poor handgrip is associated with the inability to perform crucial activities, and respondents that were able to perform these activities were stronger than those who could not.

Clearly, there are many inter-relations between variables considered in this study which bring into question the results of simple bivariate analyses. Such confounding factors can lead to an overestimate or an underestimate of the true association between exposures and diseases and can even change the direction of the observed effects (Hennekens and Buring, 1987). To overcome the effects of confounding, data on males and females were analysed separately in this study and also multiple regression was done. The results of multiple regression analysis are presented in the next section.

Table 4.30: Factors which were significantly associated with increased impairment in handgrip strength (handgrip strength < 24.7 kg for men and < 18.9 kg for women)

Variables	*Males*	*Females*	*All*
Function variables			
Slow key time	x^1	x^2	x^3
Slow plate tapping time	x^3	x^3	x^3
Poor ADL score	*	*	x^1
Poor mobility	x^1	n.s	n.s
Mental impairment			
Inability to remember the current year	n.s.	x^1	x^1
General health			
Malaria	n.s.	x^1	n.s.
Chest pain	x^1	n.s.	x^1
Poor or reduced self reported health	n.s.	x^1	x^1
Poor general health	n.s.	x^1	n.s.
Lack of hospital treatment	n.s.	n.s.	x^1
History of alcohol consumption	n.s.	x^1	x^1
Normal blood pressure	n.s.	n.s	x^1
Socio-economic status			
Lack of education	x^1	n.s.	n.s.
Being separated/divorced or widowed	*	x^1	x^1
Social network/ isolation			
Visiting friends infrequently	n.s.	n.s.	x^1
Not meeting friends	*	x^1	x^1
Not given clothes	n.s.	x^2	x^1
Given food	n.s.	x^1	x^1
Inability to visit other relatives and people	x^1	n.s.	x^1
Inability to visit children	*	n.s.	x^2
Other activities			
Inability to perform IADLs	*	*	x^3
Inability to cook	*	x^3	x^1
Inability to do laundry	*	x^1	x^1
Inability to pound maize	*	x^1	x^1
No present occupation	*	*	x^3
Inability to travel outside the village	n.s.	x^1	x^2

$x^1 = p < 0.05$, $x^2 = p < 0.01$, $x^3 = p < 0.001$

* = Cross tabulation not done, > 20% of cells had frequencies of less than 5

n.s. = not significant

PART F: 4.6 MULTIPLE REGRESSION ANALYSIS

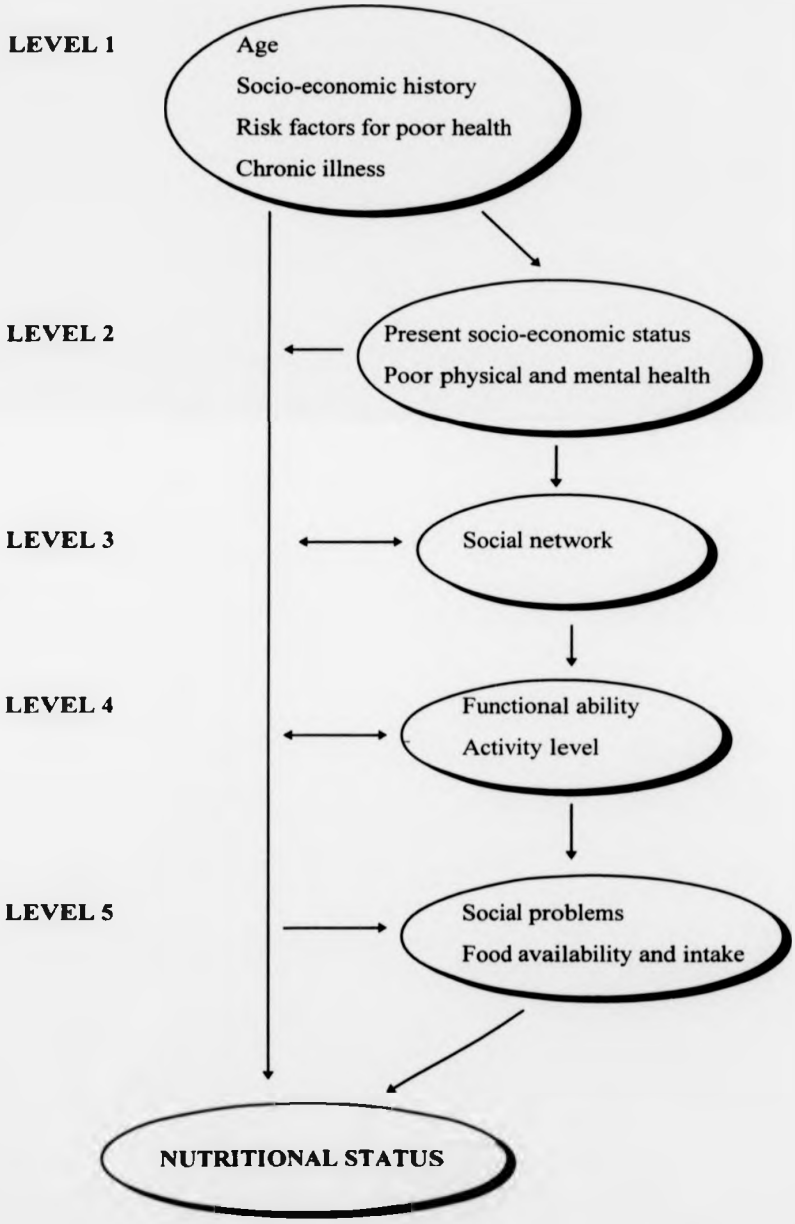
Poor nutritional status and impaired function have many causes, some of which are direct causes whereas others are underlying causes. Among children, poor nutritional status has been associated with inadequate food intake, poor feeding practices, poor hygiene, and infections *inter alia* (GOM/UN, 1993). Malnutrition carries a higher risk of mortality, an outcome of concern among children. However, since among the elderly death is inevitable, quality of life as indicated by the ability to live independently, and hence the possession of good functional ability, is a more appropriate outcome indicator.

4.6.1 HIERARCHICAL MODEL OF FACTORS ASSOCIATED WITH NUTRITIONAL STATUS

A conceptual framework was developed to examine a theoretical causal pathway through which factors are associated with nutritional status (see Figure 4.15). Factors which are in level 1 were given a high priority owing to the fact that these factors affect nutritional status directly but also indirectly through the other levels of the model. These factors are therefore considered to be confounding factors for all the successive levels. The model also indicates that variables which are in higher levels affect nutritional status directly but also indirectly through the other consecutive levels (from top to bottom). Thus, variables at each level may be mediating factors for other variables but also confounding factors for others depending on their level in the hierarchy. It is important to adjust for possible confounding variables because they can lead to either underestimation or overestimation of a true association between an exposure and an outcome and can even alter the direction of the observed effects (Hennekens and Buring, 1987). Possible ways through which these factors may influence nutritional status are discussed in chapter 2 but those not discussed are presented in this section. A list of variables for the various categories shown in the models is presented in appendix 18.

Age: As age increases, reduced activity and reduced BMR (and hence reduced energy requirement) may lead to reduced energy intake. If the food consumed is not nutrient

Figure 4.15: Hierarchical model of factors associated with nutritional status of older people



dense then poor nutrient intake may result leading to poor nutritional status (Suboticanec et al. 1989). In addition, as age increases, there is a concomitant reduction in muscle mass which may contribute to reduced immune function (WHO, 1995), frequent infections (Atchley, 1985; Lipschitz, 1992) and ultimately poor nutritional status. In summary, the effects of ageing are seen on a range of physiological, psychological and physical factors, all of which can impact on an individual's access to an adequate diet. It was decided therefore to include age at each level so as to ensure that its effects are fully controlled for.

Risk factors for poor health:

Smoking habits: Smoking is associated with a number of diseases such as heart disease, cancer and strokes (Webb and Copeman, 1996). Smoking is also associated with low body weight (Steen, 1990; Garrow, 1993) since it tends to soothe hunger and if smokers use tobacco to relieve hunger, they may postpone energy and nutrient intake and eventually this may affect their body weight (Whitney et al. 1994b).

Alcohol consumption: Alcohol consumption is associated with poor dietary intake owing to its effect on appetite. It also displaces food from the diet and hence provides energy without the other essential nutrients which are normally obtained from food (Lieber, 1988; Munro, 1989; Steen, 1990; Iber, 1990; Webb and Copeman, 1996). In addition, alcohol has toxic effects on the intestines and impairs metabolism which may lead to weight loss. Moreover, excessive alcohol intake reduces absorption of some nutrients such as folic acid and may therefore increase nutrient requirements (Iber, 1990; James, 1993). Thus, excessive alcohol intake may predispose one to poor nutritional status and to diseases.

Access to health services: Availability of health services may ensure that diseases are properly treated in a timely and effective manner. Lack of such services can lead to more serious illnesses, and their effect on nutritional status can be profound.

Chronic illness: In addition to affecting nutritional status directly (pathological factors in chapter 2), chronic illnesses may have an influence on the present health of older people

which may affect variables in the other levels such as functional status as well as their ability to visit relatives or other friends or to partake in normal activities within their communities.

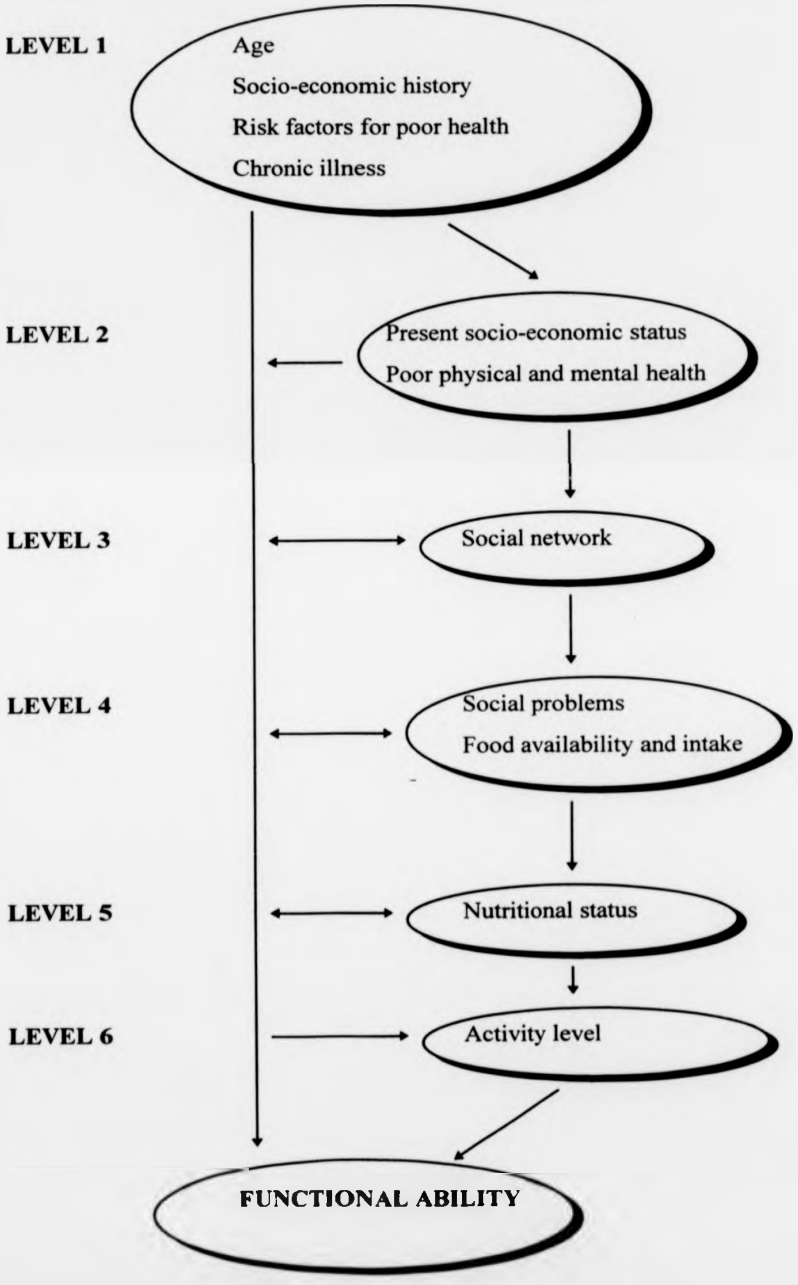
Social network: Being visited or being able to visit would ensure that older people are happy and not socially isolated and hence ill-effects of depression could be avoided. Depression common in older people is also associated with anorexia and lack of interest in food or meal time which may in turn affect dietary intake (Davies, 1989; Kohrs et al. 1989; Webb and Copeman, 1996) and consequently nutritional status. Availability of assistance would ensure better nutrition especially when people are given cash or food. In some cases, availability of assistance would depend on their socio-economic status as well as their general health. Their involvement with a social network would also influence whether they are functionally independent or not.

Food Intake: Number of meals in different seasons can act as an indicator of adequacy of meals especially regarding nutrient requirements. An individual eating three meals in a day is more likely to meet his/her requirements than one who eats two meal or less in a day. It also gives and indication of food availability (food security) which is a pre-requisite to good nutrition (Latham, 1997). Thus, people reporting fewer meals are likely to have a poorer nutritional status than those reporting more meals per day.

4.6.2 HIERARCHICAL MODEL OF DETERMINANTS OF FUNCTIONAL ABILITY

Possible factors which may influence functional ability are shown in the hierarchical conceptual framework presented in Figure 4.16. Most of the factors outlined above may affect functional ability directly but also indirectly through nutritional status which can have a bearing on function. Any variable which may result in weakening the body is also likely to influence function. For instance, diseases or depression may weaken the body and hence it may be difficult for such a person to perform normal chores as expected. How these factors affect one another and also functional ability has been discussed already (chapter 2) but highlighted below is how age may influence functional ability.

Figure 4.16: Hierarchical model of determinants of functional ability of older people



Age: As age increases, functional ability diminishes mostly owing to reduced muscle mass which affects muscle strength but also owing to reduced normal activities and illnesses. As with the nutritional status framework, age is considered to be a major confounder and as such it was included at each level. For instance, people may receive more assistance because they are older thus including age at this level makes sure that the effects of age are controlled for.

4.6.3 CORRELATION MATRIX

Prior to the multiple regression analysis, a matrix was developed to explore the correlation of all independent variables through Pearson's correlation (r). All variables whose correlation coefficient was greater than 0.80 were not entered together in the analysis to prevent the problem of multicollinearity. The presence of multicollinearity suggests that the regression coefficients could be unstable and therefore prone to a large variability from sample to sample . In addition, multicollinearity was checked during the analysis by assessing tolerance (1 minus multiple R for each independent variable). Tolerance measures the strength of the linear relationships among independent variables. Thus, it is the proportion of variance of that variable that is not attributed to its association with other independent variables in the model. When tolerance is close to one, it suggests that very little of the variability is explained by other independent variables and therefore multicollinearity is not a problem (Bryman and Cramer, 1994; Norusis, 1997). In this study, multicollinearity was not a problem since tolerance for the variables included in the analysis were close to 1.0 (Norusis, 1997).

4.6.4 METHOD

Multiple regression analysis was carried out following the conceptual frameworks shown in Figures 4.15 and 4.16. Each level presented a model and as such five models are presented (Tables 4.31 to 4.38) for each nutrition indicator and six models for functional ability (Tables 4.39 and 4.42). A p value of 0.1 was used as an inclusion criterion for the stepwise method in the multiple regression analysis and all predictor variables at each level were hence carried down to be adjusted for in successive levels. This higher p value was used firstly to allow more variables appear in the equation and secondly because the contribution of variables to multiple regression could be complex

(Altman, 1991). However, for the final model (level 5 or 6 depending on the type of dependent variable) a p value of 0.05 was used in order to retain only variables which made a statistically significant contribution to the equation. At each level, variables which did not contribute significantly to the dependent variable were dropped. From this data set, it was possible to come up with a large number of models using different combinations of variables. As reported by Norusis (1997), with one dependent variable and five independent variables, it is possible to form 32 different models and the number of possible models can increase by increasing the number of independent variables. However, the conceptual framework assisted in identifying the possible causal pathway and hence only five models for nutritional status and six models for functional ability were identified although only the results of the final models are discussed. As sex is likely to be a major confounder, multiple regression analysis was done separately for the different sexes.

4.6.5 CODING OF VARIABLES

All variables other than continuous variables were coded dichotomously (0,1). Code 1 indicated impairment or a problem depending on the type of variable. For instance, for educational status, code 1 meant no education at all and for marital status, code 1 meant having no spouse (separated, divorced or widowed). The full coding system for all the variables which appear in the hierarchical models for both nutritional status and functional ability is shown in appendix 18.

4.6.6 INTERPRETATION OF RESULTS

Determinants of indicators of muscle (AMA), fat (MUAFA), and both fat and muscle (BMI and MUAC) are shown in Tables 4.31 to 4.38 for both males and females whereas the factors associated with function ability (handgrip strength) are shown in Tables 4.39 to 4.42. Included in the tables are multiple correlation coefficients (multiple R) which express the correlation between the dependent variable and all the independent variables collectively. When multiple R is one (plus or minus), it indicates that the independent variables predict the dependent variable perfectly whereas a value close to zero shows that the relationship between the independent variables and the dependent variable is absent or not linear. The multiple coefficient of determination (multiple R^2) indicates

the amount of variation explained by the independent variables and standardized regression coefficients (beta weights) denote how many standard deviation units the dependent variable will change when the independent variable changes by one standard deviation. For dichotomous variables (all except age, nutritional status indicators, ADL score and physical tests of functional ability), since impairment was coded as 1 and non-impairment as 0, a negative beta weight indicates that poor nutritional status or poor functional ability was associated with impairment, and vice versa for a positive beta weight. For continuous independent variables, the reverse is true.

The change in multiple R^2 by each variable shows the contribution of each variable to the final multiple R^2. In order to determine how the model fits the data overall, multiple R^2 is used. A multiple R^2 close to zero denotes a model that fits poorly whereas a value close to one denotes an excellent fit. However, this method of assessing the goodness of fit is crude therefore residuals were also assessed to examine how well the model predicted the values of the dependent variables (nutritional status and functional ability) for individuals (Altman, 1991; Norusis, 1997). The residuals indicate factors which affect nutritional status and functional ability which were not explained by the study for instance genetic differences or information which was not gathered for this study.

4.6.7 DETERMINANTS OF NUTRITIONAL STATUS INDICATORS

The causes of malnutrition are complex and from the conceptual framework it is apparent that a wide range of risk factors may predispose older people to malnutrition. Through multiple regression analysis, it was possible to identify risk factors which contributed significantly to nutritional status. Although the primary concern of this study is undernutrition and its determinants, it is acknowledged that there are also risks associated with being overweight. In this sample, the prevalence of high BMI (>25 kg/m^2) was low (4.7% among males and 6.4% among females), but nonetheless some associations emerged e.g. the mobility and ADL performance of fatter women, and diastolic blood pressure among fatter men. Using BMI as a dependent variable, the amount of variation attributed to the independent variables was 40% among men and 31% among women as shown in Tables 4.31 and 4.32 respectively.

Table 4.31: Models showing factors associated with BMI (kg/m^2), adjusted partial regression coefficients B and change in multiple coefficient of determination (R^2) for males

Variable	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Change in R^2 %*
A history of smoking	-0.28**	-0.23*	-0.23*	-0.21*	-0.23**	5.6
Stiffness of joint	-0.23*	-0.24**	-0.24**	-0.24*		
Diastolic blood pressure		0.31***	0.31***	0.28**	0.27**	7.7
General health		0.19*	0.19*			
Current use of medicine		-0.16	-0.15			
Source of income		-0.25**	-0.25**	-0.24**	-0.21*	3.3
Hand grip strength				0.19	0.24*	15.8
Fear of disability and dependence					-0.21*	4.1
Living arrangement					-0.18*	3.2
Multiple R	0.38	0.60	0.60	0.63	0.63	
R^2	0.15	0.36	0.37	0.40	0.40	
Adjusted R^2	0.13	0.31	0.32	0.36	0.35	
F	7.63	7.85	8.15	10.58	9.19	
df	91	90	91	85	90	
p	.0009	.0000	.0000	.0000	.0000	

Levels of significance for individual variables * $p \leq 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4.32: Models showing factors associated with BMI (kg/m^2), adjusted partial regression coefficients B and change in multiple coefficient of determination (R^2) for females

Variable	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Change in R^2 %*
Current smoking status	-0.20**	-0.19**	-0.20**	-0.16*		
History of anaemia	-0.18 *	-0.18*	-0.19**	-0.15*	-0.15*	2.6
Painful legs in the previous 12 months	0.15*	0.16*	0.15*	0.12		
Diastolic blood pressure		0.15*	0.15*			
Occupational status		-0.12		-0.13		
With whom they shared meals			0.12			
Hand grip strength				0.34***	0.37***	11.6
Ability to perform ADLs				-0.19**	-0.21**	5.8
Mobility				0.18**	0.18**	3.2
Number of meals in the post-harvest period					0.14*	2.0
Number of meals in the pre-harvest period					-0.19**	2.6
Young generation's attitude towards the elderly					0.19*	2.7
Multiple R	0.31	0.37	0.37	0.53	0.55	
R^2	0.10	0.14	0.13	0.28	0.31	
Adjusted R^2	0.08	0.11	0.11	0.25	0.28	
F	6.48	5.71	5.61	9.62	11.24	
df	187	186	187	177	186	
p	.0003	.0001	.0001	.0000	.0000	

Levels of significance for individual variables * $p \leq 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4.33: Models showing factors associated with AMA (cm^2), adjusted partial regression coefficients B and change in multiple coefficient of determination (R^2) for males

Variable	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Change in R^2 %*
Smoking history	-0.31**	-0.22*	-0.24*	-0.26*	-0.28**	7.57
Age	-0.19*					
Coughing in the previous 12 months	-0.18					
Diastolic blood pressure		0.25*	0.28**	0.18		
Self reported health		-0.22*	-0.21*			
With whom they shared meals			0.16	0.18		
Hand grip strength				0.34**	0.37***	14.9
Multiple R	0.40	0.45	0.48	0.53	0.47	
R^2	0.16	0.20	0.23	0.28	0.22	
Adjusted R^2	0.13	0.17	0.19	0.25	0.21	
F	5.55	7.27	6.56	8.14	12.90	
df	92	91	92	86	91	
p	.002	.0002	.0001	.0000	.0000	

Levels of significance for individual variables * $p \leq 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4.34: Models showing factors associated with AMA (cm^2), adjusted partial regression coefficients B and change in multiple coefficient of determination (R^2) for females

Variable	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Change in R^2 %*
Marital status	-0.12					
Current smoking status	-0.16*	-0.22**	-0.19**	-0.17*	-0.20**	2.70
History of anaemia	-0.14 *	-0.13	-0.13*	-0.12*		
Backache[1]	0.13	0.15*	0.15*			
Stiff joint[1]	0.16*	0.21**	0.19**	0.20**	0.16*	1.88
History of tuberculosis	-0.12	-0.12	-0.14*			
Malaria[1]	-0.20**	-0.17*	-0.17*	-0.14*	-0.14*	2.17
Access to health services	0.13*		0.11	0.17*	0.16*	4.89
Diastolic blood pressure		0.14*	0.15*	0.11		
General health		-0.20**	-0.18*	-0.19**	-0.15*	1.99
Present occupational status		-0.15*	-0.12		-0.18*	2.67
Whether they received any assistance			0.15*			
Hand grip strength				0.35***	0.33***	13.50
Ability to perform IADLs				-0.17*		
Mobility				0.14*	0.18**	2.48
Multiple R	0.45	0.50	0.53	0.62	0.57	
R^2	0.21	0.25	0.29	0.39	0.32	
Adjusted R^2	0.17	0.22	0.24	0.35	0.29	
F	5.85	6.73	6.48	10.53	10.7	
df	189	188	189	177	188	
p	.0000	.0000	.0000	.0000	.0000	

Levels of significance for individual variables * $p \leq 0.05$, ** $p < 0.01$, *** $p < 0.001$
1 Whether they had this type of illness or symptom in the previous 12 months

Table 4.35: Models showing factors associated with MUAC (cm), adjusted partial regression coefficients B and change in multiple coefficient of determination (R^2) for males

Variable	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Change in R^2 %*
Smoking history	-0.39***	-0.28**	-0.31**	-0.27**	-0.30**	10.93
Age	-0.19					
Diastolic blood pressure		0.38***	0.37***	0.27**	0.24*	5.02
Chewing problems		-0.17	-0.16			
Frequency of visiting friends			-0.17			
Hand grip strength				0.36***	0.36***	20.32
Multiple R	0.41	0.52	0.56	0.60	0.60	
R^2	0.17	0.27	0.31	0.36	0.36	
Adjusted R^2	0.15	0.25	0.28	0.34	0.34	
F	8.93	11.02	9.92	15.73	16.70	
df	92	91	92	86	91	
p	.0003	.0000	.0000	.0000	.0000	

Levels of significance for individual variables * $p \leq 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4.36: Models showing factors associated with MUAC (cm), adjusted partial regression coefficients B and change in multiple coefficient of determination (R^2) for females

Variable	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Change in R^2 %*
Marital status	-0.13*	-0.13	-0.13			
Current smoking status	-0.22**	-0.23**	-0.23**	-0.21**	-0.19**	5.54
History of anaemia	-0.16 *	-0.18*	-0.18*	-0.16*	-0.16*	2.50
Backache[1]	0.14*	0.15*	0.15*			
Joint pain[1]	0.14*	0.12	0.12	0.15*	0.15*	2.40
History of tuberculosis	-0.12	-0.13*	-0.13*			
Malaria[1]	-0.15*	-0.14*	-0.13*			
Diastolic blood pressure		0.21**	0.21**	0.15*		
General health		-0.14	-0.14	-0.14*		
Hand grip strength				0.38***	0.39***	14.64
Ability to perform IADLs				-0.13*	-0.13*	1.65
Ability to perform ADLs				-0.11	-0.16*	3.06
Mobility				0.15*	0.17*	2.02
Having lost a child/grandchild					-0.18**	2.89
Multiple R	0.43	0.49	0.49	0.60	0.59	
R^2	0.19	0.24	0.24	0.36	0.35	
Adjusted R^2	0.16	0.20	0.20	0.32	0.32	
F	6.00	6.29	6.28	10.29	11.96	
df	189	188	189	177	188	
p	.0000	.0000	.0000	.0000	.0000	

Levels of significance for individual variables * $p \leq 0.05$, ** $p < 0.01$, *** $p < 0.001$
1 Whether they had this type of illness or symptom in the previous 12 months

Table 4.37: Models showing factors associated with MUAFA (cm^2), adjusted partial regression coefficients B and change in multiple coefficient of determination (R^2) for males

Variable	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Change in R^2 %*
Smoking history	-0.29**	-0.19*	-0.19*			
Diastolic blood pressure		0.33**	0.33***	0.36***	0.34***	10.95
General health		0.21*	0.21*	0.15	0.26**	6.58
Dentition		-0.20*	-0.20*	-0.17*	-0.20*	4.02
Hand grip strength				0.24*		
Ability to perform ADLs				0.28**	0.24*	6.75
Ability to perform IADLs				0.29**		
Multiple R	0.29	0.51	0.51	0.63	0.53	
R^2	0.08	0.26	0.26	0.40	0.28	
Adjusted R^2	0.07	0.23	0.23	0.35	0.25	
F	8.17	7.64	7.92	8.84	8.56	
df	92	91	92	86	91	
p	.005	.0000	.0000	.0000	.0000	

Levels of significance for individual variables * $p \leq 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4.38: Models showing factors associated with MUAFA (cm^2), adjusted partial regression coefficients B and change in multiple coefficient of determination (R^2) for females

Variable	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Change in R^2 %*
Marital status	-0.13	-0.15*	-0.15*			
Current smoking status	-0.19**	-0.20**	-0.18*	-0.18*	-0.18*	4.45
History of anaemia	-0.17 *	-0.20**	-0.21**	-0.17*	-0.17*	2.92
Backache[1]	0.14*	0.13				
Stomachache[1]	-0.14*					
Diastolic blood pressure		0.20**	0.20**	0.13		
Illness in the previous 2 weeks		-0.14*				
Ability to perform ADLs				-0.15*	-0.19**	3.00
Hand grip strength				0.31***	0.31***	9.74
Having lost a child/grandchild					-0.18*	2.84
Multiple R	0.37	0.41	0.37	0.47	0.48	
R^2	0.14	0.17	0.14	0.22	0.23	
Adjusted R^2	0.11	0.14	0.12	0.20	0.21	
F	5.78	6.26	7.51	9.95	10.90	
df	189	188	189	177	188	
p	.0001	.0000	.0000	.0000	.0000	

Levels of significance for individual variables * $p \leq 0.05$, ** $p < 0.01$, *** $p < 0.001$
1 Whether they had this type of illness or symptom in the previous 12 months

Risk factors which were clearly associated with a low BMI among males (Table 4.31) were poor handgrip strength, a history of smoking, fear of dependence and disability, poverty (having one or no source of income) and living alone. Among females (Table 4.32), low BMI was associated with poor hand grip strength, reduced food intake in the pre-harvest period and a history of anaemia. The contribution of each independent variable to the BMI final model are shown in Figures 4.17 and 4.18 for men and women respectively.

Figure 4.17: Contribution of determinants of BMI after controlling for confounding variables among males

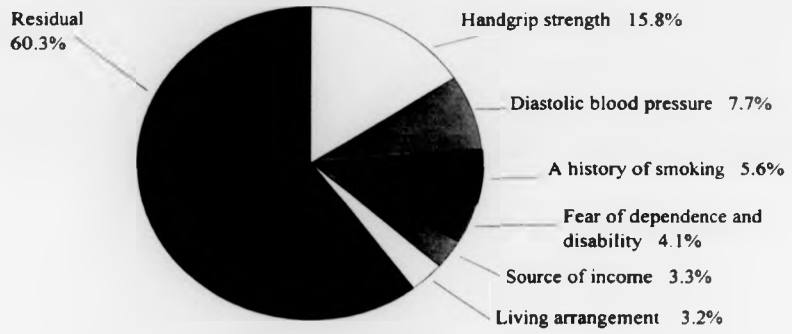
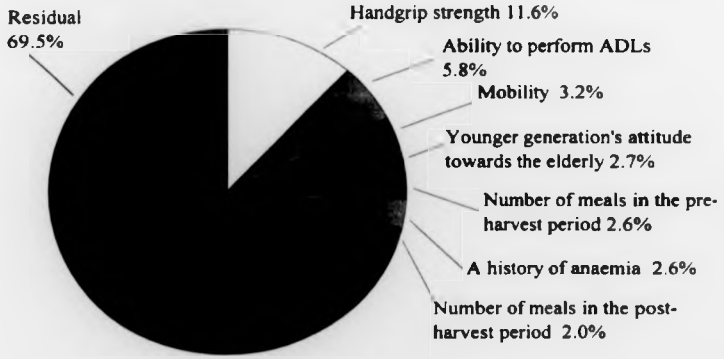


Figure 4.18: Contribution of determinants of BMI after controlling for confounding variables among females



Using the other nutritional status indicators (AMA, MUAC, MUAFA) as dependent variables yielded varied results. The amount of variation explained by the final models ranged from 22% to 36% as shown in Tables 4.33 to 4.38. However, consistently, handgrip strength emerged as an important independent predictor of nutritional status explaining a substantial proportion of the variation except among males where handgrip did not predict MUAFA (in the final model) since its contribution was not statistically significant. Thus among females, fat, muscle and both fat and muscle indicators were independently predicted by handgrip strength whereas among males only muscle and a combination of fat and muscle were predicted by handgrip strength. Other factors which were associated with smaller arm muscle areas among men were a history of smoking and among women, current smoking behaviour, poor health (as assessed by the nurse), having no occupation and having had malaria in the preceding 12 months. It is interesting to note that age was not a significant predictor of any nutritional status indicator for either males or females.

4.6.8 FUNCTIONAL ABILITY INDICATORS

Among the several functional tests carried out, handgrip strength was consistently associated with nutritional status indicators and with the other functional tests and was hence used as an outcome variable. Several analyses were performed by level following the conceptual framework outlined in Figure 4.16. In level 5, different nutritional indicators were included in the analysis in turn and results are presented in Tables 4.39-4.42). The format of presentation is similar to that of nutritional status.

Consistent with nutritional status, handgrip strength was positively associated with nutritional status in both males and females regardless of the type of nutritional status indicator. The amount of variation explained by the independent variables when BMI was included as a nutritional status indicator, was 59% among males and 29% among females. In the final model, in addition to handgrip strength being inversely correlated with age, poor handgrip strength was also associated with inability to visit relatives or other people, a poor nutritional status (low BMI), having chest pain in the previous 12 months, poor access to health services, having no current occupation and having a stiff joint in the preceding 12 months among males (see Table 4.39).

Table 4.39: Models showing determinants of handgrip strength (kg), adjusted partial regression coefficients B and change in multiple coefficient of determination (R^2) for males

Variable	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*	*Change in R^2*
Age	-0.36***	-0.34***	-0.27**	-0.30***	-0.23**	-0.24**	8.2
Stiff joint[1]	-0.21*	-0.24**	-0.22**	0.18*	-0.17*	-0.16*	2.2
Present alcohol consumption	-0.20*	-0.17*					
Stomachache[1]	0.18*						
Heart problems[1]	0.17*				0.14		
Chest pain[1]	-0.16	-0.22**	-0.22**	-0.27**	-0.21**	-0.24**	4.9
Access to health services	-0.15	-0.18*	-0.19*	-0.17*	0.20**	-0.17*	3.2
General health		0.30***	0.28***	0.33***	0.23**	0.25**	4.1
Present occupational status		-0.31***	-0.19*	-0.19*	-0.20*	-0.21*	3.0
Source of income		-0.16*	-0.14	-0.18*			
Diastolic blood pressure		0.15	0.17*	0.12			
Ability to visit relatives or other people			-0.27**	-0.25**	-0.28***	-0.28***	20.4
Having lost a spouse or a sibling				-0.13			
BMI					0.27***	0.26***	13.3
Multiple R	0.65	0.75	0.76	0.78	0.78	0.77	
R^2	0.42	0.56	0.57	0.61	0.61	0.59	
Adjusted R^2	0.38	0.52	0.53	0.56	0.57	0.55	
F	9.03	11.93	12.61	12.67	14.21	15.05	
df	93	92	93	92	91	91	
p	.0000	.0000	.0000	.0000	.0000	.0000	

Levels of significance for individual variables * $p \leq 0.05$, ** $p < 0.01$, *** $p < 0.001$
1 Whether they had this type of illness or symptom in the previous 12 months

Among females, poor handgrip strength was associated with a poor nutritional status (low BMI), inability to travel outside the village, receiving food, having had stomach problems in the previous 12 months, poor access to health services and having no spouse (separated, divorced, widowed) (see Table 4.40).

Table 4.40: Models showing determinants of handgrip strength (kg), adjusted partial regression coefficients B and change in multiple coefficient of determination (R^2) for females

Variable	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*	*Change in R^2*
Marital status	-0.23**	-0.19**	-0.18*	-0.21**	-0.16*	-0.15*	2.0
Age	-0.18**	-0.12			-0.11		
Stomachache[1]	0.16*	-0.13*	-0.13	-0.14*	-0.13*	-0.16*	2.2
Access to health services	-0.15*	-0.15*	-0.14*	-0.18*	-0.18**	-0.16*	2.2
Headache[1]	0.13	0.14*	0.15*	0.14*			
A history of alcohol consumption	-0.12						
Number of objects recalled		0.20**	0.23**	0.19**	0.15*	0.18**	5.3
Self reported health		-0.15*	-0.17*	-0.17*	-0.13*		
Receipt of assistance			0.13*				
Whether they were given any food				0.20**	0.16*	0.16*	2.3
Having lost a spouse or a sibling				-0.13*	-0.12		
BMI					0.27***	0.29***	11.8
Ability to travel						-0.13*	3.0
Multiple R	0.40	0.45	0.46	0.50	0.56	0.54	
R^2	0.16	0.21	0.21	0.25	0.31	0.29	
Adjusted R^2	0.13	0.18	0.18	0.22	0.28	0.26	
F	5.88	6.71	6.83	7.60	8.89	10.23	
df	189	188	188	187	186	185	
p	.0000	.0000	.0000	.0000	.0000	.0000	

Levels of significance for individual variables * $p \leq 0.05$, ** $p < 0.01$, *** $p < 0.001$
1 Whether they had this type of illness or symptom in the previous 12 months

Thus, among females, having a spouse entailed being active which is not surprising since married women are culturally expected to care for the their spouses. On the other hand, receiving assistance in form of food was negatively associated with handgrip strength which relates well to the theory of disuse contributing to loss of muscle strength. Receipt of food (or other assistance) may also indicate a need, suggestive of poor economic status.

Age did not appear in the final model as a predictor of handgrip strength among women, possibly owing to the fact that proportionately, very few women were actually aged 70 years and above (14.7% compared to 44.7% males). The contribution of the determinants of handgrip strength are shown in Figures 4.19 and 4.20 for men and women.

Table 4.41: Models showing determinants of handgrip strength (kg), adjusted partial regression coefficients B and change in multiple coefficient of determination (R^2) for males

Variable	*Model 5*	*Model 6*	*Change in R^2*	*Model 5*	*Model 6*	*Change in R^2*	*Model 5*	*Model 6*	*Change in R^2*
Age	-0.23**	-0.27**	20.61	-0.28**	-0.28**	20.61	-0.23*	-0.24**	20.61
Access to health services	-0.17*			-0.16*			0.16*	-0.16*	2.45
Chest pain[1]	-0.20*	-0.25**	4.58	-0.21*	-0.26**	4.65	-0.23**	-0.26**	5.80
Heart problems[1]	0.12			0.15*					
Stiff joint[1]	-0.19*	-0.16*	2.30	-0.19*	-0.17*	2.69	-0.20*	-0.20*	3.22
General health	0.23**	0.22*	3.50	0.23**	0.26**	4.31	0.25**	0.23**	3.07
Present occupational status	-0.18*						-0.24*	-0.21*	3.02
Source of income	-0.12						-0.14		
Ability to visit relatives or friends	-0.28**	-0.36***	10.11	-0.36***	-0.36***	10.33	-0.27**	-0.29**	9.94
MUAC	0.26**	0.31***	15.44						
AMA				0.24**	0.26**	10.50			
MUAFA							0.20*	0.21*	9.09
Multiple R	0.79	0.75		0.76	0.74		0.77	0.76	
R^2	0.63	0.57		0.58	0.54		0.59	0.57	
Adjusted R^2	0.59	0.54		0.54	0.51		0.56	0.53	
F	14.01	18.65		14.56	16.89		13.27	14.03	
df	92	92		92	92		92	92	
p	.0000	.0000		.0000	.0000		.0000	.0000	

Levels of significance for individual variables * $p \leq 0.05$, ** $p < 0.01$, *** $p < 0.001$
1 Whether they had this type of illness or symptom in the previous 12 months

Table 4.42: Models showing determinants of handgrip strength (kg), adjusted partial regression coefficients B and change in multiple coefficient of determination (R^2) for females

Variable	*Model 5*	*Model 6*	*Change in R²*	*Model 5*	*Model 6*	*Change in R²*	*Model 5*	*Model 6*	*Change in R²*
Age	-0.12			-0.16			-0.11		
Marital status	-0.14*	-0.14*	1.74	-0.14*	-0.14*	1.84	-0.15*		
Access to health services	-0.20**	-0.18*	2.60	-0.22**	-0.20**	3.70	-0.17*	-0.14*	1.94
Self reported health	-0.16*	-0.17*	2.97	-0.14*	-0.15*	2.78	-0.15*	-0.15*	2.23
Stomachache[1]				-0.11	-0.13*	1.52	-0.11	-0.13*	1.63
Number of objects recalled	0.16*	0.19**	5.44	0.15*	0.18*	5.13	0.17*	0.21**	6.34
Given food	0.13*	0.16*	2.64	0.15*	0.17*	2.44	0.17*	0.18*	2.40
Having lost a spouse or a sibling	-0.13*			-0.13*			-0.14*		
MUAC	0.32***	0.33***	14.48						
AMA				0.30*	0.31***	13.26			
MUAFA							0.24***	0.26**	9.74
Ability to travel								-0.14*	3.28
Multiple R	0.57	0.55		0.58	0.55		0.55	0.52	
R^2	0.33	0.30		0.33	0.31		0.30	0.28	
Adjusted R^2	0.30	0.28		0.30	0.28		0.27	0.25	
F	10.98	12.85		9.95	11.37		8.68	9.78	
df	188	187		188	187		188	187	
p	.0000	.0000		.0000	.0000		.0000	.0000	

Levels of significance for individual variables * $p \leq 0.05$, ** $p < 0.01$, *** $p < 0.001$

1 Whether they had this type of illness or symptom in the previous 12 months

Figure 4.19: Contribution of determinants of handgrip strength after controlling for confounding variables among males

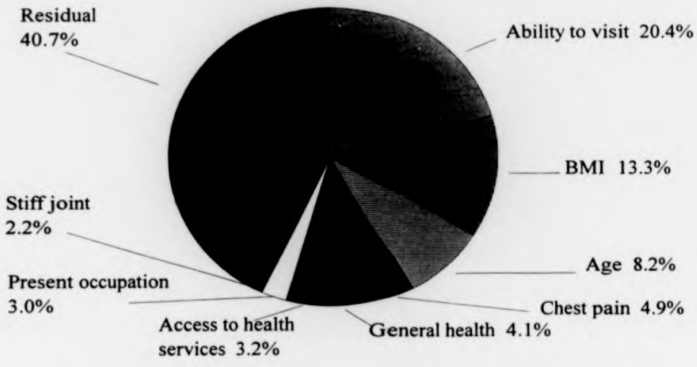
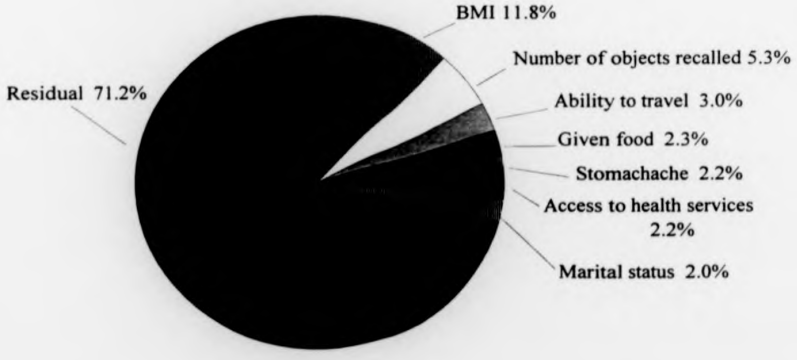


Figure 4.20: Contribution of determinants of handgrip strength after controlling for confounding variables among females



PART G: 4.7 SPECIAL RESPONDENTS

4.7.1 KYPHOTIC RESPONDENTS

Kyphosis (also called dowager's hump) is the curvature of the spine which occurs particularly in old age resulting in a hunchback appearance among older people (Kuczimarski and Kuczimarski, 1993; Sinclair, 1991). Kyphosis occurs as a result osteoporosis of the veterbrae which is loss of bone mass common in old age. Although all people lose bone not everybody develops osteoporosis (Kuczimarski and Kuczimarski, 1993). Osteoporosis occurs as result of reduced calcium absorption and increased calcium resorption due to reduced calcitriol (active form of vitamin D also called $1,25(OH)_2D$ which enhances calcium absorption) and a diminished activity of osteoblasts (cells which are essential for bone formation) (Schlenker, 1993). In this study, 19.1% (n=18) males and 16.3% (n=31) females were kyphotic. Occurrence of kyphosis increased significantly with age in both males and females. Among males, the respective percentages of kyphotic respondents were 0%, 10% and 33.3% and among females, 7.8%, 15.3% and 35.7% for the 55-59, 60-69 and 70+ age-groups. In addition, in both males and females, kyphotic respondents were significantly older. Among men, the mean age of kyphotic respondents was 76.4y compared to 67.2y among non-kyphotic respondents ($p < 0.001$). Among females, the mean age of kyphotic respondents was 67.6y compared to 62.4y among non-kyphotics ($p = 0.001$).

The prevalence of undernutrition among the kyphotics (BMI <18.5 kg/m^2, using height estimated from armspan) was not significantly different from the non-kyphotic subjects although it was higher among kyphotic females compared to their counterparts (Table 4.43). With regard to functional ability, being kyphotic was associated with a higher prevalence of impairment in hand grip strength particularly among females. The rate of relative impairment among kyhotics was twice that of non-kyphotics (see Table 4.43). This could be partly explained by age since most kyphotic respondents were older than non-kyphotics.

Table 4.43: Comparison of nutritional status and functional ability (as assessed by handgrip strength) between kyphotics and non-kyphotics (%)

Category	*Sex*	*Kyphotics* n =18 males n= 31 females	*Non-kyphotics* n=76 males n=159 females
Undernutrition (BMI < 18.5 kg/m^2)	Males	23.5	36.0
	Females	31.0	27.0
Functional impairment (handgrip strength < 24.7 kg among men and < 18.9 kg among women)	Males	44.4	19.7
	Females	45.2	20.8*

* $\chi^2 = 8.30$, p=0.004

4.7.2 OEDEMATOUS RESPONDENTS

Oedema is the unusual accumulation of body fluids in extra-cellular tissues of the body (Schlenker, 1993) common in protein deficiency and other clinical conditions (Whitney et al. 1994c). In this study, twelve respondents (3 males and 9 females) were oedematous. Since oedema entails increase in body water, it complicates the interpretation of anthropometric data particularly weight and relative weight for heights as well as mid-upper arm fat areas (Gibson, 1990; Kuczimarski and Kuczimarski, 1993). Thus, no anthropometry data are presented for these respondents.

Oedema was assessed clinically by a qualified nurse by physically pressing their lower limbs and if the pressed area did not return to normal immediately then the respondent was deemed oedematous. Since the prevalence of oedema was low, it was not possible to perform any statistical tests. Nevertheless, the average age of the males was 75 years and for females it was 67 years. Two males and one female were house-bound and none was living alone. All males were married whereas among females, 4 were married and 5 were widowed.

Social conditions

Seven of the 12 respondents had an occupation, and agriculture was their main source of income followed by contributions from children. Half of the respondents stated that life was unsatisfactory mainly owing to economic, health and food problems. In addition most of them were concerned about health and diet and becoming dependent and disability. Although food shortage was rated as a main problem, 10 respondents had more than one meal per day during the pre-harvest period when food stocks of most families are depleted.

Health status

Most of the respondents (9) rated their health as either reduced or poor and 9 were ill in the preceding two weeks. The most common complaint was joint and muscular problems (particularly leg problems) followed by malaria and headaches. In the preceding 12 months, most of the respondents reported having the following illnesses or symptoms: malaria (n=11) headaches and stiff joint (n=10), backache (n=9), coughs, joint pain and stomach-ache (n=8), chest pain (n=6) and heart problems (n=4). Only half of the respondents reported having hearing and sight problems. All respondents had lost at least one tooth although only half reported chewing problems. Four respondents had a history of smoking tobacco whereas 3 were smoking currently. As for alcohol consumption, 5 used to drink it in the past while only 2 reported drinking now.

Functional ability

In the assessment of ADLs, seven had problems performing activities such as transferring (n=7), 4 others had problems with bathing and toileting. Mobility was also a problem for others (n = 10).

The mean handgrip strength for males (30.3 kg) and females (22.5 kg) were between 50^{th} and 75^{th} percentile of the total sample whereas for plate tapping time, they fell above 75^{th} percentile (ie impaired) for both males (21.5 secs) and females (27.6 secs). As for key time, the mean for females (9.8 secs) just fell below the 50^{th} percentile whereas for the males (19.2 secs), it fell above the 75th percentile. However, using the

cut-off points of 24.7 kg for males and 18.9 kg for females for handgrip strength, two males were classified as normal (one did not perform the test) whereas two females were classified as impaired. Applying 8.7 seconds for males and 14.8 seconds for females cut-offs for key time 2 males and 2 females were classified as impaired and using 20.7 seconds for males and 21 seconds for females for plate tapping time as in the main sample, 1 male and 4 females were classified as impaired. However, 3 females and 1 male did not perform this test.

In general, health problems and functional impairment (as assessed by ADL) were more prevalent in the oedematous group than in the non-oedematous group. Oedema was considered as a risk factor because it is a sign of illness or nutrient deficiency. Thus, in any screening or targeting program, oedema respondents would be given special consideration since they are at nutritional risk due to their condition.

CHAPTER 5: DISCUSSION

In this chapter, results of the study are discussed according to specific sections as outlined in the preceding chapter.

5.1 SOCIAL FACTORS

Demographic characteristics: In most countries, women tend to outlive men (Suzman et al. 1992; WHO, 1995) and in this study, 47.4% of the women were widowed as opposed to only 11.7% of the men. This happens because women tend to marry older men who die before they do and in contrast, men tend to marry younger women and also have a greater possibility of re-marrying younger women if widowed (Matuja and Ndosi, 1994) hence, men have spouses to rely on while most older women have to find other sources of social support.

Educational level: Literacy level was very poor among the respondents but was consistent with national figures which show higher illiteracy rates among women than among men (literacy levels: national 48%, men 65%, women 34%). High illiteracy rates in Malawi are attributed to lack of nearby schools, cultural and religious factors and expensive school fees which can not be afforded by many families (GOM/UN, 1993). Illiteracy can limit change and development since it is associated with poor reception of novel ideas. Recently, the government has introduced free primary education to combat illiteracy.

Occupation: It is apparent that many respondents were engaged in agricultural activities. This shows how important functional independence is to the elderly. Thus, if the elderly were to remain functionally able, they would be better able to fend for themselves, with little or no assistance from relatives. Their involvement in agricultural and other income generating activities would ensure a good income.

Although 56% of older people received monetary contributions from their children and other relatives as reported in Table 4.6, still the majority (about 70%) of the respondents tended to rely on agriculture for income (see Table 4.4) emphasising the importance of functional independence among older rural people.

Social interaction

Social interaction plays an important role in the life of the elderly as it does in other stages of life. Socialisation is extremely valuable for the development of children but among the elderly, it enhances their well-being. It boosts their morale and also adds a sense of being part of the society and of self-worth. In this study, the majority of the respondents were active in religious activities as well being in contact with children and other relatives. However, a surprisingly large proportion never participated in religious activities perhaps because of impaired mobility and distance but also maybe owing to the presence of other traditional practices which are non-religious. Social isolation is believed to be associated with depression and dissatisfaction with life which may in turn have a bearing on food intake (Davies, 1989) and hence the nutritional status of the individuals. Living and eating alone have been associated with poor nutritional status (Howarth, 1989; DHSS 1972 and 1979). In this study, although very few people lived alone, among men it was associated with low BMI after controlling for potential confounders.

Role of the family: It is evident from the results that the extended family plays a major role in supporting the elderly. This was seen from the number of people getting various kinds of assistance, visits and even living with children or other relatives. However, Gorman (1995) reported that extended family support is often insufficient to guarantee a reasonable quality of life among older people. Although people may claim getting a variety of assistance, its adequacy is questionable. In Malawi, there is evidence to show that the extended families are undergoing changes owing to increased urbanisation (Chatsalira, 1990; GOM/UN, 1993). In addition, responsibility to care for older people is not shared equally and mostly done by women (Gorman, 1995), and as reported in this study, most of the females were supported by daughters and men were supported by spouses. Since caring for older people is seen as a norm, it is not considered as a burden

even in times of crisis. However, further studies are needed to understand the implications of economic strain on the caring of older people.

Stressful events: Most respondents had lost either a child or a grandchild. This is also reflected in the country's high infant mortality rates (135 per 1000 live births) as well as high mortality among young adults in the wake of AIDS. In 1992, the prevalence of HIV infection was 23% in urban areas and 8% in rural areas among 15-49 year olds and now the rates are likely to be higher due to long incubation period of the disease (GOM/UN, 1993). Although older people may fear death less than younger people, it touches their lives more often than it touches those of other age categories (Atchley, 1985).

In bivariate analyses, having lost a spouse or sibling and lack of family care were associated with a significant increase in the prevalence of undernutrition among women although their effects were insignificant in multiple regression analysis. However, having lost a child was associated with both low MUAC and MUAFA among females.

5.2 CLINICAL FACTORS

General health: The most common illnesses among the respondents were joint and muscular pains, respiratory problems and malaria. Joint and muscular pains are common illnesses among older people as reported in other studies (Allain et al. 1997; Manandhar et al. 1997b) whereas respiratory ailments and malaria are common health problems in Malawi in all ages (GOM/UN, 1993). Sixty four percent of the respondents were ill in the previous two weeks and also some had chronic illnesses which is probably the reason why most people rated their health as either reduced or poor. In addition, health was rated as a major cause for being dissatisfied with life and also as a major concern in life. Thus, good health is an important asset for better quality of life among older people. Since no full, hospital-based clinical examination, with tests and x-rays was carried out in this study, information on chronic illness is seriously limited.

Access to health services: Access to health services is generally good in Malawi inasmuch as about 85% of the population live within 8 km to the nearest health facility,

although this distance could prove too great for an older person with limited mobility. However, access guarantees neither good utilisation nor high quality health care (GOM/UN, 1993). In the areas studied, health centres were nearby although most older people did not utilise these services owing in part to beliefs that most of their ailments were due to old age and also the fact that there were discouraged by clinical staff. If this stigmatisation persists, most of the old people will continue to suffer and die unnecessarily from diseases that can be diagnosed and treated. There is an urgent need to encourage older people to utilise existing health services, and to raise awareness among health staff and carers of older people of the need and benefits of health care for older people. Formal and informal channels and education programmes can be utilised to counteract ageist attitudes (Gray, 1991) in communities and among health professionals. But above all, national policy makers need to recognise the contribution of older people to society, to acknowledge their right to health care, and to take steps to ensure that older people seek and receive the health care they require.

Vision and Hearing: Vision was a more common problem among the respondents than hearing problems. People become far-sighted as they get older due to loss of elasticity of the lens which leads to a reduced ability to accommodate when viewing close objects. In addition, the likelihood of getting cataracts increases due to increased opacity of the lens with age (Webb and Copeman, 1996). With hearing, the auditory system generally deteriorates with age and accumulation of wax has also been attributed to hearing loss common in the elderly (Webb and Copeman, 1996). These conditions can be dealt with adequately with early diagnosis. Provision of hearing aids can address hearing problems whereas low cost (if not free) spectacles and surgery to remove cataracts can save eyes. In fact, during the study period, all respondents with cataracts were referred to a nearest health centre for treatment.

Chewing problems: Most of the respondents had lost their teeth and hence had chewing problems. Losing teeth is common among older people owing to age and poor dental care. While chewing problems may have an adverse effect on dietary intake, there was no association between having chewing problems and nutritional status. It is possible that the respondents had adapted to the situation by selecting foods which were

easier to chew or it is also possible that other factors were more important than chewing problems in the multiple regression analysis.

Alcohol and smoking habits: A high proportion of both men and women reported drinking alcohol and/or smoking tobacco. Beer is brewed within the communities and is viewed as part of socialising. It is also possible that the ill effects of smoking and alcohol are not well known or are taken lightly. There are now campaigns aimed at discouraging people from using drugs as well as drinking alcohol excessively. The benefits of these campaigns are yet to be seen. Using the chi-square statistic, prevalence of undernutrition was significantly associated with current smoking status among women.

Blood pressure: In this study, over 60% of both men and women were classified as hypertensive. The reasons for such a high prevalence are unknown. It has been demonstrated that blood pressure increases with age although the factors associated with this are being scrutinised (Feldman, 1993). However, among older people hypertension is not uncommon due to the change in the morphology of their arteries which become rigid with age. Thus, pseudo-hypertension is sometimes encountered in some elderly people who have rigid brachial arteries that cannot be compressed by the sphygmomanometer cuff, therefore overestimating the blood pressure readings (James and Pecker, 1994; WHO, 1996). This has been shown to be a problem in Western populations but whether the same morphological changes occur in all populations is uncertain (James and Pecker, 1994). In addition, people of African origin are believed to have an ethnic predisposition to hypertension as a result of their hypersensitivity to salt (Webb and Copeman, 1996). Studies have shown that in the UK rates of hypertension are much higher amongst Afro-Caribbean than amongst the white population and similarly black Americans are more susceptible to hypertension than white Americans (Webb and Copeman, 1996). In a study conducted by Stamler et al. (1976) in the USA, the prevalence of elevated diastolic blood pressure (cut-off point ≥90 mmHg) per 1,000 people aged 65 years and over was 475.7 in black men compared to 321.6 in white men and 478.9 in black women as compared to 307.9 in white women. High blood pressure is considered a major health problem because of its association

with increased risk of coronary heart disease, cerebrovascluar disease (stroke), renal disease and retinal damage (Webb and Copeman, 1996). In view of this problem, all those with blood pressure readings of >90 mmHg (diastolic) and >140 mmHg (systolic) were referred to the nearest health clinic.

5.3 ANTHROPOMETRY

This study provides unique data on the anthropometric characteristics of older people in rural Malawi. The pattern revealed is similar to patterns reported in other African countries (Ndaba and O'Keefe, 1985; Thoner, 1993; Aspray et al. 1994; Ethangatta et al. 1996; Pieterse, 1997) as well as in other developing countries such as India (Marlow et al. 1996; Manandhar et al. 1997b), Sarawak (Strickland and Ulijaszek, 1993) and China (Side et al. 1991). The Asians however, were slightly shorter but had larger triceps than Malawians reflecting either genetic or urban-rural differences since most of the Asian studies were conducted in urban areas.

Comparing the anthropometric measurements of the study to those of the black population used in the National Health and Nutrition Examination Survey (NHANES) I and II (Frisancho, 1990) as suggested by WHO (de Onis and Habicht, 1996; WHO, 1995), the Malawians had substantially lower values than their American counterparts (Table 5.1). The Malawi sample was poor whereas the NHANES study consisted of a cross-section of American Society. It is possible that urban Malawians (if all social classes are included) would present a different picture. The Malawians are lighter, shorter and have less fat and muscle than those in developed countries (Delarue et al. 1994; de Groot et al. 1996; Lehmann et al. 1991; Fidanza et al. 1984). In developed countries, overnutrition tends to be a major concern whereas in developing countries undernutrition is the major public health concern (Launer and Harris, 1996). On the other hand, in Malaysia (Yassin and Terry, 1991), the prevalence of both underweight and overweight appears to be high and their anthropometric means are slightly higher than for Malawi. Genetic and environmental factors such as life-styles, socio-economic status, access to health facilities, health conditions and differences in mortality of older people bring about differences in anthropometric characteristics between populations (Launer and Harris, 1996). In fact, Robson et al. (1971) showed that there are ethnic

Table 5.1: A comparison of mean (sd) anthropometric measurements between older men and women in Malawi and the USA (NHANES study)

Measure	*Age group*	*Males*		*Females*	
		Malawi	*USA*	*Malawi*	*USA*
Weight	55-59.9	56.8 (7.5)	79.4 (17.0)	48.7 (6.7)	78.7 (22.4)
(kg)	60-64.9	53.9 (8.2)	77.5 (14.5)	49.0 (8.2)	74.1 (16.1)
	65-69.9	53.5 (6.1)	73.5 (14.5)	50.9 (10.0)	71.8 (14.8)
	70-74.9	57.8 (8.7)	72.1 (14.9)	46.1 (6.0)	69.5 (15.8)
Height	55-59	168.1 (5.2)	173.5 (6.7)	155.5 (5.4)	160.8 (7.0)
(cm)	60-64.9	166.0 (6.0)	174.1 (6.5)	155.3 (5.0)	160.1 (6.7)
	65-69.9	163.9 (5.4)	170.8 (6.3)	155.1 (6.3)	159.1 (5.9)
	70-74.9	167.2 (7.5)	170.9 (6.9)	155.1 (5.5)	158.4 (5.8)
MUAC	55-59	26.0 (2.7)	32.9 (4.1)	25.8 (2.8)	34.2 (7.0)
(cm)	60-64.9	24.7 (2.4)	32.4 (3.8)	26.0 (3.3)	33.0 (5.0)
	65-69.9	25.0 (2.1)	31.3 (4.0)	26.4 (3.6)	32.0 (4.7)
	70-74.9	25.7 (3.2)	30.4 (3.7)	24.4 (2.7)	31.0 (4.4)
Triceps	55-59	7.3 (2.8)	11.2 (7.2)	12.5 (5.6)	28.7 (12.0)
(mm)	60-64.9	6.9 (3.2)	11.8 (7.0)	12.8 (6.1)	27.7 (10.1)
	65-69.9	7.1 (2.4)	10.7 (6.8)	13.0 (6.0)	25.6 (9.6)
	70-74.9	9.3 (6.1)	9.8 (5.3)	10.1 (4.1)	24.3 (9.3)
BMI	55-59	20.1 (2.0)	26.3 (5.1)	20.2 (2.7)	30.4 (8.2)
(kg/m^2)	60-64.9	19.5 (2.7)	25.5 (4.2)	20.3 (3.2)	28.9 (6.1)
	65-69.9	19.9 (2.4)	25.1 (4.6)	21.1 (3.5)	28.4 (5.8)
	70-74.9	20.7 (3.4)	24.6 (4.4)	19.0 (2.3)	27.6 (5.9)
CAMA	55-59	35.1 (10.4)	58.7 (13.4)	31.7 (6.9)	43.4 (18.9)
(cm^2)	60-64.9	30.9 (7.5)	55.5 (12.3)	32.4 (7.0)	40.6 (12.1)
	65-69.9	31.4 (6.7)	53.1 (14.3)	33.5 (8.5)	40.0 (11.9)
	70-74.9	31.6 (9.0)	50.2 (13.2)	29.5 (7.2)	37.6 (11.3)
MUAFA	55-59	9.1 (3.5)	18.0 (12.5)	15.2 (6.4)	44.0 (25.5)
(cm^2)	60-64.9	8.3 (4.3)	18.5 (12.1)	15.9 (8.8)	40.7 (18.3)
	65-69.9	8.5 (3.2)	16.3 (11.5)	16.4 (9.1)	36.8 (16.9)
	70-74.9	11.6 (8.5)	14.6 (8.8)	11.8 (5.5)	33.9 (15.3)
AFI (%)	55-59	16.9 (5.7)	19.3 (10.0)	27.7 (7.7)	44.4 (11.7)
	60-64.9	16.4 (6.2)	20.7 (9.8)	27.3 (9.5)	44.6 (10.6)
	65-69.9	16.9 (4.7)	19.4 (9.6)	27.6 (8.8)	42.5 (10.8)
	70-74.9	20.5 (10.2)	18.6 (7.9)	23.9 (7.4)	41.8 (11.0)

differences in the deposition of fat in the triceps region with Caucasians depositing more fat than Negroids.

In Malawi, undernutrition has been (and continues to be) a serious problem. Studies conducted in the late 30s reported high rates of malnutrition in children (Berry and Petty, 1992). Thus, poor older people today were likely to have been stunted and wasted in childhood and therefore may not have reached their full genetic potential. With continuous hardship from childhood to adulthood and repeated infections, nutritional problems persist into old age.

Changes in Anthropometry with age

Changes in most of nutritional indicators with old age have been documented in both longitudinal and cross-sectional studies. In this study, most of the measurements indicated poorer nutritional status in higher age-groups although this was not statistically significant. Selective survivorship may partially obscure age-related changes since those with better nutritional status at a younger age (such as below 65 years) are more likely to live longer.

Age-related height loss is attributed to osteoporosis leading to shortening of the spinal column (Mitchell and Lipschitz, 1982a; Haboubi, 1990), alterations in posture (Lipschitz, 1992; de Groot et al. 1996) and kyphosis (curvature of the spine) (Chumlea and Baumgartner, 1989). Older females in the study were substantially shorter than the average adult Malawian females (154.9 cm vs 156 cm, (NSO, 1994) which could reflect a true decline in height or a secular trend (Noppa et al. 1980; van Leer et al. 1992). Armspan did not change with age-group among women which is in keeping with other studies (van Leer et al. 1992). Weight was also lower in the higher age-groups in agreement with other studies (Yassin and Terry, 1991; Lehmann and Bassey, 1996). Most of the decline in weight is attributed to an age-related decline in body water (Rico et al. 1993). Older age-groups had lower MUACs and lower muscle areas (CAMA) than younger age groups in both males and females. This could be due to loss of fat and lean muscle associated with ageing (Lipski et al. 1993). Similar findings have been reported by Ruiz-Torres et al. (1995), Yassin and Terry (1991) and Herman et al. (1998), although

Reid et al (1992) and Woo et al. (1988) reported contrary results. The decline in muscle mass is attributed to the loss of protein and body water (Kuczmarski, 1989). The reduction in muscle mass with age is believed to contribute to the reduction in muscle strength as age increases (Skelton et al. 1994; Kallman et al. 1990).

Most studies have reported larger triceps measurements among females than among males (de Groot et al. 1991; Visser et al. 1994). This observation was also apparent in this study. Larger mean skinfolds have been associated with survival (Milne, 1979) and small skinfolds with increased risk of subsequent mortality (Campbell et al. 1990). However, their use is still in debate due to the re-distribution of fat from limbs to trunks, the increase in internal fat (Schwartz et al. 1990), the compressibility of skinfold with age (Chumlea, 1991; Chumlea et al. 1984) and measurement errors (Fuller, 1991; Lohman, 1988). Using arm fat index and mid-upper arm fat area, this study has demonstrated that men have consistently less fat than females. This has also been reported by Baumgartner et al (1995). Regarding age, among males there was a tendency to increase the fat whilst among women the converse was true. Generally, body fat tends to increase until age 70-75y after which there appears to be no additional increase. However, this kind of analysis can only be verified by studies which measure adipose tissues on the trunk which are better predictors of overall fatness as a person ages (Kuczmarski, 1989).

Nutritional indicators

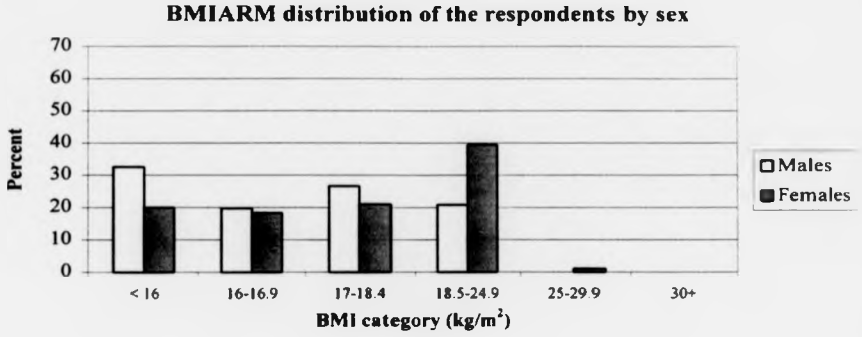
Most nutritional studies of the elderly have been hindered by lack of suitable indicators for assessing nutritional status. This is compounded by lack of suitable reference values for the elderly. It is apparent that using different indicators can yield different results. What is clear from this study is that low BMI is a major concern in Malawi. It has been associated with low survival rates among the elderly in several studies (Campbell et al. 1990; Rajala et al. 1990). Individuals with a low BMI may encounter problems in responding to emergencies (Durnin, 1994). Some studies have reported a decline in BMI with advancing age (Yassin and Terry, 1991; Strickland and Ulijaszek, 1993; King et al. 1997 among men), while others have indicated otherwise (Carmelli et al. 1991; Woo et al. 1988). In this study, mean BMI was slightly lower in the oldest men and women. In addition, among women, the prevalence of undernutrition was highest in the oldest age-

group which is indicative of a worsening situation with advancing age but could also be an indication of worsening health which may have a negative influence on the nutritional status of older people. Chronic illnesses which are prevalent among older people may have a bearing on their nutritional status particularly if they remain undiagnosed and therefore untreated. On the other hand, selective survival into extreme old age of those who are better nourished and healthier could result in a lower prevalence of malnutrition in the oldest age-group.

Since among blacks, armspan greatly exceeds height in adulthood (Reeves et al. 1996a; 1996b; Steele and Mattox, 1987) armspan cannot be used to substitute for height in older people without correction. It is striking to note that in this study the prevalence of undernutrition defined as BMI < 18.5 kg/m^2, was 2.2 times higher when armspan was used in the BMI equation instead of height (i.e. BMI=weight (kg)/armspan (m)^2) (see Figure 5.1). A total of 79.1% of males and 41.5% of females are classified as malnourished using this method. Similar findings have also been reported in Indonesia when armspan was used in the BMI equation (Rabe et al. 1996). Findings such as these highlight the enormous ethnic differences in the relationship between height and long bone measures. It also stresses the need for more studies measuring both height and long bones so as to establish the relationship for different ethnic groups, hence permitting the calculation of BMI for kyphotic people.

Although BMI <18.5 kg/m^2 was used a common cut-off point for all respondents, its reliability is questionable particularly in those aged 70 years and over. This could be one of the reasons why the effect of age on nutritional status was not significant. The use of the BMI cut-off point of 18.5 kg/m^2 to identify the undernourished in this population may be valid, but further studies are needed to confirm validity, covering all age-groups and larger sample sizes. Comparisons of prevalences in normal and undernourished respondents of the presence of related conditions (functional ability, health and socio-economic factors) are given in appendix 19. While significance was not achieved for most factors, again possibly because of sample size, the trend was generally in a direction to suggest that those with BMIs less than 18.5 kg/m^2 were worse off.

Figure 5.1



The prevalence of undernutrition was much lower when MUAC was used as an indicator of nutritional status compared to when BMI was used. It is possible that the cut-offs suggested by James et al. (1994) are not applicable to this population. In their paper, it was noted that the mean MUACs for the African women was higher than for the Asian women except for the Somalis and Ethiopians. This may indicate a need for different cut-offs for the ethnic groups rather than pooling data from different populations to develop a cut-off point and moreover, the cut-off points are for adults and may therefore not be applicable for the elderly. Furthermore, since there are ethnic differences in fat deposition in the triceps region (Robson et al. 1971), this may also have an influence on the MUAC measurement.

Anthropometry with living arrangement and marital status: Anthropometric measurements were not directly associated with living arrangement. It is possible that the limited sample size in those living alone (n= 25) may have masked a likely relationship between living alone and anthropometric characteristics. However, research results tend to be contradictory, with some studies conducted in Western countries showing that men living alone tend to have a lower food intake (Howarth, 1989, DHSS, 1972 & 79, Burr et al. 1982; Davis et al. 1990) and while others (LeClerc and Thornbury, 1983; Posner et al. 1987) finding no association between living alone and dietary intake. It is believed that when a person is living alone, he/she may find little

reason to prepare adequate meals and may therefore resort to convenience of snacks (Herrman, 1984) which may be inadequate nutritionally. In addition, they are constantly reminded about their loneliness during meal times which may also affect their appetite and hence nutritional status.

As for marital status, women who had a spouse had better anthropometric measures than those without a spouse. Thus, having a spouse had a protective effect which could reflect better socio-economic conditions, but the results might have been also confounded by age. Being house-bound on the other hand was associated with large values for almost all the variables in both sexes. This could be attributed to inactivity and hence being fat.

5.4 FUNCTIONAL ABILITY

Activities of daily living (ADLs): Direct comparison with other studies is not possible since the type of ADLs assessed tend to vary from study to study (see chapter 2). In this study, most respondents were independent in almost all ADLs (Katz index, chapter 3). This is similar to what was reported in Guyana (PAHO, 1989 assessed ability to bath, dress, toilet, transfer, groom and whether they were mobile) and in Zimbabwe (Wilson et al. 1991 assessed ability to bath, dress, toilet, groom, feed and walk; Allain et al. 1997 assessed ability to bath, dress, toilet, transfer, groom and whether they were mobile). Compared to the SENECA study (Schroll et al. 1996) however, this sample was more independent since in that study, only 54% of the men and 37% of the women in the baseline survey and 40% of the men and 22% of the women in the follow-up study, were able to perform all the ADLs unaided. The difference could be attributed partly to the fact that the SENECA sample was older (all aged >65 years) but could also be due to the fact that culturally in Malawi people are expected to perform these activities and therefore prefer carrying out these tasks rather than relying on other people. Moreover, in the SENECA study 16 ADLs were included some of which are classified as instrumental activities of daily living (IADLs) (see Osler et al. 1991 in Tables 2.3 and 2.4 in chapter 2) and tend to be difficult. This therefore increased the prevalence of dependency in the SENECA study which may have not been the case if only the Katz ADL had been included in their analysis.

In general, women tend to be more dependent in ADLs than males (Jette and Branch, 1981; Osler et al. 1991; Ruigomez et al. 1991). The reasons for this gender difference are ambiguous but Osler et al (1991) have attributed it to the fact more women live longer than their counterparts and therefore the oldest males comprise a more unusual group. However, in this study more males were dependent in at least one ADL than women which suggests that the gender difference may vary with cultures. The fact that the male sample was significantly older than the female sample may also have played a part in the gender difference. With regard to age, those aged 70 years and over had higher rates of dependency than their younger counterparts. The study therefore supports the notion that functioning in ADLs declines with age as reported in both cross-sectional and longitudinal studies (Haga et al. 1991; Antilla, 1991; Hisnanick, 1994; Duffy and MacDonald, 1990; Barker, 1989). However, in all these studies, there was still a substantial proportion of older people who were still independent supporting the opinion that even in old age, it is possible to maintain good function.

IADL: Gender differences in activities carried out by respondents made it difficult to compare the sexes as in other studies (Ashworth et al. 1994; Branch and Meyers, 1987). IADLs are also known to decline with age (Antilla, 1991). In this study, the ability to travel outside the village was the main IADL which tended to decline with age in both sexes. Among females however, the ability to perform activities such as cooking, pounding maize, sweeping, drawing water was also diminished among the older subjects compared to their younger counterparts. This could be owing either to the fact that when subjects become older they receive more assistance or that difficult tasks are avoided as individuals grow older because of waning of energy or physical impairment, or loss of muscle strength.

Mobility is vital to older people because it enables them to participate in agricultural activities as well as in preparing their own food (Manandhar, 1995). A decline in mobility with age as evident in this study, has been attributed to impairments in ability to walk properly, a decline in muscle strength with age and musculoskeletal changes (neck and back flexibility and condition of the feet) (Tinetti, 1986). Among males, those who reported having mobility problems had a higher prevalence of relative impairment in hand

grip strength. However, this relationship could be confounded by age since among the older respondents, the prevalence of mobility problems and poor handgrip strength were higher than among younger respondents.

Physical performance measures: The results of tests of handgrip strength agree with those reported in literature: men are generally stronger than women and function declines with age (Hyatt et al. 1990; Webb et al. 1989; Kallman et al. 1990; Bassey and Harries 1993; Lehmann and Bassey, 1996). In the longitudinal study conducted by Bassey and Harries (1993), the reduction in handgrip strength was by 12% among men and 19% among women in the 4 year period. The decline in strength has been attributed to a number of reasons but mostly to reduction in muscle mass with age which may be caused by disuse, illness or to a decline in customary activity or just to ageing as result of alterations of muscle fiber composition (Kallman et al. 1990; Lexell, 1995), or a decreased number of muscle fibres (Grimby and Saltin, 1983; Grimby, 1995). Handgrip strength was lower than that reported in developed countries particularly among men, even though the respondents were younger than those in developed countries as shown in Table 5.2. Among Malawian women however, the mean was closer to that of older women in developed countries. This may indicate that indeed the onset of old age occurs earlier in most developing countries but could also reflect differences in nutritional status. Handgrip strength is positively associated with nutritional status (Guo et al. 1996; Harries, 1985) and in developing countries, undernutrition tends to be a major problem (Launer and Harris, 1996) which is likely to predispose them to poor function. In this study, body mass index and arm muscle area were both positively associated with handgrip strength in both men and women even after controlling for potential confounders. Furthermore, in a study conducted in Bombay (Manandhar et al. 1997a), there was a significant association between having a low body mass index (BMI < 16) and an increased risk of low handgrip strength using multiple logistic regression (Odds ratio = 5.7085, $p<0.0001$). Findings such as these have also been reported in young adults (aged 15-35 years) where chronic energy deficiency was associated with poor handgrip strength after correcting for stature and forearm muscle area (Vaz et al. 1996). The Malawi sample was similar to older samples from Nigeria (Harries, 1985) (age range 55-64, mean handgrip strengths were 34.3 ±6.6 kg and 31.1 ± 6.1 kg among males and 22.4 ± 5.0 kg

and 22.2 ±4.8 kg among females in Nigeria and Malawi, respectively) and Tanzania (Pieterse, 1997) but stronger than the Indian sample (Manandhar, 1997) as shown in Table 5.2.

Table 5.2: A comparison of mean (sd) handgrip strengths in kg

Study	*Males*		*Females*	
	Age (years)	*Mean handgrip kg (sd)*	*Age (years)*	*Mean handgrip kg (sd)*
Malawi	55 - 94	28.0 (5.9)	55 - 94	21.7 (4.5)
Hyatt et al, 1990	76.0 (mean)	32.7 (10.1)	78 (mean)	22.0 (8.6)
Bassey and Harries, 1993	74 (mean)	33.8 (9.3)	76 (mean)	19.5 (6.3)
Lehmann and Bassey, 1996	> 65	36.6*	> 65	21.3*
	> 69	32.6†	> 69	18.3†
Tanzania (Pieterse, 1997)	50 - 93	30.3 (6.7)	50 - 93	22.2 (5.1)
India (Manandhar, 1997)	50 - 96	22.65 (6.6)	50 - 96	13.4 (4.5)

* 1985

† 1989

While studies have shown the importance of manual dexterity in assessing functional ability, cross-national comparisons tend to be limited due to the differences in methodology. For instance, in this study opening a padlock was used to assess it whereas others have used a 27 item battery or a 15 item battery (see chapter 2). The same applied for psychomotor function where reaction time and tapping time are assessed in a different manner. The closest to the methodology used in this study is a study by Era and Rantanen (1997) who assessed psychomotor function by giving respondents 2.5 and 5.0 seconds and counted the number of taps (tapping rate). This is a converse of what was assessed in this study. However, since the principle is the same, crude comparisons can be made. They found that men performed better than women contrary to the results of this study where no sex difference was observed in the plate tapping time but showed that psychomotor

function declined with age as observed in this study. Nevertheless, low tapping rate was associated with poor survival rate indicating its importance as a measure of function.

These functional dimensions are of great importance for many activities of daily life (Skelton et al. 1994; Manandhar, 1995). In Malawi, older people are very active, particularly in agricultural activities, although some do get assistance with household work. It is possible that they do not perform to their maximum potential due to poor nutritional status and illnesses which are not uncommon. In this study, the prevalence of undernutrition was 33.7% among men and 27.7% among women and the most common illnesses affecting older people were muscular and joint pains, respiratory problems and malaria. Thus, although continued activity is supposed to preserve function since exercises are known to improve muscle strength (Fiatarone et al. 1990 and 1994; Sharpe et al. 1997), this may not be achieved in the presence of malnutrition and frequent bouts of illnesses.

It is apparent from the study that ADLs were not efficient in discriminating respondents at high risk of functional impairment and as such, they are not useful for assessing function in this population. On the other hand, handgrip strength was seen to be a good indicator of function among older people. In addition to being associated with nutritional status, poor handgrip strength has also been found to be related to mortality (Milne and Maule, 1984; Phillips, 1986) and other functional dimensions (see chapter 2) as was evident in this study as well. Thus, having a poor handgrip strength may jeopardise performance of other crucial activities.

5.5 RELATIONSHIP BETWEEN NUTRITIONAL STATUS AND FUNCTIONAL ABILITY

5.5.1 General relationship: To date, there is limited knowledge of the association between nutrition and function in the elderly although there is a growing interest in this aspect. In his review, Torres-Gil (1996) indicates that good nutrition is crucial for keeping older people healthy, functioning and remaining independent at home. In essence, this research was aimed at establishing the links between nutritional status and functional ability in a developing country.

The results lend support to findings that poor nutritional status is associated with poor function particularly handgrip strength in both sexes (Manandhar, et al. 1997a; Vaz et al. 1996). In this study, 15.8% and 11.6% of the variation in BMI was explained by handgrip strength in men and women respectively. Among females, poor ADL score was associated with high BMI as revealed by a study conducted among the Japanese living in Hawaii (Davis et al. 1998) but no such association was found among men as also reported by Iswarawanti et al. (1996).

5.5.2 Risk factors for low body mass index

After controlling for possible confounders, the following factors were the determinants of body mass index identified through multiple regression analysis.

Poor handgrip strength: Older people may have problems in acquiring food depending on their physical strengths and availability of resources. Poor handgrip strength may imply inability to engage in agricultural activities effectively, hence affecting productivity but can also mean inability to prepare own meals and hence having an impact on nutritional status particularly in absence or with limited support from relatives. Thus, poor strength can have a bearing on the individual's nutritional status. The association between BMI and handgrip strength has also been reported by others in both younger (Vaz et al. 1996) and older adults (Manandhar et al. 1997a).

A history of smoking: Smoking is associated with low body weight but also with chronic illnesses. It was a risk factor among men but not among women. It is possible that men smoke more cigarettes per day than women. The average number of cigarettes smoked were 3.7 and 2.5 among men and women respectively. Although this was an estimate for their current status, it is possible that even in the past the trend was similar. The results of this study are similar to what was reported by Bales et al. (1997) that smoking was one of the factors which was independently associated with low BMI (low if $<15^{th}$ percentile) (Adjusted OR = 2.21, 95% CI: 1.43-3.42) in their community dwelling elderly (n=2,103, mean age 78.3 years).

Source of income: Multiple sources of income can indicate wealth since it provides a purchasing power which could ensure food availability in case of poor production. Food availability is a pre-requisite to better nutrition. Those who had one or no source of income were more likely to have a low BMI which may imply that they were likely to be poorer than their counterparts. Surprisingly, this was an important factor among men and not among women. Studies conducted in both developed and developing countries have shown that poverty is associated with poor nutritional status among older people (Miller et al. 1996; Ethangatta et al. 1996). However, in developing countries many older people enter old age after a life time of deprivation, poverty and poor dietary intake.

Living alone: When a person is living alone, he/she may find little reason to prepare adequate meals. This may be worse among men since culturally cooking is seen as a woman's task; men may therefore rely on other people entirely who may have other responsibilities. Thus among men, living alone was associated with a low BMI explaining 3.2% of the variation in BMI. This could be as a result of lack of food and/or social isolation. Other studies have also reported a similar association, that men living alone are likely to have a poorer diet and hence a poor nutritional status than women in a similar situation (Howarth, 1989; DHSS, 1972 & 1979). However, this remains a controversial subject since research results tend to be contradictory.

Fear of dependence and disability may lead to depression among older people. Depression which is common in older people has been associated with anorexia and lack of interest in food or meal time which may in turn affect dietary intake (Davies, 1989). In most cases depression is usually owing to a sense of loss of loved ones, low productivity and income, a poor sense of worth and body image and limited mobility. This may lead to avoiding food altogether or they may overeat to compensate (Krause and Mahan, 1978).

History of anaemia: A history of anaemia indicates a history of malnutrition and such people are prone to poor nutritional status. In addition, anaemia is also associated with poor function which can itself lower productivity (Anklesaria, 1997) and hence lead to a poor diet.

Having one meal in pre-harvest period: Although access to land in Lilongwe is not a major constraint and the land is generally very productive, owing to the fact that agriculture is almost entirely rain fed (with a few irrigation schemes) and acquisition of agricultural inputs such as fertilisers and seeds (particularly hybrids) is difficult and expensive, food shortages do occur especially 2 - 3 months prior to harvest. This is also the time when agricultural activities reach their peak hence there is no time for adequate meal preparation. This is believed to be common in most rural populations of the third world (Pacey and Payne, 1985). The situation is worsened by increased infections in this time of the year due to rains which create breeding places for mosquitoes and flies which transmit diseases (Government of Malawi/United Nations, 1993). As a result, malnutrition is very high. Thus, having only one meal per day in the pre-harvest period could be a reflection of food shortage or lack of time for adequate meal preparation. Since the study was conducted during the harvest period, it is also possible that they had not recovered from the ill effects of the pre-harvest period. Seasonal changes in nutritional status have also been reported in children and adults in Ethiopia (Branca et al. 1993).

Diastolic blood pressure: Having a high diastolic blood pressure was associated with a high body mass index particularly among men, which reflects a high fat percentage in the body. These findings are consistent with what was reported in China (Idema et al. 1998). This therefore did not qualify as one of the risk factors for low BMI but the converse was true. However, it should be noted that in this study prevalence of overweight or obesity was very low.

Ability to perform ADLs and mobility problems were associated with being fat. Thus, the likelihood of having mobility problems and being unable to perform at least one ADL was higher among respondents with a higher BMI. In Hawaii, BMI was negatively associated with six of the ADLs (Davis et al. 1998) and this association was attributed to either being too fat therefore unable to perform normal activities of daily life, or indirectly through diseases and disability. In the Malawi study, it is not clear what could have contributed to this association since the prevalence of overweight was very low.

5.5.3 Risk factors for poor handgrip strength

As evident in Tables 4.39 to 4.42, there was a difference between men and women in the risk factors for poor function. However, in both sexes, health and nutrition factors were important determinants of handgrip strength.

Age: The decline in handgrip strength with advancing age has been attributed to a decline in muscle mass (Kallman et al. 1990; Lexell, 1995; Grimby and Saltin, 1983; Grimby, 1995). In multiple regression analysis, age was an important factor only among males. This could be attributed to the fact that women were significantly younger than men and hence the limited proportion of older women in the study (only 14.7% of the women were aged 70 years and above compared to 44.7% of the males in the same age category) could have obscured important age-related changes in handgrip strength.

Low BMI: Low body mass index indicates low body fat and muscle. Thus, its association with poor handgrip strength is probably through the reduced muscle mass. Reduction in muscle mass (Dutta, 1997) has been associated with the decline in muscle strength commonly associated with advancing age (Kallman et al. 1990; Skelton et al. 1994). In this study, it appears that the relationship between function ability (handgrip strength) and nutritional status is two way. Although we can not assume causality from a cross-sectional study it is possible that measures designed to improve one may have a beneficial effect on the other.

Inability to travel and inability to visit: The fact that respondents were unable to travel outside their own village and also unable to visit relatives, shows that their functional ability was poor. This could have been due to age but also disuse. Since age was controlled for, a decline in using muscles would be the possible explanation for the decline in muscle strength. Although handgrip strength assesses the strength of the upper extremity, it has also been associated with other dimensions of functional ability such as risk of falling (Wickham et al. 1989) and mobility problems (Rantanen et al. 1994).

Poor health, chest pain and stomach-ache: Respondents that were ill were more likely to be weak and therefore could not carry out the functional tests to their expected levels. It is also possible that psychologically they felt that they could not perform these tests effectively due to their poor health and as such they were not motivated to perform the tests maximally.

Marital status: Having no spouse was an important factor for handgrip strength among women. It is possible that those without a spouse were not as active since they did not have a spouse to care for. One may argue that those without a spouse would be more active since they have to perform all the activities on their own; it is possible however that having no spouse may encourage more assistance from other relatives. Although most of the widowed respondents were significantly older, the reduced strength could not have been because of age alone since its effects were controlled for.

No access to health services: Having no access to health services may indicate poor health in the sense that even minor illnessess are not properly treated and as such people are generally weak and hence have poor functional status.

No occupation: The respondents without occupation were likely to be inactive. The loss of function could be attributed to a combination of disuse and age as well since those without occupation were significantly older and hence had probably lost some of their muscle mass. However, the effect of age was controlled for thus reduced customary activity had an independent effect on muscle strength. Diminished customary activity is known to contribute in part to the loss of muscle mass which is associated with reduced muscle strength (Kallman et al. 1990) and therefore may aggravate the decline in muscle strength with age.

Given food: Food is vital in ensuring that people are strong and able to perform their routine activities. However, among old people being given food may result in inactivity since they do not have to prepare their own meals. Thus, loss of strength can be explained through reduced activity. Alternatively, the receipt of food may indicate a poorer group of elderly, judged by relatives to be in need of support.

5.6 KYPHOSIS AND NUTRITIONAL STATUS AND FUNCTION

There was no significant difference in nutritional status between kyphotics and non-kyphotics. On the other hand, functional impairment was more common among kyphotics in both sexes but significantly so only among women. It would have been interesting to control for age but the smaller numbers prevented such analyses. However, other studies have shown that kyphosis assessed qualitatively is associated with functional problems particularly with difficulty reaching (OR = 2.21, 95% CI: 1.14 to 4.29) and difficulty in performing heavy housework (OR = 1.64, 95% CI: 1.03 to 2.61), adjusting for potential confounders including age and gender (Ryan and Fried, 1997). Furthermore, in the same study, quantitative kyphosis was independently associated with stair climbing time ($p = 0.005$). These findings suggest that being kyphotic is a risk factor for functional impairment and if indeed this is the case, it may imply that people who are kyphotic may need more help than non-kyphotics. Like this study, Ryan and Fried's study was also cross-sectional therefore causality could not be assumed and further research is needed to fully understand the impact of kyphosis on functional ability.

5.7 LIMITATIONS OF THE STUDY

Being a cross-sectional study, we can not assume causality between poor function and poor nutritional status and we need to confirm this hypothesis in a longitudinal or intervention study. Cross-sectional studies are faced with 'chicken or egg' dilemma since both exposure and outcome are assessed concurrently (Hennekens and Buring, 1987). It is therefore not possible to determine whether exposure preceded outcome. Thus, one can not show whether poor handgrip preceded poor nutritional status or vice versa. Furthermore, selective survival into old age of those who are better nourished and healthier could also have an effect on the results. Nevertheless, the study's aim of establishing associations was possible with the study design used.

Very few younger men (<60 years) participated in the study presumably because of working elsewhere. This may have introduced a bias. It also affected the ratio of males to females. However, the important aspects of functional ability and nutritional status were still determined despite the small sample size of men. Similar future studies

should try to include equal numbers of men and women and possibly stratified by age because younger respondents were poorly represented.

The clinical data was limited since full hospital based clinical examination was not carried out and hence it was difficult to ascertain chronic illnesses. It was also difficult to understand interaction of social factors within households using only the questionnaire. This therefore calls for the use of an anthropological approach to understand such interactions.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

The hypotheses tested in this study were that poor nutritional status is associated with lowered functional ability and that there are social, economic and health related factors associated with nutritional status and functional ability which can be used to define nutritional vulnerability.

This study supports the first hypothesis to some extent, namely that poor nutritional status is associated with functional ability but only as assessed by handgrip strength: in both bivariate and multivariate analyses, handgrip strength was positively associated with nutritional status indicators. In addition, using the BMI cut-off point of 18.5 kg/m^2, the prevalence of impaired handgrip strength in the undernourished group was twice that in the normally nourished group. As for the other functional ability tests, the study did not support the hypothesis since although the tendency was for those with poorer nutritional status to perform poorly in psychomotor and cognitive function, as well as in the lock and key test (among women) and in ADLs (among men), no such associations were observed after controlling for possible confounders. It is possible that the limited sample size or uneven age distribution could have obscured the relationships. It is also possible that since we are measuring different dimensions of function, some may have a direct relationship with nutritional status whereas others may not have independent effects on nutritional status and vice versa. Furthermore, the BMI cut-off of 18.5 kg/m^2 may not be appropriate for defining poor nutritional status in older adults. This could not be examined further because of small numbers in the lower BMI categories.

The study has also shown that there are some social, economic and health-related factors which are associated with a low BMI. However, many social, economic and health-

related factors which were included in the multiple regression analysis did not emerge as significant. It is possible that these factors did not have independent effects on nutritional status or that the sample size was not large enough to test this hypothesis. Another contributing factor could be the fact that most of the socio-economic and health-related information was elicited through self-report. Using objective measures would perhaps have provided better information and hence better associations with nutritional status. Again, the appropriateness of the BMI cut-off of 18.5 kg/m^2 may also have limited the outcome of this examination of nutritional vulnerability.

The specific objectives of the study were to ascertain levels of malnutrition and functional impairment, to examine the relation between these variables and to identify risk factors associated with malnutrition.

6.1.1 Anthropometry

The results show a high prevalence of malnutrition (using BMI < 18.5 kg/m^2) among older people in Lilongwe district, Malawi, which until recently was unrecognised. Thus, the study has demonstrated for the first time that undernutrition is a significant problem among older people in rural Lilongwe (about a third of the older people are undernourished compared with only 10.1% of younger adult rural women in 1992). More importantly, these results highlight the need to incorporate older people in existing and future nutrition and health programmes.

The respondents were lighter and slightly shorter and had less fat and muscle than those in developed countries but were comparable to their African counterparts for most measurements. The most prominent change with age which was observed in the study was the decline in muscle area. This is also known to contribute to the reduction in muscle strength with age.

6.1.2 Functional ability

The results demonstrate that the majority of the older people in the sample from the rural Lilongwe district of Malawi are independent in performing activities of daily living (ADLs). As for the physical tests of functional ability, the absence of established cut-off

points and comparison groups (young adults), limited the definition and interpretation of functional impairment. However, using 25th percentile as a cut-off point, the study found that those impaired in handgrip strength were also more likely to perform poorly in other functional tests.

The functional ability of the Malawi sample, as assessed by physical tests, is comparable to that of other African countries but lower than that reported in developed countries. Presumably this could be due to malnutrition, illnesses or earlier onset of old age.

Performance in tests of functional ability declined with age and in most tests, men performed better than women. However, performance in ADLs was not associated with handgrip strength (using multiple regression techniques), thus possibly limiting the use of ADLs as a screening tool in this population.

6.1.3 Relationship between nutrition and function

The study supports the hypothesis that poor nutritional status is associated with poor functional status but only as assessed by handgrip strength, in both men and women after controlling for possible confounders. However, poor functioning in manual dexterity, psychomotor function and cognitive function was not significantly associated with poor nutritional status, after controlling for possible confounders.

Bivariate analyses revealed significant associations between handgrip strength and nutrition status indicators (BMI, MUAC, arm muscle and fat areas) in both sexes and between psychomotor function (plate-tapping test) and the same nutritional status indicators except arm fat area, among men. However, no other associations were found between functional ability and nutritional status.

In this sample at least multivariate analyses revealed that handgrip strength was the only dimension of functional ability to be significantly associated with nutritional status; the strongest associations were with indicators that reflect muscle mass exclusively (AMA) or in part (BMI, MUAC).In the wake of HIV/AIDS in African countries (Gorman, 1995), the role of older people is changing. Most older people will have to take care of

orphaned grandchildren and this stresses the need for the older people to remain functionally independent so that they can be effective carers themselves.

6.1.4 Risk factors for undernutrition

The risk factors emerging from this study characterise some of the factors which may predispose older people to malnutrition in the area studied. However, since the relationship between the risk factors and nutritional status is not causal, further studies are proposed especially prospective or intervention studies with larger sample size to establish causality. Nevertheless, this study can be viewed as a beginning in Malawi in ensuring that the older people are not forgotten and more importantly in understanding their problems and recognising that they play an important role in our societies.

The social factors associated with low BMI were living alone and fear of dependence and disability whereas the economic factors associated with low BMI included poverty (having no or only one source of income) and reduced food intake in the pre-harvest season. Poor handgrip strength, a history of anaemia, and smoking were the health related factors associated with low BMI. Other factors were not significantly associated with low BMI, perhaps because limited sample size hindered the association.

6.1.5 Other findings

6.1.5.1 Social factors

The study found that widowhood is a common condition among older women of rural Lilongwe. Illiteracy was very high though not surprisingly so considering the constraints their families might have faced when they were young. Many of the older people were engaged in agricultural activities and with help, they may support themselves well into old age.

Although about a quarter of the respondents are assisted in various aspects by their immediate family and other relatives, the adequacy of such help is questionable since these carers also have families to care for. While the contributions of the extended family should not be undermined, they are not always adequate or available. Thus, if older people continue to be active they are more likely to lead a better life than if they

are inactive and dependent. However, there will always be the ill and frail who will need support from families and society at large and this emphasises the importance of the traditional extended family.

6.1.5.2 General health

Most older people rated their health as poor or somewhat reduced which is not surprising since most complained of muscular and joint pains, respiratory problems and malaria in addition to chronic ailments such as backache. A substantial proportion of older people complained more about sight problems than hearing problems. Persistent chewing problems were also common among the respondents. Smoking and alcohol consumption were common among both men and women although it was extremely difficult to quantify actual consumption.

6.1.5.3 Risk factors of functional impairment

In the absence of strong associations between most functional ability indicators, and other variables, the only dimension of functional impairment used as a dependent variable in multiple regression analysis was handgrip strength. Risk factors for poor handgrip strength among men included age, socio-economic factors (inability to visit children and other relatives; no current occupation) and health factors (low BMI, poor health and limited access to health services). Among women, it was associated with inability to travel outside their village and having no spouse (social); receipt of food (economic) and health factors (low BMI, poor or no access to health services and poor health).

6.2 RECOMMENDATIONS

6.2.1 POLICY AND PROGRAMMATIC ISSUES

1. Older people should be incorporated in existing and future nutrition and health programmes rather than designing special programmes for the elderly which may be seen as diverting the attention of the nation to the elderly. In this way, nutrition and health issues will cover the whole life-cycle and hence be more likely to achieve the national goal of ameliorating the nutritional status of the whole population. One of the risk factors for low BMI which emerged from the study was reduced food intake in the pre-harvest season. This problem can be addressed directly by providing food to poor older people in the pre-harvest period when food stocks are depleted or indirectly through income generating activities which would ensure that older people have adequate money to purchase food. Income generation is a common strategy for combating poverty and the involvement of older people in designing such programmes would ensure success of such ventures. For those who assist older people, the government can introduce a tax rebate system so that more money is available for that purpose.

2. This and other studies have revealed that better nutritional status is strongly associated with better function (as assessed by handgrip strength). It is thus important to support projects which aim at improving the nutritional status of younger adults (nutrition education so that people have proper diets, income generation to purchase food, disease prevention) since individuals are likely to have better function and a healthier ageing if they enter old age with a better nutritional status.

3. As nutritionists, we have a long way to go to achieving better nutrition in Malawi. However, our aim should be working together with other sectors which aim to alleviate poverty and improve crop and animal production so as to ensure that adequate food is available for home consumption. Nutrition education has been our main emphasis but without resources it is futile. Programmes aimed at increasing crop productivity (for instance, subsidised agricultural inputs such as fertilisers and

seeds) and small animal rearing should also involve older people since they also rely on agriculture for food and income.

4. Health aspects are also crucial when it comes to nutrition. Although nutritionists may have no control over the type or number of health facilities, we should encourage people to use available resources effectively, so that ill-health can be reduced and its impact on nutritional status can be minimised. Health care must also be at least as accessible to elderly people as it is to other members of the household. If we have better health and nutrition from birth through adulthood, we are more likely to achieve healthy ageing. Most of the respondents complained about malaria, respiratory infections and muscular and joint pains. Treating such symptoms and diseases may improve their well being and they are likely to participate in day to day activities efficiently. The government should be thinking of providing hearing aids and low cost spectacles since hearing and vision problems tend to increase with age and were reported among the majority of the respondents as problems in this study. Low cost aids to improve mobility and manual dexterity would reduce dependence and improve quality of life. Providing dentures and cataract surgery will also assist many older people. Anti-smoking campaigns need to strengthened not only because a history of smoking was associated with low BMI but because smoking is also associated with other diseases. The prevalence of hypertension and other chronic illnesses in this study was high.

5. Churches, schools and local communities can be mobilised to assist older people within their localities. This would widen social networks and would therefore help to meet both the physical and social needs of older people.

6. Since older people need to remain economically active, they should be encouraged to participate in as many activities as possible so as to remain independent for as long as possible since increased inactivity is associated with reduced function and increased illnesses.

7. Training of health professionals, including nutritionists, should incorporate courses on ageing and the special health, nutritional and social needs of older people.

6.2.2 FUTURE RESEARCH

1. Since this study was conducted only in one district, one may argue that it is not representative of the country and therefore policies can not be made on such data. It is felt that a national study on a representative sample needs to be undertaken immediately using a similar protocol in order to verify the results obtained. Policies tailor-made for older people could be drafted and eventually incorporated in the existing policy documents. However, the research is a good starting point for a country where studies pertaining to nutrition of the older people were non-existent.

2. The study has established an association between nutritional status and functional ability. We need now to answer two basic questions:
   a) Can we improve nutritional status by improving the diet of elderly people?
   b) If we improve nutritional status, does functional ability improve?

3. In the areas where the study was conducted, it would be appropriate to test interventions on a pilot basis so as to identify ways of assisting the older people and improving their quality of life by addressing some of the problems identified in the study. Such operational research would need input from various ministries and organisations. It would be more beneficial if the older people participated in designing interventions to ensure that their needs are properly addressed.

4. It would be useful to conduct studies to examine the relationship between height and arm-span among young adults so as to establish a local relationship which could be used among the elderly in the future since height can not be measured accurately in individuals with kyphosis and bent legs. Such studies are needed not only for Malawi, or indeed Africa, but also for all ethnic groups.

5. Anthropological research on coping strategies, intra-household relationships and interactions that may affect treatment of the elderly and perception of the elderly by other family members would also be valuable.

6. This study did not investigate the prevalence of micronutrient deficiencies. Work from developed countries suggests that such deficiencies do indeed exist among older people, and a study from India found a high prevalence of anaemia. Extensive research is needed on micronutrient deficiencies among older people in developing countries, to investigate prevalence and identify solutions.

7. Research is needed on the appropriateness and interpretation of BMI and MUAC cut-offs for older people, especially in relation to functional outcomes, morbidity and mortality.

8. In the long run, monitoring systems should be instituted which include older people as suggested by WHO (WHO, 1995; de Onis and Habicht, 1996), and which can provide primary clues warranting interventions.

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APPENDIX 1: QUESTIONNAIRE (ENGLISH VERSION)

BUNDA COLLEGE OF AGRICULTURE
Home Economics/Human Nutrition Department, Lilongwe, Malawi

LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE
Department of Epidemiology and Public Health
Public Health Nutrition Unit, London.

QUESTIONNAIRE FOR THE STUDY OF NUTRITIONAL STATUS AND FUNCTIONAL ABILITY OF THE ELDERLY IN RURAL AREAS OF MALAWI (LILONGWE DISTRICT).

INTRODUCTION AND INFORMED CONSENT

Thank you for coming here and spending some of your time with us. **Introduce team members.** We are field workers from Bunda College of Agriculture and we are here to ask you some questions and take some physical measurements which will enable us to determine your nutritional status. This examination will take about 1 and half hours. We will start by asking you some general questions about health and activity and then do some easy physical tests which assess your strength, mobility, flexibility, balance and co-ordination. Then lastly we will take some measurements of your body size, fat and muscle to assess your nutritional status. The information to be obtained will be confidential, your names will not be given to anybody. The information will be used to assist the government in its formulation of strategies for the elderly in Malawi. Before we begin, we would like you to tell us whether or not you understand why we are here and that you agree to take part in this Project (ASK :Do you understand what we are doing and do we have your consent to continue ?).

1. Individual ID	1. ⌊_⌋⌊_⌋⌊_⌋
2. Date of interview Day/Month/Year	2 ⌊_⌋⌊_⌋⌊_⌋⌊_⌋
3. Name of Enumerator_____	
4. Enumerator ID	4. ⌊_⌋
5. Village name code_____	
6. Village ID	6. ⌊_⌋⌊_⌋
7. Traditional Authority_____ 8. Traditional Authority ID	8. ⌊_⌋
9. Name of Respondent _____Find out if the respondent can be interviewed, if not write the name of the proxy here ..... If the proxy can not be trusted, abandon the interview)	
10. Age of Proxy (999 for not applicable)	10. ⌊_⌋⌊_⌋⌊_⌋
11. Relationship of the proxy to the respondent 1. Child 2. Grandchild 3. Son/Daughter in law 4. Spouse 5. Relative 6. Friend 7. Other specify 9. Not applicable	11. ⌊_⌋
12. Sex of Respondent 1. Male 2. Female	12. ⌊_⌋
AGE	
13. What is your age ? (777 don't know, 888 no answer)	13. ⌊_⌋⌊_⌋⌊_⌋

14. How old were you at Independence ? (777 don't know, 888 no answer) 14 |_|_|_|

15. How old were you during the worst famine (for enumerator 1949) <777 don't know, 888 no answer> 15 |_|_|_|

COGNITIVE SCREEN

16. Can you tell me what day of the week it is today ? 16. |_|

0. Incorrect response 1. Correct response 7. Don't know 8. No answer

17. Can you tell me what year is it? 17. |_|

0. Incorrect response 1. Correct response 7. Don't know 8. No answer

DEMOGRAPHIC AND SOCIO-ECONOMIC INFORMATION

18. At present, what is your marital status 18. |_|

1. Single (never married) 2. Married (traditional or civil)
3. Separated/divorced 4. Widowed 5. Other (specify) 8. No answer

19. How long have you been .....(specify current marital status from question above 77 don't know, 88 No answer) **If answer 1, 3, 5, 8 go to Q23** 19. |_|_| years

20. If married, how many times have you been married? (99 for not applicable, 77 don't know, 88 No answer) 20. |_|_| times

21. If widowed, when did the spouse die? year/month (99/99 for not applicable, 77/77 don't know, 88/88 No answer) 21. |_|_|_|_|

22. At what age did the spouse die? (999 for not applicable, 777 don't know, 888 No answer) 22. |_|_|_|

23. Who is the head of this household?_____(indicate whether male or female) 23. |_|

24. What is his/her occupation?_____ 24. |_|

25. Do you live with other people? 1. Yes 0. No (if no go Q27) 25. |_|

26. If yes, we would like to know a little about all the other people who live here with you, like how old they are and how they are related to you

27. Total number living in Household (01 for those living alone)

28. Educational level attained by the respondent 27 |_|_|

0. No education at all 1. Standard 1-4 2. Standard 5-8 3. Any Secondary
4. Certificate/Diploma/Degree 5. Other (Specify) 7. Can not remember 8. No response 28 |_|_|

26. **Household Composition**

Relationship code	Age category	Working (yes=1, 0=2)	Sex (male=1, female =2)

Relationship codes

01	Spouse	02	Son	03	Daughter
04	Son/Daughter-in-law	05	Grandchild	06	Brother/Sister
07	Other relatives (specify)	77	Don't know	88	No Answer

Age category codes

1.	< 5 years	2.	6-14	3.	15-19	4	20-39
5.	40-59	6.	60+	777	Don't know	888	No answer

29. Can you describe your past occupation? _____

30. What is your present occupation?_____

31a. What is your source of income? _____

31b. On average, how much do you get (8888 no answer, 7777 don't know)

a. Per month? b. Per year? 31b. |_|_|_|_| m 31b.|_|_|_|_| y

SOCIAL NETWORK/SOCIAL SUPPORT

32a. How many children have you had? (88 no answer, 77 don't know) 32a.|_|_|

32b. Do you have living children? (8 no answer, 7 don't know) 1. Yes 0. No (if no, go to Q33) 32b.|_|

32c. If yes, how many living children do you have? (specify answer male or female) <77 Don't know, 88 No response, 99 not applicable). 32c.|_|_| male 32c.|_|_| female

33. We would like to know who assists you, what type of assistance you are given and the frequency of the assistance (relatives <children, other relatives>, friends and other people - prompt to fill in the table below)

Relationship	Sex	Kind of Assistance	Frequency of assistance

Relationship codes

01	Spouse	02	Son	03	Daughter
04	Son/Daughter-in-law	05	Grandchild	06	Brother/Sister
07	Other relatives (specify)	77	Don't know	88	No Answer

Frequency codes

0.	Never	1.	Once or twice a year
2.	Every few months	3.	Once or twice a month
4.	Once a week	5.	More than once a week
7.	Don't know	8.	No response

34. How often are you visited by your relatives (children, other relatives), friends and other people (prompt to fill in the table below).

Relationship	Sex	Frequency of visits

Relationship codes

01	Spouse	02	Son	03	Daughter
04	Son/Daughter-in-law	05	Grandchild	06	Brother/Sister
07	Other relatives (specify)	77	Don't know	88	No Answer

Frequency codes

0.	Never	1.	Once or twice a year	2.	Every few months	3.	Once or twice a month
4.	Once a week	5.	More than once a week	7.	Don't know	8.	No response

35. How often do you visit your relatives (children, other relatives), friends and other people (prompt to fill in the table below).

Relationship	Sex	Frequency of visits

Relationship codes

01	Spouse	02	Son	03	Daughter
04	Son/Daughter-in-law	05	Grandchild	06	Brother/Sister
07	Other relatives (specify)	77	Don't know	88	No Answer

Frequency codes

0.	Never	1.	Once or twice a year	2.	Every few months
3.	Once or twice a month	4.	Once a week	5.	More than once a week
7.	Don't know	8.	No response		

36. About how often do you attend religious meetings or services? 36. |__|

0.	Never	1.	Once or twice a year
2.	Every few months	3.	Once or twice a month
4.	Once a week	5.	More than once a week
7.	Don't know	8.	No response

37a. Do you meet friends socially outside your home? 37a. |__|

1. Yes 0. No 8. No response

37b. If yes, how often? 37b. |__|

1. Very often, every few days 2. Quite often, a few times a month
3. Once a month 4. Once every few months
5. Very rarely 7. Don't know 8. No response 9. Question not applicable

MEALS

38. How many meals do you eat per day in the following seasons (8 no answer) 38. |__| preh

a. Pre-harvest b. Post harvest 38. |__| posth

39. With whom do you normally eat your meals?_____ 39. |__|__|

40. Under what circumstances do you most enjoy your food? (choose the best one) 40. |__|

1. When with other family members 2. When taken at regular intervals

3. When food is given when feeling hungry

4. When food is given whilst having an appetite

5. When I get/given the foods I prefer, choose

6. Other reason 7. Don't know 8. No response

FEARS AND CONCERNS

41. At this point in your life, what are your main concerns (0 not mentioned, 1 mentioned for each, 7 Don't know, 8 No response): 41

i. Preparation for death and spiritual life i. |__|

ii. Health and diet ii. |__|

iii. Disability and increasing dependence

iv. Money and property

v. Other family members

vi. Any other, specify_____

42. How are your relationships with your relatives?_____

43. How do you feel about the attitude of the younger generation towards you?

_____

44. How satisfied are you with your present life?

1. Very dissatisfied 2. Dissatisfied 3. Satisfied
4. Very satisfied 7. Don't know 8. No response
If answer 3,4,7,8 go to 46

45. What are the main causes for dissatisfaction in your life? (0 not mentioned, 1 mentioned for each, 77 Don't know, 88 No response, 99 Not applicable)

i. Economic problem

ii. Health problem

iii. Housing problem

iv. Food problem

v. Transportation problem

vi. Clothing problem

vii. Social (activities/relations) problems

viii. Other problem (specify)_____

46a. Have you lost a close relative through death in the past 12 months?

1. Yes 0. No (if not go to Q49)

46b. If yes, who is it that died? _____

46c. Which month and year did the most recent death occur? 77. Don't know 88. No response

47. How many of your close friends have died in the past 12 months?

77. Don't know 88. No response 99. Not Applicable

Medical/Clinical examination

48. Name of examiner .....

49. How do you rate your health at present? (in case of a proxy how do you think x regards his/her health?

1. Good 2. Some what reduced 3. Poor 8. No answer

50a. Have you had any health problems during the last 2 weeks?

1. Yes 0. No 8. No answer **If answer 0,8 go to 51**

50b. If yes, what were the problems? 99 for not applicable_____

50c. Have you sought any treatment?

1. Yes 0. No 8. No answer if answer 0,8 go to 51

50d. If yes, where did you seek treatment?(indicate all given answers)

1. Hospital/clinic 2. Traditional healer 3. Groceries
4. Self (traditional) 5. No treatment 6. Other specify
8. No response 9. Not Applicable

51. Do you hear well? 1. Yes 0. No 3. Has some difficulties

4. Has great difficulties 5. Deaf 7. Don't know 8. No response

iii ☐
iv. ☐
v. ☐
vi. ☐
42 ☐
43 ☐
44 ☐
45
i. ☐
ii. ☐
iii ☐
iv ☐
v. ☐
vi ☐
vii ☐
viii. ☐
46a ☐
46b. ☐
46c ☐☐☐☐
47. ☐
48 ☐
49 ☐
50a ☐
50b ☐
50c ☐
50d ☐☐☐
51. ☐

52. Do you see well? 1. Yes 0. No 3. Somewhat reduced — 52. ___
4. Much reduced 5. Regard self as blind 7. Don't know 8. No response

53a. Is there an obvious disability? 1. Yes 0. No **(If no, go to Q54a)** — 53a. ___

53b. If yes, specify 1. Deaf 2. Blind 3. Lame 4. Other specify 9. Not applicable — 53b. ___

54a. In the past year (12 months- indicate from which month to cover 1 year period) have you had?(1 Yes, 2 No, 7 Don't know, 8 no response) — 54a.

i. Pain or cramps in your legs at night — i ___
ii. A lot of indigestion — ii. ___
iii. Pain in any of your joints — iii. ___
iv. Stiffness in your joints when you first wake up in the morning — iv. ___
v. Rheumatism — v. ___
vi. Headache — vi. ___
vii. Chest pain — vii. ___
viii. Back pain — viii. ___
ix. Heart problems — ix. ___
x. Malaria — x. ___
xi. Coughs — xi. ___

54b. Has a doctor told you that you have/had: 1. Yes, 0. No, 7. Don't know, 8. no response — 54b

i. Diabetes (sugar disease) — i. ___
ii. High blood pressure — ii. ___
iii. Heart attack — iii. ___
iv. Broken or fractured hip — iv. ___
v. Anaemia — v. ___
vi. TB — vi. ___
vii. Arthritis — vii. ___

55a. Are you taking any medicine now? 1. Yes 0. No (if no go to 56) — 55a. ___

55b. If yes, what type? _____ — 55b. ___

55c. And for what purpose? _____ — 55c. ___

56. Are any of your own teeth missing ? 1. Yes, all 2. Yes, some 0. No, still have all own teeth
7. Don't know 8. No answer — 56. ___

57. Do you wear false teeth ? 1. Yes, all 2. Yes, some
0. No, do not need any 7. Don't know 8. No answer — 57. ___

58. Do you have any problems chewing food ?
0. No 1. Yes, always and all foods
2. Yes, sometimes, adapted diet to exclude hard foods 7. Don't know 8. No answer — 58. ___

59. Are there any foods that you cannot eat these days because of your teeth ?
1. Yes, very many 2. Yes, a few hard foods 0. No, all foods still eaten
7. Don't know 8. No answer — 59. ___

60. Do you have any problems swallowing food ?
1. Yes, frequently 2. Yes, sometimes 0. Never 7. Don't know 8. No answer — 60. ___

61a. Is the respondent Kyphotic? (With spinal curvature) 1. Yes 0. No

61b. Is any part of the respondent's body swollen? (oedema) 1. Yes 0. No

61a. ___
61b. ___

62. Do you feel that you are receiving the care you need? 62. |__|

1. Yes 2. To some extent 0. No 7. Don't know 8. No answer

63. Who is the most important person to you?_____ 63. |__|

64. Do you find that you forget things more often recently than before? 64. |__|

1. Yes 0. No 7. Don't know 8. No response

65a. Do you have problems sleeping now than before? 65a. |__|

1. Yes 0. No 7. Don't know 8. No response

65b. If yes, do you ever take anything that helps you sleep at night? 65b. |__|

1. Yes 0. No 7. Don't know 8. No response 9. Not applicable

65c. How often do you take these pills? 65c. |__|

1. Once or twice a year 2. Every few months
3. Once or twice a month 4. Once a week
5. More than once a week 7. Don't know
8. No response 9. Not applicable

66a. Have you ever smoked (past)? 1. Yes 0. No 8. No response 66a. |__|__|

66b. Do you smoke now? present 1. Yes 0. No 8. No response 66b |__|

66c. |__|__| day

If answer 0, 8 go to Q67a 67a. |__|

66c. On average, how many cigarettes do you usually smoke per day? (77 don't know, 88 no response)

67a. Do you drink alcohol? 1. Yes 0. No 8. No response If answer 0, 8 go to Q68

67b. If yes, how often? (times/week, times/month (77 don't know, 88 no response, 99 not applicable). 67b. |__|__| wk 67b |__|__| mo

68. When you are ill, who is the main person who assists you?_____ 68 |__|

EXAMINER'S ASSESSMENT

69. During the interview, was the subject mentally alert? 1. Yes 2. No 69. |__|

70. Depressed or tearful? 1. Yes 2. No 70. |__|

71. General health assessment. 1. Good health 2. Minor health problems 71. |__|

3. Ill health 4. Other specify

72. Action taken 72. |__|

1. Referred to a clinic/hospital for treatment 2. Not applicable

73. Respondent's blood pressure (two measurements) 73|__|__|__| Systo 1

Systolic mmHg |__|__|__| Diast 1

Diastolic mmHg |__|__|__| Systo 2

|__|__|__| Diast 2

QUESTIONNAIRE, PROCEDURES AND RECORDING FORMS FOR FUNCTIONAL ABILITY INFORMATION (ACTIVITIES OF DAILY LIVING (ADL) AND PHYSICAL PERFORMANCE TESTS). For anthropometric measurements procedures, see separate forms.

Now we are going to ask you some questions about your ability to do basic daily activities in and around your home during the last week. We need to know whether you are able to perform a task by yourself, requiring a little help to do a task, requiring a lot of help to do a task, or need constant help. Remember these are used as a record of what a person DOES, not a record of what a person COULD DO. The main aim is to establish a DEGREE OF INDEPENDENCE FROM ANY HELP, PHYSICAL OR VERBAL, however minor and for what reason. The need for supervision means that a person in NOT INDEPENDENT. Middle category 2 implies that the person supplies over 50% of the effort.

74a **Feeding (Eating)**

In the last week, has someone put food into your mouth for you ? Or have you been able to do take food from your plate by yourself ? 74a ☐

0 Unable - Assistance in all aspects of feeding
1 Some assistance in feeding, cutting up but not all the time and not for all foods
2 Totally able to feed self 8 No answer

74b. Give reason(0,1)_____ 74b ☐

75a. **Transfer**

In the last week, have you been able to move around the house i.e. from floor to standing, to bed or chair, by yourself or has someone been helping you ? Are you able to sit without support ?

0 Unable - Person needs total assistance in moving in and out of bed/floor and or chair, cannot move by self without being lifted or held by one or two people, and cannot sit unsupported
1 Person needs some assistance in moving in and out/off floor/bed to chair, may be guided or supported for safety but is not totally lifted, can sit unsupported 75a ☐
2 Can move between floor, bed, chair totally independently and sit unsupported 8 No answer

75b. Give reason(0,1)_____ 75b ☐

76a. **Dressing**

In the last week, have you been able to dress yourself (e.g. wrapping cloth, pulling on blouse, fastening buttons, pulling vest/shirt on and off etc), independently or do you require assistance ? If you require assistance is this for all your dressing or for about half ? Do you select your own clothes ? 76a ☐

0 Unable - Cannot dress self at all, may remain partially undressed
1 Needs assistance with some aspects of dressing, help with buttons but can put some garments on alone
2 Independent, can choose all clothes by self, take on and off by self and perform all details
8 No answer 76b ☐

76b. Give reason(0,1)_____

77a. **Bathing**

In the last week, have you been able to wash your body fully and without assistance ? Or are you only able to wash a part of your body without help ? If you had assistance, what did they do? 77a ☐

0 Unable - Requires direct assistance and supervision of all bathing activities
1 Can perform some aspects without assistance but for safety is often directly assisted, or can only wash part of body by self and not full body 77b ☐
2 Can bathe completely alone 8 No answer

77b. Give reason(0,1)_____

78a. **Using the toilet** (includes mobility)

In the last week, have you been able to get from your home to the toilet independently, by yourself without a helper ? To get to the toilet do you use any support such as a walking stick, crutches or wheelchair ? (At night this may be management of bedpan by self) Do you require assistance, such as a member of your family to help you? Can you undress sufficiently yourself, get down to squat and up again, clean yourself afterwards, and return? Or do you always use a bedpan (potty, bucket, bowl etc.) for all your toileting? 78a. ☐

0 Unable - Cannot reach the toilet unless assisted all the way, cannot undress, squat and clean self unassisted and leave toilet. If does not go out of the home, cannot use home toilet (pan, bowl, bucket) unassisted etc.
1 Receives some assistance in some of the tasks, either getting to and from, undressing, squatting, cleaning self. But can do some things alone or only needs help sometimes 78b. ☐
2 Independent : can perform all tasks by self 8 No answer

78b. Give reason(0,1)_____

79a. **Continence**

Do you find that you are unable to get to the toilet in time or that you have been leaking? 79a. ☐

0 Total incontinence in urination and defecation
1 Partial or occasional/incontinence in urination and defecation
2 Urination and defecation entirely self-controlled 8 No answer

79b. Give reason (0,1)_____ 79b ☐

SELF REPORTED GROSS MOBILITY

80. **Walk half a mile** 80. ☐

Can you walk about 1 kilometre ? (Enumerators to give an estimate of distance equivalent to a kilometre) 0 No
1 Yes, but with difficulty/slowly/with helper/only infrequently
2 Yes, easily, frequently, can use a stick 8 No answer

81. **Ability to travel** 81. ☐

Can you get to places outside of walking distance ? If so, how do you travel ? Bus, train, bicycle ?

Can you travel alone?

0 Unable to travel unless emergency arrangements
1 Yes with some help such as an assistant/slowly/only infrequently or if really necessary
2 Yes, easily, frequently, can travel alone if necessary, can use a stick
8 No answer

82. What other activities do you perform around the house?_____ 82. ☐

OBSERVED GROSS MOBILITY: Observation of movements during interview and tests **(Mobility)**

83. OBSERVATION ONLY (Do not need to ask these as questions)

Is the respondent immobile and bedridden, not able to move around at all ? Or does the respondent walk very slowly and with difficulty, with or without an aid or helper? Or can the respondent walk easily and without either aid or helper ?

0 Bedridden, cannot stand or walk without constant supervision or assistance
1 Can stand and walk but sometimes needs assistance for some manoeuvres. Movement is slow, stiff and apparently painful. Walking aid such as stick or crutches used all the time and other support such as wall used 83. ☐
2 Is fully mobile with no apparent restrictions
3 Not able to move at all due to disability/amputation/stroke/severe injury

FUNCTIONAL ABILITY TESTS CODING

INTRODUCING FUNCTIONAL ABILITY TO THE SUBJECT

"As you know, certain movements of your body become more difficult to do as you grow older. We would now like you to try to do several different movements of your body that involve your arms. I will first describe each movement to you. Then either I or my assistant will demonstrate it to you. Then we would like you to try to do it too. If you cannot do a particular movement or you feel it would be unsafe to try to do it, then tell me and we will move on to the next test instead. We would like you to try each exercise if you can. But we don't want you to try to do anything that might make you feel unsafe, in pain or uncomfortable. Do you understand?"

84. OBJECT MEMORY TEST

MEASUREMENT PROCEDURE

1. Present the tray covered with 10 objects. Make sure they are all present and in a neat arrangement (larger objects at the back of the tray). Make sure you have the list of objects ready for recall later.
2. "Please look carefully at the 10 objects on this tray and try to remember them. The objects are all everyday objects that should be familiar to you. You can pick them up or name them out loud if that helps you to remember them. I do not want you to recall them straight away but only after some time. Later on we will ask you to recall them for us.

   We will give you 1 minute, starting from now."
3. TIME FOR 1 MINUTE
4. Then cover the tray and keep out of sight.

LIST OF OBJECTS FOR THE MEMORY TEST

Cup, Matches, Safety pin, Nail, Comb, Bottle, Spoon, Key, Battery, Button

85. LOCK AND KEY TEST

A timed lock and key test to assess hand skill and flexibility of finger joints.

"Next we will be looking at your hand function by asking you to pick up a key and open a lock. Show me which hand you would normally use to hold a key. I will hold the key like this. I want you to pick up the key and open it, like this."

1. **DEMONSTRATE THE PROCEDURE**

"Although I will be timing you, I would like you to move carefully and smoothly, trying not to drop the key. Do you have any questions? Good. When I say start, please begin."

2. TIME THE SUBJECT: FROM PICKING THE KEY AND OPENING THE LOCK

If the first attempt is not satisfactory, then repeat.

Begin timing as soon as the subject moves hand towards the key. End timing when the padlock has been opened.

85a. Ability to pick up key: 85a. |__|

0 No 1 Yes, but slowly or with difficulty
2 Yes, easily 3 Not done/could not perform due to disability /amputation /painful arthritis
8 Refused/did not co-operate

85b. Ability to hold key: 85b. |__|

0 No 1 Yes, but with difficulty, dropped key 2 Yes, easily

3 Not done/could not perform due to disability/amputation /painful arthritis
8 Refused/did not co-operate

85c. **Timed Lock and Key Test :** 85c |__|__|__| secs

..... Time to open padlock in seconds
333 Not done/could not perform due to disability/amputation /painful arthritis
888 Refused/did not co-operate

86. PLATE TAPPING TEST

PSYCHOMOTOR SKILL: PLATE TAPPING TEST

We will use Plate Tapping Test to measure speed and co-ordination that require psychomotor function.

MEASUREMENT PROCEDURE

1. We need to have two circular discs each 20 cms in diameter, fixed securely on a table top. The centre of these discs should be 80 cms apart and a rectangular plate of a contrasting colour and size (10 cms x 20 cms) is placed between the two discs equidistant from each disc.
2. The table top should be adjusted so that the table top is just below the umbilical level.
3. "Stand in front of the table in front of the middle shape with your feet slightly apart. Place your non-preferred hand on the rectangle in the middle and keep it there all the time. Place your preferred hand on the circles. You will move your preferred hand back and forward between the two outside circles as quickly as possible. You must pass each time over the hand staying still in the centre. Be sure to touch the middle of the outer circles properly each time. If you miss the middle of these, we will not count that lap. When I say READY, move your preferred hand to one of the circles and when I say GO move your preferred hand back and forth as quickly as possible 25 times. Do not stop until I say STOP. Try and keep going till you have done 25, even if this is slow. You do not need to count. I will shout out the numbers for you. You will do the test once now and once a little later. Your faster time will be your score. OK. READY. START".
4. Start the stopwatch at the signal "ready...start". Assuming the subject starts on disc A, the stopwatch is stopped when he/she touches this disc for twenty fifth (25th) time. Thus the total number of taps on disc A and disc B amounts to 50, or 25 cycles between A and B.
5. Remember that the hand on the rectangular plate has to stay there during the entire test.
6. Take two trials and allow a rest in between (Hand dynamometry). The better result is the score
7. The score is the time needed to touch the disc a total of 25 times, recorded in tenths of seconds. If the subject fails to touch a disc, an extra tap is added in order to reach the required 25 cycles.

RECORD PLATE TAPPING RESULT (FIRST TRY)

86a. **Tapping test timing**

Time of the first try |__|__|__| **Secs**
333 Unable to perform due to disability/ amputation/ painful arthritis
888 Refused/did not co-operate

87. HAND DYNAMOMETRY

The Equipment: We are using a special piece of equipment called a Hand Dynamometer for measuring hand grip strength. It measures strength in Kilograms.

MEASUREMENT PROCEDURE:

We will measure both the dominant or preferred hand (the one the subject normally uses), and the non-dominant or non-preferred hand and repeat the test three times on each hand. This allows the technique to become familiar and the subject to be given several chances to improve the reading. One last attempt on the preferred hand is also given.

"This test is going to measure your grip strength. First, bend your arm so that the forearm is resting across your stomach in a relaxed position. Then place your hand in the machine to make sure it is the right size for your hand. Does that feel comfortable?"

1. Subject should be sitting. Sit opposite the subject and first explain what the instrument is and what it measures.
2. Demonstrate the holding position and how to grip
3. Place the loop over the subject's head and arm and hand in correct position lying across the lap and against the trunk. the wrist should be in about 15 degrees of extension.
4. Place hand in the instrument and adjust for size. The second joint of the forefinger should be approximately at a right angle. "Now you are to squeeze the handle as hard as you can just for a few seconds. You must try your very best concentrating on squeezing with all your strength. We will repeat this three times on both hands and then let you have one last try on your preferred hand. "Subjects should not be allowed to squeeze the instrument more than once.
5. Take: 3 readings on the dominant hand, 3 readings on the non-dominant hand, 1 last reading on the dominant hand (this is usually the highest)
6. Give a lot of verbal encouragement to the subject (calling, clapping, shouting etc.). Let the subject see their results on the dial before you move the pointer back to 0 (zero) each time.

87a.	**Preferred hand grip strength**	87a
.....	best attempt	____kg
333	Unable to perform due to disability/ amputation/ painful arthritis	____kg
888	Refused/did not co-operate	____kg
		____kg
87b.	**Non-preferred hand grip strength**	87b
.....	best attempt	____kg
333	Unable to perform due to disability/ amputation/ painful arthritis	____kg
888	Refused/did not co-operate	____kg
87c.	**Dominant hand** 1 Left 2 Right	87c.__
	3 No preference, uses both equally, or only one working hand	

86b. SECOND PLATE TAPPING TEST 86b.__

"Now we would like you to repeat the tapping test again for us. We are sure you can do it faster than the last one so let's see you really speeding it up. But remember to keep this hand in the middle and only the other hand crosses over as fast as possible. Be sure to touch the circles clearly. Twenty five times again. Are you ready (SET TIMER). GO." (Code 333, 888 as in first try).

84 OBJECT MEMORY TEST

"A few minutes ago, we showed you a tray with 10 everyday objects. We gave you a minute to look at these asked you to remember them. Do you remember this? Now we want you to see how many of the objects that you saw you can remember. Just call them out to me when I ask you to start. Again we are going to give you 1 minute to recall the objects on the tray. Are you ready?"

Start the stopwatch on word "GO". Record the number recalled. Cross off the objects from your master list as recalled and give encouragement (but no direct clues) during recall. 84.|__|__|

Number of objects recalled

88 Could not perform (visual handicap)

99 Refused or did not co-operate

This is the end of the functional ability tests (put the functional ability equipment away safely to one side and prepare for the anthropometric measurements.)

MAKE SURE ALL YOUR ANTHROPOMETRY EQUIPMENT IS READY (see English procedure for anthropometry)

ANTHROPOMETRIC MEASUREMENTS

MEASUREMENT **88. Measurer.....** 88.|__|

99.9 or 999.9 for not taken (according to digits of the measurement and give reason (s) for not taking the measurement).

89. Weight (kg) 89.
|__|__|__| kg
|__|__|__| kg

90. Oedema 1. Present 0. Absence of oedema 90.|__|

91. Height (cm) 91.
|__|__|__|:|__| cm
|__|__|__|__| cm

92. Kyphosis 1. Present 0. Absent 92.|__|

93. Arm span (cm) 93.
|__|__|__|:|__| cm
|__|__|__|__| cm

94. Demispan (cm) 94.
|__|__|__|:|__| cm
|__|__|__|:|__| cm

95. Mid Upper Arm Circumference (cm) 95
|__|__|:|__| cm
|__|__|:|__| cm

96. Triceps Skinfold Thickness (mm) 96
|__|__|:|__| mm
|__|__|:|__| mm
|__|__|__| mm

ANTHROPOMETRIC MEASUREMENTS

In this research, the measurements to be taken will include the following:

1. **Weight**
2. **Standing Height**
3. **Armspan**
4. **Demi-span**
5. **Mid-Upper Arm Circumference**
6. **Triceps Skinfold Thickness**

1. **WEIGHT**

CARE AND CHECKING EQUIPMENT

The equipment is a **Soehnle Electronic Scale (7300)**. It requires 1 battery.

A new battery must be used every week i.e.: before checking equipment on Monday morning.

Always remove the battery from the base when not actually measuring i.e.: whilst carrying, storing in lockers, during meals. When changing the battery, turn scale upside-down, do not rest on the button end.

Keep the scales surface clean and ensure that **"feet"** are clearly drawn.

CHECKING (Calibration)

Every morning check the scale against the iron weight (5 Kgs, 10 Kgs, 20 Kgs, 40 Kgs). Note any differences in your field notebook.

MEASUREMENT PROCEDURES:-

1. Place scale on a flat level ground against a wall, if possible.
2. Ask the subject to **remove shoes/slippers and any heavy items** (e.g. keys, tins of tobacco, money, etc).
3. When the subject is ready, lead across to scales, explaining procedure.
4. Activate the scale by touching the platform.
5. Test figure appears on the display. Then **0.0** indicates that the scale is ready.
6. Instruct subject to step onto scales giving assistance if necessary. Feet should be in the position marked. Instruct subject that he/she should stand as still as possible and not hold or lean onto the wall or observer.
7. Read the display when it stabilises and record on **"Data Form"** immediately. Record to one decimal place (e.g. 52.5 Kgs).
8. Help the subject off the scale and replace support if necessary. The scale will immediately switch off when the subject steps off the scale.
9. Repeat the measurement as above.

Make a note next to the measurement if

1. **Display changing considerably**
2. **Subject has noticeable swelling (oedema) of any part of the body.**

2. STANDING HEIGHT

CARE AND CHECKING EQUIPMENT

The equipment used is a **CMS Portable Stadiometer**. The stadiometer divides into 2 parts. Keep these parts together with rubber bands. Keep the head piece safely. Report any problems to the field supervisor immediately. Clean the base regularly and check that the tape is well-attached, and is not coming loose.

MEASUREMENT PROCEDURES:-

1. Check that the subject has removed shoes/slippers and any head gear.
2. Position the Stadiometer vertically against a flat wall.
3. Instruct the subject to stand with their back against the Stadiometer, looking straight ahead, arms loose at sides and shoulders relaxed. Check position from front.
4. Feet should be as close to the base of the stadiometer as possible.
5. Check the position of the Frankfurt Plane (see diagram in Gibson, 1990). You should be standing at the side of the subject now. Imagine a horizontal line drawn from the base of the subject's eye to the top of the earhole.

6. Ask the subject to stand tall and take a deep breath in. At the same time, bring down the headpiece to sit firmly on top of the highest part (crown) of the head. If the hair is thick or curly, press down gently on the headpiece to be sure it is resting on the top of the head.
7. Take the reading under the arrow of the headpiece. Record immediately to the nearest 0.1 cm.
8. Repeat the measurement by moving the head piece up and bringing it down after you have requested the subject to take a deep breath. **Indicate whether the subject has kyphosis (spinal curvature) or not.**

3. ARMSPAN

MEASUREMENT PROCEDURES:-

1. Ask the subject to stand erect against a wall as in the height measurement. Both arms should be raised and outstretched laterally and maximally at the level of the shoulder with the palms facing forward. Subject should be instructed to look straight ahead.
2. Using the flexible steel tape, place the tie on the end of the middle finger and hold it there (**assistant needed**).
3. Stretch out the tape to the opposite arm and take the measurement at the end of the middle finger. Support the arm if necessary, either at the base of wrist or elbow.
4. Keep the tape as straight as possible, preferably passing close over the clavicles. Be careful that the wrists are straight and not bending backwards or forward.
5. Take the measurement twice, and record the reading to the nearest 0.1 cm.

4. DEMISPAN

This measurement is similar to armspan but takes only one arm: **THE LEFT ARM**.

MEASUREMENT PROCEDURES:-

1. The subject should stand in the same position and raise only the left arm to a right angle position (shoulder level), as straight as possible, and with a palm facing forward, wrist straight.
2. Using the same flexible steel tape, place the tip in the gap between the middle and fourth fingers at their base. Keep the subject's fingers closed. Secure this tip with one hand then pull the tape towards the subject.
3. Identify the **STERNAL NOTCH** - this is the dip where the 2 clavicles meet at the base of the neck. Take the measurement at the middle of this point.
4. Take the measurement twice, and record the reading to the nearest 0.1 cm.

NOTE: Try to do both the armspan and demispan as quickly as possible. Let the subject rest their arms between measurements. **Both measurements can be taken while the subject is sitting down (write down comments beside the measurement if this is done).**

5. MID UPPER ARM CIRCUMFERENCE (MUAC)

MEASUREMENT PROCEDURES:-

1. Ask the subject to stand at ease with **LEFT ARM** uncovered to the shoulder. Roll up sleeves or remove shirt. Explain what you are going to do: i.e. identify the mid point of the arm, and measure the circumference.
2. Bend the left arm at the elbow to a right angle with the forearm placed across the trunk. The whole arm should be loose and muscles relaxed. The subject should look straight ahead with head in the Frankfurt Plane as in height measurement.

3. Identify the bony tip of the shoulder blade (acromion process) (see diagram in Gibson, 1990). Place the tip of the tape over this point.
4. Identify the tip of the olecranon process at the elbow (tip of the elbow).
5. Stretch down the tape and take the reading at the olecranon. This measures length between 2 points.
6. From behind, mark the skin with a pen at the half way point (i.e.: divide reading by two). It is best to make the mark on the side of the tape nearest to the subject's body.
7. Reposition the arm so that it is hanging loosely by the side and relaxed just away from the body.
8. Wrap the tape gently but firmly around the arm at the mid point. Do not pull it so tight that the tissues are compressed, but be careful that it is not too loose, and it falls in a straight line around the arm.
9. Measure to the nearest millimetre (0.1 cm).
10. Repeat the measurement.

6. TRICEPS SKINFOLD THICKNESS

This measurement is taken at the back of the upper arm at the mid point, about **1 cm** above the level already marked on the skin for the **MUAC** measurement with the arm hanging relaxed. The skinfold is measured with a vertical pinch using a **SKINFOLD CALIPER**.

Duplicate skinfold measurements made with precision calipers should normally agree within **1 mm**.

HOW TO PICK UP THE SKINFOLD

1. Use the left hand.
2. Measure on the subject's left side.
3. Use left hand thumb and forefinger to pick up a layer of skin and subcutaneous tissues which is fairly mobile relative to the underlying muscle and bone.
4. Keep gentle but firm pressure on the skinfold while the calipers are applied and until the calipers are removed.

HOW TO USE AND READ THE CALIPERS

1. Ensure that the dial is on **0 (zero).** If not, use the spare instead and report to the Field Supervisor.
2. Take caliper handle in the right hand palm with the dial up.
3. Open the caliper "**jaws**" to about **10 cms**.
4. Position the calipers "Jaws" on either side of the skinfold about **1 cm** below the fingers.
5. Gradually release the handle to let the jaws of the calipers come to rest on either side of the skinfold, still supporting the handle in the palm of the right hand.
6. Wait until the needle becomes steady or stops moving fast, and for not more than **3 seconds**.
7. Take the reading to the nearest **0.2 mm.**
8. Open the jaws again and remove the caliper gently. Do not let the jaws snap.
9. Release the skinfold.
10. Pick up and take the reading at least **twice (2 more times)**.

If your measurements are not acceptable i.e.: a difference of more than **1 mm**, you should repeat the series.

THIS IS THE LAST OF THE MEASUREMENTS

REMEMBER TO THANK YOUR SUBJECT FOR HIS/HER CO-OPERATION.

APPENDIX 2: QUESTIONNAIRE (CHICHEWA VERSION)

QUESTIONNAIRE FOR THE STUDY OF NUTRITIONAL STATUS AND FUNCTIONAL ABILITY OF THE ELDERLY IN RURAL AREAS OF MALAWI (LILONGWE RURAL).

BUNDA COLLEGE OF AGRICULTURE
Home Economics/Human Nutrition Department , Lilongwe, Malawi

LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE
Department of Public Health and Policy
Human Nutrition Unit, London.

INTRODUCTION AND INFORMED CONSENT

Zikomo kwambiri pobwera kuno kuti mudzacheze nafe makamaka posiya ntchito zanu kuti mudzakhale nafe. Ife tachokera ku College ya za ulimi ku Bunda ndipo tabwera kuno kuti tidzacheze nanu. Tili ndi mafuso pang'ono okhuza za umoyo wanu ndiponso kukuyezani kuti tione mavuto amene mumawapeza ndiponso ngati matupi anu ali a thanzi. Ticheza nanu kwa ka nthawi pang'ono. Poyamba tikufunsani mafunso, kenaka tikupemphani kuti muyese zochitachita kuti tipime mphamvu zanu ndipo pomaliza tikuyezani pa sikelo ndiponso msinkhu ndi zina kuti tidziwe za thanzi la thupi lanu. Zimene mutiwuze zizathandiza kuti boma lipeze njira zothandizira anthu achikulire muno m'Malawi. Koma dziwani kuti maina anu sakaperekedwa kwina kuli konse, zonsezi ndi za chinsinsi. Koma tisanayambe tifuna tidziwe ngati mwamvetsa zimene tikufuna kuchita ndiponso ngati mukuvomera kuti tipitirize (Funso: Kodi mwamvetsa zimene tikufuna kuchita ndipo mwalola kuti tipitirize?)

. Individual ID **(RESPOID)**	1. ___
2. Date of interview (DayMonthYear) **(DATE)**	2.____
3. Name of Enumerator _____	
4. Enumerator ID_____ **(ENUMID)**	4 __
5. Village name _____	
6. Village ID **(VILLID)**	6 ___
7. Traditional Authority _____8. Traditional Authority ID **(TACODE)**	8 __
9. Name of Respondent _____ (Find out if the respondent can be interviewed, if not write the name of the proxy here ..... if the proxy can not be trusted, abandon the interview)	
10. Age of Proxy(999 for not applicable) **(PROXYAGE)**	
11. Relationship of the proxy to the respondent **(PROXRELT)**	
1. Child 2. Grandchild 3. Son/Daughter in law 4. Spouse 5. Relative 6. Friend 7. Other specify _____ 9. Not applicable	10. ___
12. Sex of Respondent 1. Male 2. Female**(SEX)**	11. __
	12. __
AGE	
13. Kodi muli ndi zaka zingati ? (777 sakudziwa (ayiwala), 888 sanayankhe).**(SAGE)**	
14. Nanga pa nthawi yanjala yaikulu ija munali ndi zaka zingati? **(for enumerator 1949)**? (777 sakudziwa (ayiwala), 888 sanayankhe) **(FMAGE)**	13. ___
	14. ___

15a. Estimated age (999 if they know their age)**(ESTAGE)** 15a|__|__|__|

15b. Final age **(FAGE)** 15b. |__|__|__|

COGNITIVE SCREEN

16. Kodi lero ndi la chingati? **(COGNDAY)** 16. |__|

1. Yankho lolondola 2. Yankho lolakwa 7. Sakudziwa 8. Sanayankhe

17. Nanga chaka chino ndi chaka chanji? **(COGNYEAR)** 17. |__|

1. Yankho lolondola 2. Yankho lolakwa 7. Sakudziwa 8. Sanayankhe

DEMOGRAPHIC AND SOCIOECONOMIC INFORMATION

18. Kodi muli pa banja? **(MARSTAT)** 18. |__|

1. Sanakwatiwepo/sanakwatirepo 2. Wokwatiwa/wokwatira
3. Wolekanitsidwa/Wolekana 4. Wofedwa
5. Zina (tchulani) _____ 8. Sanayankhe

19. Kodi papita nthawi yaitali bwanji muli .....(specify current marital status from question above 77sakudziwa (ayiwala), 88 sanayankhe).**(TIMEMRT)** 19. |__|__| years

If answer 1, 3, 5, 8 go to Q23

20. Ngati ndinu wokwatiwa/wokwatira, mwakwatiwapo / mwakwatirapo kangati chiyambire? (99 funso silikuwakhudza, 77 sakudziwa (ayiwala), 88 sanayankhe).**(MARTIME)** 20. |__|__| times

21. Ngati ndinu ofedwa, anzanu abanjawo anatisiya liti? chaka/mwezi (99/99 kwa amene funso silikuwakhudza, 77/77sakudziwa (ayiwala), 88/88 sanayankhe). **(SPSEDDYR)** 21 |__|__|__|__|

22. Nanga anali ali ndi zaka zingati panthawiyo? (999 kwa amene funso silikuwakhudza, 777 sakudziwa (ayiwala), 888 sanayankhe) **(SPSEDAGE)** 22. |__|__|__|

23. Kodi mutu wa banja ndi ndani pa banja pano? (Tchulani ngati ali wa mkazi kapena wamwamuna kapena m'bale wamkazi kapena wamwamuna) **(HHHEAD)** _____ 23. |__|

24. Nanga kodi amagwira ntchito yanji? _____ **(HHOCCUP)** 24. |__|

25. Kodi mumakhala ndi anthu ena pano? **(LIVEARR)** 1. Inde 0. Ayi 25. |__|

26. Ngati mumakhala ndi anthu ena, tifuna tidziwe zina ndi zina za onse amene mumakhala nawo monga zaka zawo ndiponso ubale umene ulipo ndi inuyo.

Household Composition

Chibale	Zaka (range)	Ntchito 1 = Inde, 0 = Ayi	Sex (male = 1, female = 2)

Relationship codes

01	Akazi/amuna awo	06	Achimwene/chemwali (mlongo)
02	Mwana wa mwamuna	07	Achibale ena (tchulani)_____
03	Mwana wa mkazi	77	Sakudziwa
04	Apongozi	88	Sanayankhe
05	Mzukulu		

Age range codes

1.	< 5 years	2.	6-14	3.	15-19	4.	20-39
5.	40-59	6.	60+	777	Sakudziwa	888	Sanayankhe

27. Kodi kuwerengera anthu onse amene mumakhala nawo pamodzi ndi inu mulipo angati? (01 kwa okhala okha) _____ **(NOINHH)**

28. Kodi sukulu munalekezera kalasi yanji? (Ngati ndi kalasi ya kale tchulani) **(EDUCTNL)**

1. Sanapite ku sukulu 2. Standard 1-4 3. Standard 5-8 4. Sekondale
5. Certificate/Diploma/Degree 6. Ina (tchulani ----------) 7. Ayiwala 8. Sanayankhe 28.|__|

29. Kodi kale munkagwira ntchito yanji (tchulani ntchito zonse?**(OCCUPPAS)** _____29 |__|__|

30. Nanga panopo mukugwira ntchito yanji? **(OCCUPPRES)** _____ 30.|__|__|

31a. Kodi ndalama zothandizira pa banja lanu mumazipeza bwanji?**(SINCOME)** _____31a |__|__|

31b. Mongoyerekeza kapena mukaonetsetsa, tingati mumapeza / mumapatsidwa ndalama zingati (8888 sanayankhe, 7777 sakudziwa) a. Pa mwezi? **(MINCOME)** 31b.|__|__|__|__| m

b. Chaka? **(YINCOME)** 31b.|__|__|__|__| y

SOCIAL NETWORK/SOCIAL SUPPORT

32a. Kodi munaberekapo ana angati? (88 sanayankhe, 77 sakudziwa) **(CHILDHAD)** 32a.|__|__|

32b. Nanga mwa ana amenewa alipo ali moyo? (8 sanayankhe, 7 sakudziwa) **(LIVCHID)** 32b.|__|

1. Inde 0. Ayi (ngati ayi, go to Q32)

32c. Ngati alipo, ndi angati? (aamuna angati, aakazi angati) <77 sakudziwa, 88 sanayankhe, 99 kwa amene funso silikuwakhudza). **(LMCHILDR)** 32c.|__|__| m **(FCHILDR)** 32c.|__|__| f

33. Tsopano tikufuna kudziwa za anthu amene amakuthandizani, chithandizo chomwe amapereka ndiponso kuti amapereka kangati chithandizo chimenechi (tchulani amene amapereka chithandizo monga achibale (ana kapena achibale ena, anzawo/achinansi kapena anthu ena apadera - afunseni mowathandiza ndipo mayankho ake mulembe munsimu).

Chibale	Sex mamuna = 1, mkazi = 2	Chithandizo chomwe amapereka	Chithandizocho chimaperekedwa kangati (frequency)

Relationship codes

01	Akazi/amuna awo	06	Achimwene/chemwali (mlongo)
02	Mwana wawo wa mwamuna	07	Achibale ena (tchulani) _____
03	Mwana wawo wa mkazi	08	Anzawo
04	Apongozi	09	Anthu ena apadera (tchulani) _____
05	Mdzukulu	77	Sakudziwa 88 Sanayankhe

Frequency codes

1.	Sathandizidwa	2.	Kamodzi kapena kawiri pa chaka
3.	Kamodzi pamiyezi ingapo	4.	Kamodzi kapena kawiri pa mwezi
5.	Kamodzi pasabata	6.	Kupitirira kamodzi pa sabata
7.	Sakudziwa	8.	Sanayankhe

NENANI NGATI SAMATHANDIZIDWA _____

34. Kodi mumayenderedwa kangati ndi anthu awa? achibale (ana ndi achibale ena), anzanu/anansi kapena anthu ena? - afunseni mowathandiza ndipo mayankho ake mulembe munsimu).

Chibale	Sex mamuna = 1,mkazi = 2	Nthawi yomwe amayenderedwa (frequency)

Relationship codes

01	Akazi/amuna awo	06	Achimwene/chemwali (mlongo)
02	Mwana wawo wa mwamuna	07	Achibale ena (tchulani) ----------
03	Mwana wawo wa mkazi	08	Anzawo
04	Apongozi	09	Anthu ena apadera (tchulani) _____
05	Mdzukulu	77	Sakudziwa 88 Sanayankhe

Frequency codes

1.	Sayenderedwa	2.	Kamodzi kapena kawiri pa chaka
3.	Kamodzi pamiyezi ingapo	4.	Kamodzi kapena kawiri pa mwezi
5.	Kamodzi pasabata	6.	Kupitirira kamodzi pa sabata
7.	Sakudziwa	8.	Sanayankhe

NENANI NGATI SAMAYENDEREDWA _____

35. Nanga inuyo mumawayendera kangati ndi anthu awa? achibale (ana ndi achibale ena), anzanu/achinansi kapena anthu ena? - afunseni mowathandiza ndipo mayankho ake mulembe munsimu).

Chibale	Sex mamuna = 1, mkazi = 2	Nthawi yomwe amayendera anthu ena (frequency)

Relationship codes

01	Akazi/amuna awo	06	Achimwene/chemwali (mlongo)
02	Mwana wawo wa mwamuna	07	Achibale ena (tchulani)_____
03	Mwana wawo wa mkazi	08	Anzawo
04	Apongozi	09	Anthu ena apadera tchulani _____
05	Mdzukulu	77	Sakudziwa 88 Sanayankhe

Frequency codes

1.	Sayendera anthu ena	2.	Kamodzi kapena kawiri pa chaka
3.	Kamodzi pamiyezi ingapo	4.	Kamodzi kapena kawiri pa mwezi
5.	Kamodzi pasabata	6.	Kupitirira kamodzi pa sabata
7.	Sakudziwa	8.	Sanayankhe

NENANI NGATI SAMAYENDERA ANTHU ENA _____

36. Nanga kumisonkhano yakutchalitchi (ya mpingo) kapena yopemphera mumapita kangati? **(ATTENDRM)**

1. Sapita 2. Kamodzi kapena kawiri pa chaka
3. Kamodzi pamiyezi ingapo 4. Kamodzi kapena kawiri pa mwezi 5. Kamodzi pasabata
6. Kupitirira kamodzi pa sabata 7. Sakudziwa 8. Sanayankhe 36 |__|

37a. Kodi mumakumana ndi anzanu kwina kocheza osati kunyumba kuno kapena pakhomo pawo? 37a. |__|
(MFRIENDS)

1. Inde 0. Ayi 8. Sanayankhe

37b. Ngati mumakumana nawo, ndi kangati? **(FFRIENDS)** 37b. |__|

1. Kawiri-kawiri (kangapo pa sabata) 2. Masiku angapo pa mwezi
3. Kamodzi pa mwezi 4. Kamodzi pa miyezi ingapo
5. Mwakanthawi 7. Sakudziwa
8. Sanayankhe 9. Funso silinawakhudze (sakumana , 2, 8 for Q 37a above)

MEALS

38. Kodi mumadya kangati pa tsiku pa nyengo izi? (7 sakudziwa 8 sanayankhe) 38a |__| preh

a. Musanakolole (Nov - April) **(MEALPREH)** 38b |__| posth

b. Mutatha kukolola (May - Oct) **(MEALPOSH)**

39. Nanga kodi kawirikawiri chakudya mumadya ndi ndani?**(MEALWHOM)** _____ 39 |__|__|

40. Kodi ndi nthawi iti imene chakudya chimakusangalatsani kwambiri (sankhani chimodzi chofunika kwambiri)?**(ENJOYMEL)** 40. |__|

1. Akamadya ndi achibale 2. Akamadya nthawi yoyenera nthawi zonse
3. Akadya ali ndi njala kwambiri chakudyacho
4. Akadya akuchifuna kwambiri chakudyacho 5. Akamadya zakudya zimene amafuna 6. Zifukwa zina (tchulani) _____ 7. Sakudziwa 8. Sanayankhe

FEARS AND CONCERNS

41. Kodi panthawi ino zimene mukuganizira kwambiri kapena zimene mukuda nazo nkhawa ndi zotani? (0 = chomwe sichinatchulidwe, 1 = chomwe chatchulidwa, 7 = sakudziwa, 8 = sanayankhe) 41

1. Kukonzekera imfa ndi moyo wauzimu **(LIFCONC1)** i. |__|
2. Zazakudya ndi umoyo wa thanzi **(LIFCONC2)** ii. |__|
3. Kukalamba ndi kudalira anthu ena pa ntchito **(LIFCONC3)** iii. |__|
4. Zachuma ndi ndi katundu amene ali naye **(LIFCONC4)** iv. |__|
5. Zaachibale **(LIFCONC5)** v. |__|
6. Zina, tchulani_____ **(LIFCONC6)** vi. |__|

42. Kodi mumakhala bwanji ndi achibale anu? _____**(FRELATIO)** 42. |__|

43. Nanga ana a masiku ano (kapena a mbadwo uno) mukuganiza kuti maganizo awo kwa inu achikulire ndi wotani? _____**(YGATTITD)** 43. |__|

44. Kodi ndinu okhutitsidwa ndi umoyo wanu? **(LSATISF)** 44. |__|

1. Osakhutitsidwa mpang'ono pomwe 2. Osakhutitsidwa 3. Okhutitsidwa
4. Okhutitsidwa kwambiri 7. Sakudziwa 8. Sanayankhe **If answer 3,4,7,8 go to Q46**

45. Nanga chimene chimakupangitsani kusakhutira ndi moyo wanu ndi chiani ? (0 = chomwe sichinatchulidwe, 1 = chomwe chatchulidwa, 7 = sakudziwa, 8 = sanayankhe, 9 = Funso silinawakhuze) 45

1. Mavuto a zachuma **(CDISSAT1)** i. |__|
2. Kudwala-dwala **(CDISSAT2)**

3. Mavuto a nyumba **(CDISSAT3)** ii. |__|
4. Mavuto a zakudya **(CDISSAT4)** iii. |__|
5. Mavuto a kayendedwe **(CDISSAT5)** iv. |__|
6. Mavuto a zovala **(CDISSAT6)** v. |__|
7. Mavuto a pachibale kapena ndi anzawo **(CDISSAT7)** vi. |__|
8. Mavuto ena tchulani_____ **(CDISSAT8)** vii. |__|
viii. |__|

46a. Kodi alipo achibale ena amene anatisiya pamiyezi khumi ndi iwiri yapitayi (kuchokera mwezi wa -------- mpaka lero <use events>)?**(CLORELD)** 46a. |__|

1. Inde 0. Ayi (ngati ayi go to Q47)

46b. Ngati alipo ndi ndani (relationship)? _____**(RELATD)** 46b. |__|

46c. Nanga zovuta zokhudza achibale za posachedwapa zinachitika mwezi wanji ndipo chaka chiti? 46c. |__|__|__|__|

(DYRMO) 7777. Sakudziwa 8888. Sanayankhe 9999. Funso silinawakhuze

47. Nanga ndi anzanu angati amene anatisiya pa miyezi khumi ndi iwiri yapitayi (kuchokera mwezi wa ---------- mpaka lero)? **(CLOSFRDD)** 47. |__|__|

00. Palibe anzawo amene anamwalira 77. Sakudziwa
88. Sanayankhe99. Funso silikuwakhudza (alibe anzawo)

Medical/Clinical examination

48. Name of examiner ..... **(EXAMID)** 48. |__|

49. Kodi umoyo wanu munganene kuti uli bwanji kuyerekeza ndi anzanu azaka zanu kapena a misinkhu yanu? (in case of a proxy- Kodi mukuganiza kuti iwowa umoyo wawo amauganizira kuti uli bwanji kuyerekeza ndi anthu a zaka zawo? **(SHEALTH)** 49. |__|

1. Wamphamvu 2. Wamphamvu zochepa 3. Wopanda mphamvu
7. Sakudziwa 8. Sanayankhe

50a. Kodi munadwalapo pa ma sabata awiri apitawo? **(HPROBLEM)** 50a. |__|

1. Inde 0. Ayi 8. Sanayankhe If answer 0,8 go to 51

50b. Ngati ndi choncho, munadwala matenda anji? 99 funso silikuwakhudza (sanadwalepo pa masabata awiri apitawo) _____**(TYPPROBL)** 50b. |__|__|

50c. Nanga munafuna chithandizo kwina kuli konse? **TRTSOT)** 50c |__|

1. Inde 0. Ayi 8. Sanayankhe If answer 0,8 go to 51

50d. Ngati ndi choncho, munafuna kuti chithandizo chimenechi?**(WTRTSOT)** 50d. |__|

1. Kuchipatala 2. Kwa a Sing'anga
3. Kugula mankhwala ku ma grocery 4. Anafuna makhwala okha (achikuda)
5. Kwina tchulani _____ 7. Sakudziwa 8. Sanayankhe
9. Funso silinawakhudze (sanafune chithandizo)

51. Kodi mumamva bwino-bwino? **(HEARING)** 51. |__|

1. Inde 0. Ayi 3. Movutikirapo pang'ono
4. Movutikira kwambiri 5. Samamva/ ndi wosamva
7. Sakudziwa 8. Sanayankhe

52. Nanga kodi mumaona bwino-bwino? **(SIGHT)** 52. |__|

1. Inde 0. Ayi 3. Movutikirapo pang'ono 4. Movutikira kwambiri
5. Saona 7. Sakudziwa 8. Sanayankhe

53a. Kodi ali ndi chilema kapena ndi wolumala? 1. Inde 0. Ayi (ngati ayi, go to Q54) **(DISABLEH)** 53a. |__|

53b. Ngati ndi choncho, tchulani chilema chake **(TYPDISB)** 53b. |__|

1. Samamva/ndi wosamva 2. Samaona 3. Ndiolumala

4. China tchulani _____ 9. Funso silinawakhuze (alibe chilema)

54a. Kodi pa miyezi khumi ndi iwiri yapitayi (kuchokera mwezi wa ------ mpaka lero) munadwalapo matenda awa?1. Inde 0. Ayi 7. Sakudziwa 8. Sanayankhe 54a

i. Kuphwanya/kupweteka kwa miyendo pa nthawi ya usiku **(PNLEGS)** i |__|

ii. M'mimba kutsekula kapena kudzimbidwa **(PNSTOMAC)** ii |__|

iii. Kupweteka kwa mokumanira mafupa **(PNJOINT)** iii. |__|

iv. Kuuma kwa mokumanira mafupa mukadzuka m'mawa **(STIFFJNT)** iv.|__|

v. Kupweteka kwa mutu **(HEADACHE)** v.|__|

vi. Kupweteka kwa m'chifuwa **(PNCHEST)** vi. |__|

vii. Kupweteka kwa msana **(PNBACK)** vii.|__|

viii. Matenda a mtima **(PNHEART)** viii.|__|

ix. Malungo **(MALARIA)** ix.|__|

x. Kukhosomola/chifuwa **(COUGHS)** x. |__|

xi. Matenda ena tchulani _____ **(OTHERDIS)** xi.|__|

54b. Kodi a dokotala kuchipatala anakuuzanipo kuti mukudwala kapena munali ndi matenda awa: 1. Inde, 0. Ayi , 7. Sakudziwa, 8. Sanayankhe 54b

i. Matenda a shuga **(DIABETES)** i. |__|

ii. BP (kuthamanga kwa magazi) **(HIGHBP)** ii. |__|

iii. Matenda a mtima **(HEARTACK)** iii. |__|

iv. Kuthyoka mafupa **(BRKHIP)** iv. |__|

v. Kusowa/kuchepa magazi **(ANAEMIA)** v. |__|

vi. Chifuwa chachikulu (TB) **(TUBERCUL)** vi. |__|

vii. Arthritis (kuphwanya/kutupa kwa mokumanira mafupa) **(ARTHRIT)** vii. |__|

55a. Kodi pa nthawi ino mukumwa makhwala ena ali onse?

1. Inde 0. Ayi (ngati ayi go to 56) **(MEDICNOW)** 55a |__|

55b. Ngati ndi choncho, nanga ndi makhwala anji?_____**(TYPEMEDIC)** 55b |__|

55c. Ndipo makhwalawo ndi othandiza pa matenda anji? _____ **(PURPSMED)** 55c. |__|

56. Kodi pali mano anu ena amene anachoka kapena munagwelula ? **(OWNTEETH)** 56 |__|

1. Inde, onse 2. Inde, angapo 0. Ayi,ali ndi mano onse

7. Sakudziwa 8. Sanayankhe

57. Kodi muli ndi mano ochita kuvala (ogula, achizungu)? **(FTEETH)** 57. |__|

1 Inde, onse 2. Inde, angapo 0. Ayi, sawasowa poti ali ndi mano onse
7. Sakudziwa 8. Sanayankhe

58. Nanga zakudya zimakuvutani kutafuna ?**(CHEWING)** 58 |__|

0. Ayi 1. Inde, nthawi zonse ndiponso zakudya zonse
2. Inde, nthawi zina, anasiya kudya zakudya zolimba 7. Sakudziwa 8. Sanayankhe

59. Nanga pali zakudya zimene simudya masiku ano chifukwa cha vuto la mano? 59. |__|

1. Inde, zambiri2. Inde, zapang'ono zolimba 0. Ayi, zonse amadya
7. Sakudziwa 8. Sanayankhe **(SFOOD)**

60. Nanga kodi mumavutika kumeza zakudya? **(SWALLOW)** 60 |__|

1. Inde, kawiri-kawiri 2. Inde, nthawi zina 0. Ayi 7. Sakudziwa 8. Sanayankhe

61a. Kodi msana wawo wa wofunsidwa ndiwowelama (onani chithuzi)**(KYPHOCL)** 61a |__|

1. Inde 0. Ayi

61b. Nanga thupi lawo likuoneka kutupa (oedema) **(OEDEMACL)** 61b |__|

1. Inde 0. Ayi

62. Kodi mukuganiza kuti mumalandira chisamaliro chokwanira? **(TAKENCAR)** 62. |__|

1. Inde 2. Pang'ono 0. Ayi 7. Sakudziwa 8. Sanayankhe

63. Kodi munthu wofunika kwambiri pa moyo wanu ndi ndani? _____ **(IMPOPERS)** 63. |__|

64. Kodi masiku ano mukuganiza kuti mumaiwala-iwala zinthu kuposera kale? **(MEMORY)** 1. 64. |__|

Inde 0. Ayi 7. Sakudziwa 9. Funso silinawakhuze (saiwala)

65a. Nanga masiku ano mumavutika kuti mugone kusiyana ndi kale/mbuyomu?**(SLEEP)** 65a. |__|

1. Inde 0. Ayi 7. Sakudziwa 8. Sanayankhe

65b. Ngati ndi choncho, pali mankhwala amene mumamwa kuti mupeze tulo mwansanga? 65b. |__|

(SLPASST) 1. Inde 0. Ayi 7. Sakudziwa 8. Sanayankhe

9. Funso silinawakhuze

65c. Ngati mumamwa, ndi kangati pa sabata kapena pa mwezi kapena pa chaka? **(FREQPILL)**

1. Kamodzi kapena kawiri pa chaka 2. Kamodzi pamiyezi ingapo 65c. |__|
3. Kamodzi kapena kawiri pa mwezi 4. Kamodzi pasabata 5. Kupitirira kamodzi pa sabata
7. Sakudziwa 8. Sanayankhe 9. Funso silinawakhuze

66a. Kodi kale munkasuta fodya? **(SMOKPAST)** 66a.|__|__|

1. Inde 0. Ayi 8. Sanayankhe

66b. Nanga masiku ano mumasuta fodya? **(SMOKPRES)**

1. Inde 0. Ayi 8. Sanayankhe If answer 0, 8 go to Q67a 66b. |__|

66c. Mongoyerekeza, tingati mumasuta ndudu zingati patsiku? (77 Sakudziwa, 88 Sanayankhe) 66c.|__|__|day

(NUMCIGAR)

67a. Kodi mumamwa mowa? **(ALCOHPRE)** 67a. |__|

1. Inde 0. Ayi 7 Sakudziwa 8. Sanayankhe

67b. Nanga Kodi kale munkamwa mowa? **(ALCOHPAS)** 67b. |__|

1. Inde 0. Ayi 7. Sakudziwa 8. Sanayankhe

67c. Ngati tsopano mumamwa mowa, ndi kangati pa sabata ndipo ndi kangati pa mwezi? (77 Sakudziwa, 88 Sanayankhe, 99 Funso silinawakhuze - samamwa mowa). 67c. |__|__| wk |__|__| mo

(FRQALCWK) (FRQALCMO)

68. Kodi mukadwala amakuthandizani/kapena amene amakusamalirani kwambiri ndi ndani? 68. |__|

(HELPILL) _____

EXAMINER'S ASSESSMENT

69. Kodi pamene mumawafunsa mafunso anali ochangamuka? **(SUBALERT)** 69. |__|

1. Inde 0. Ayi

70. Kapena anali kuoneka kudandaula kapena kusasangalala? **(SUBDEPRS)** 70. |__|

1. Inde 0. Ayi

71. General health assessment. **(GHEALTH)** 71. |__|

1. Good health 2. Minor health problems 3. Ill health
4. Other specify _____

72. Action taken **(ACTIONTN)** 72. |__|

1. Referred to a clinic/hospital for treatment 2. Not applicable

73. Respondent's blood pressure (two measurements) 73.

Systolic **(SYSTOLI1)** **(SYSTOLI2)** |__|__|__|S1
|__|__|__|S2

Diastolic	**(DIASTO1)**	**(DIASTO2)**	|_|_|_|D1 |_|_|_|D2

QUESTIONNAIRE, PROCEDURES AND RECORDING FORMS FOR FUNCTIONAL ABILITY INFORMATION (ACTIVITIES OF DAILY LIVING (ADL) AND PHYSICAL PERFORMANCE TESTS).(For anthropometric measurements and physical performance tests procedures, see separate forms).

Pa nthawi ino tikufunsani za ntchito zomwe mwakhala mukugwira pakhomo pano pa sabata yathayi. Tikufuna tidziwe zomwe mumatha kugwira panokha, zomwe mumagwira mothandizidwa ndi anthu ena ndi zomwe amakugwirirani anthu ena. (Kwa ofunsa) Kumbukirani kuti muyenera kulemba zimene ofunsidwa amachita osati zimene angathe kuchita. Cholinga ndi kufuna kudziwa ngati iwowo ali odzidalira pa ntchito kapena amadalira anthu ena ndi zifukwa zake.

74a. **Za kadyedwe**. **(EATING)**

Kodi sabata yathayi alipo amene amakudyetsani zakudya kapena kodi sabata yathayi mumatha kudya chakudya nokha? 74a |__|

0 Samatha - amathandizidwa pa zonse zokhudzana ndi zakudya (amadyetsedwa)
1 Amathandizidwa pa zina monga kutema osati nthawi zonse kapena pazakudya zonse
2 Amatha kudya okha opanda wowathandiza 8 Sanayankhe

74b. Chifukwa (0,1)_____ **(EATRSN)** 74b.|__|

75a. **Zakadzukidwe/ndi kukhalidwe ka pansi (TRANSFER)**

Kodi sabata yathayi, mumatha kuyenda kuzungulira nyumba mwanu monga kudzuka mukakhala pansi kapena pa mpando panokha kapena alipo amene amakuthandizani? Kodi mumatha kukhala pansi panokha opanda okuthandizani? 75a |__|

0 Samatha - amafuna chithandizo podzuka, pokhala ndipo samatha kuyenda okha, amayenera kunyamulidwa ndi munthu kapena anthu awiri ndipo samatha kukhala paokha
1 Amafuna chithandizo chapang'ono podzuka, pokhala ndi pozungulira pakhomo Amatha kuthandizidwa kuti atetezezedwe koma samanyamulidwa, amatha kukhala osathandizidwa.
2 Sasowa chithandizo. Amatha kudzuka, kukhala pa okha. 8 Sanayankhe

75b. Chifukwa (0,1) _____ **(TRNSRSN)** 75b.|__|

76a. **Zakavalidwe** **(DRESSING)**

Kodi sabata yathayi mumatha kuvala zovala nokha (monga kumanga nsalu, kuvala bulauzi, kumanga ma batani, kukokera shati ndi zina zotero) kapena mumathandizidwa? Ngati mumathandizidwa, ndi pa zonse kapena theka la kuvala? Nanga mumasankha nokha zovala zanu ? 76a.|__|

0 Samatha - Samatha kudziveka, amatha kukhala osavala
1 Amafuna chithandizo pa zina monga kumanga mabatani koma Amatha kuvala zina pa okha
2 Amatha kuvala okha opanda chithandizo, Amasankha zovala okha, Amatha kuvala ndi kuvula okha. 8 Sanayankhe

76b. Chifukwa (0,1)_____ **(DRESSRN)** 76b.|__|

77a. **Zakasambidwe** **(BATHING)**

Kodi sabata yathayi mumatha kuzisambitsa thupi lonse opanda okuthandizani? Kapena mumatha kusamba mbali ina opanda chithandizo? Ngati munathandizidwa, okuthandizaniwo, anakuthandizani bwanji? 77a. |__|

0 Samatha - amafuna chithandizo posamba (amachita kusambisidwa)
1 Amatha kupanga zina opanda chithandizo koma powateteza, amayenera kuthandizidwa

kapena amatha kusamba mbali ina ndipo kwina amayenera kuthandizidwa.
2 Amatha kusamba okha opanda chithandizo 8 Sanayankhe

77b. Chifukwa (0,1)_____**(BATHRSN)** 77b.|__|

78a. **Kugwiritsa ntchito chimbuzi** (includes mobility) **(TOILET)**

Kodi sabata yathayi mumatha kupita kuchimbuzi nokha opanda okuthandizani? Nanga popita kuchimbuzi alipo amene amakuthandizani kapena mumagwiritsa ntchito ndodo, crutches, wheelchair? (At night this may be management of bedpan by self) Nanga mumafuna kuti mbale wanu akuthandizeni, Nanga mumatha kuvula, kukhala pa chimbuzi bwino-bwino ndi kuzikonza mukamaliza? Kapena, kodi mumagwiritsa ntchito chitini (potty) pochita chimbuzi? 78a.|__|

0 Samatha - Sangafike kuchimbuzi paokha pokhapokha wina awaperekeze, sangathe kuvula, kukhala pa chimbuzi kapena kuzikonza okha. Ngati satuluka, samatha kugwiritsa ntchito chitini paokha.
1 Amathandizidwa pa zina monga kupita ndi kubwera kuchimbuzi, kuvula, kukhala, ndi kuzikonza. Koma zina amatha kupanga okha kapena amafuna kuthandizidwa nthawi zina osati nthawi zonse.
2 Amatha kupita kuchimbuzi ndi kupanga zonse okha opanda owathandiza
8 Sanayankhe

78b. Chifukwa (0,1)_____**(TOILRSN)** 78b.|__|

79a. **Continence:** **(CONTINEN)**

Kodi mumatha kufika ku chimbuzi mu nthawi yake osadzionongera?

0 Samatha kufika kuchimbuzi munthawi yake. Amadzionongera.
1 Amadzionongera mwa kamodzi kamodzi 79a.|__|
2 Amatha kudzigwira. Amatha kufika kuchimbuzi mu nthawi yake opanda kudzionongera
8 Sanayankhe

79b. Chifukwa (0,1) _____**(CONTINRN)** 79b.|__|

80a. **Zakayendedwe**: **(WALK)**

Kodi mumatha kuyenda mtunda wokwanira 1 kilometre ? (Kuchokera kuno kukafika ...)

0 Ayi 80a.|__|
1 Inde, koma movutikira/mwapang'ono pang'ono /mothandithandizidwa /mwa kamodzi kamodzi
2 Inde, mosavutikira, kawirikawiri, amagwiritsa ntchito ndodo
8 Sanayankhe

80b. Chifukwa (0,1) _____ **(WALKRSN)** 80b.|__|

81a. **Za kuyenda** **(TRAVEL)**

Kodi mumatha kupita kutali koti simungathe kuyenda pansi? Ngati ndi choncho, mumayenda bwanji? pa Bus, pa sitima, pa njinga yopalasa ? Kodi mumatha kuyenda nokha? 81a.|__|

0 Samatha kuyenda okha, pokha pokha zitavuta ndiye amayenda
1 Inde mothandizidwa/pang'ono pang'ono/ kamodzikamodzi kapena ngati kuli kofunika
2 Inde, mosavutikira, kawirikawiri, amatha kuyenda okha ngati kuli kofunika, amatha kugwiritsa ntchito ndodo 8 Sanayankhe

81b. Chifukwa (0,1) _____ **(TRAVERSN)** 81b.|__|

82.Kodi ndi ntchito zina ziti zimene inu mumagwira pakhomo pano?_____**(OTHERA)** 82.|__|

OBSERVED GROSS MOBILITY: Mayendedwe pa nthawi ya mafunso ndi poyesa nyonga **(MOVEMENT)**

83a. ZOMWE MWAONA ZOKHA (Musafunse mafunso otsatirawa)

Kodi wofunsidwawo amatha kuyenda kapena ayi? Kodi amachita kunyamulidwa? Nanga kapena amayenda mwapang'ono pang'ono, movutikira kapena mothandizidwa kapena a yi? Kodi amatha 83a.|__|

kuyenda mosavutikira opanda wowathandiza?

0 Amachita kunyamulidwa, sangathe kuima kapena kuyenda okha, amayenera kuthandizidwa nthawi zonse.
1 Amatha kuima ndi kuyenda komwe koma nthawi zina amafuna kuthandizidwa pa zinthu zina. Amayenda pang'ono pang'ono, movutikira ndipo nthupi mumawapweteka akamayenda. Nthawi zonse amagwiritsa ntchito ndodo kapena khoma akamayenda.
2 Amayenda bwinobwino opanda vuto lililonse.
3 Samatha kuyenda chifukwa chopunduka/anadulidwa mwendo/matenda/kuvulala/matenda a stroke.

83b. Nenani ngati amangokhala panyumba (sayenda-yenda)

1. Inde 0. Ayi **(HOUSEBND)** 83b.|__|

FUNCTIONAL ABILITY TESTS CODING

85a. **Kanyamulidwe ka kiyi:** **(PICKUP)** 85a. |__|

0 Sanathe 1 Anatha koma movutikira kapena mwapang'ono pang'ono
2 Anatha, bwino-bwino mosavutikira
3 Sanachite chifukwa cholumala/chopanda manja /chomva ululu chifukwa chamatenda (arthritis)
8 Anakana kuchita mayeso

85b. **Kagwiridwe ka kiyi:** **(HOLDKEY)** 85b |__|

0 Sanathe 1 Anatha koma movutikira, anagwetsa kiyi
2 Anatha, mosavutikira 3 Sanachite chifukwa cholumala/chopanda manja /chomva ululu chifukwa chamatenda (arthritis)
8 Anakana kuchita mayeso

85c. **Nthawi yotsekulira loko:** **(KEYTIME)** 85c.|__|__|__|. secs

.....Nthawi yotsekulira loko mumasekonzi:
333 Sanachite chifukwa cholumala/chopanda manja /chomva ululu chifukwa chamatenda (arthritis)
888 Anakana kuchita mayeso

86a. Tapping test timing : (86a + 86b) (**FASTPLAT** less time and **SLOWPLAT** more time) 86a.|__||__||__|.secs

..... Time of the first try
333 Sanachite chifukwa cholumala/chopanda manja /chomva ululu chifukwa chamatenda (arthritis)
888 Anakana kuchita mayeso

87a. Nyonga za dzanja lomwe limagwira ntchito nthawi zonse (**BESTHD1 BESTHD2 BESTHD3 BESTHD4**) 87a
|__|__| |__|kg
.....Kuyesa kwa mphamvu kwambiri |__|__| |__|kg
333 Sanachite chifukwa cholumala/chopanda manja /chomva ululu chifukwa chamatenda (arthritis) |__|__| |__|kg
|__|__| |__|kg

888 Anakana kuchita mayeso

87b. Nyonga za dzanja lomwe silimagwira ntchito nthawi zonse (**OTHERHD1 OTHERHD2 OTHERHD3**) 87b
|__|__| |__|kg
..... Kuyesa ndi mphamvu zonse |__|__| |__|kg
333 Sanachite chifukwa cholumala/chopanda manja /chomva ululu chifukwa chamatenda (arthritis) |__|__| |__|kg
888 Anakana kuchita mayeso

87c. **Nanga ndi dzanja liti limene limagwira ntchito kwambiri (DOMINANT)** 87c.|__|

1 Lakumanzere 2 Lakumanja
3 Amagwiritsa ntchito manja onse ngakhale kawiri-kawiri limagwira ntchito ndi limodzi

86b. Tapping test timing (86a + 86b **FASTPLAT** less time **SLOWPLAT** more time)

..... Time of the second try

333 Sanachite chifukwa cholumala/chopanda manja /chomva ululu chifukwa chamatenda (arthritis) 888 Anakana kuchita mayeso — 86b |__|__|__|__|Secs

84 **Lembani nambala ya zinthu zomwe zakumbukiridwa.** **(OBJECTS)**

33 Sanathe kuona zinthu chifukwa samaona (visual handicap) 88 Anakana — 84.|__|__|

ANTHROPOMETRIC MEASUREMENTS

MEASUREMENT 88. Measurer..... — 88.|__|

88.8 or 888.8 for not taken (according to digits of the measurement and give reason (s) for not taking the measurement).

89. Weight (kg) **(WEIGHT 1)** **(WEIGHT 2)** — 89 |__|__|.|__| kg |__|__|.|__| kg

90. Oedema 1. Present 0. Absence of oedema **(OEDEMAEN)** — 90.|__|

91. Height (cm) **(HEIGHT1)** **(HEIGHT2)** — 91. |__|__|__|.|__| cm |__|__|__|.|__| cm

92. Kyphosis 1. Present 0. Absent **(KYPHOSEN)** — 92 |__|

93. Arm span (cm) **(ARMSPAN1)** **(ARMSPAN2)** — 93 |__|__|__|.|__| cm |__|__|__|.|__| cm

94. Demispan (cm) **(DEMISP1)** **(DEMISP2)** — 94. |__|__|__|.|__| cm |__|__|__|.|__| cm

95. Mid Upper Arm Circumference (cm) **(MUAC1)** **(MUAC2)** — 95 |__|__|.|__| cm |__|__|.|__| cm

96. Triceps Skinfold Thickness (mm) **(TRICEPS1)** **(TRICEPS2)** **(TRICEPS3)** — 96 |__|__|.|__| mm |__|__|.|__| mm |__|__|.|__| mm

FUNCTIONAL ABILITY TESTS CODING

KUFOTOKOZA ZA KAPIMIDWE KA NYONGA

"Monga mukudziwa kuti thupi lathu limasintha timakula, tikufuna muyese zochita chita zokhuza manja. Poyamba ndifotokoza kachitidwe kake kenaka ndikusonyezani mmene mungachitire. Kenaka tifuna kuti inu muyesere kuchita zimene tikusonyezenizo. Ngati mukuona kuti simungathe kapena kuti mthupi mwanu mukupweteka ndiye mukuganiza kuti zitha kukhala zovuta kuti inu muyesere, tiuzeni kuti mwina mutha kuyesera zina. Ife tikufuna kuti muyesere zonse zimene tikuuzeni koma ngati simungathe, chonde tifotokozereni. Zamveka eti.

84. ZA KUKUMBUKIRA ZINTHU

NJIRA YAKE

1. Bweretsani mbale momwe muli zinthu khumi. Onetsetsani kuti zonse zilipo ndipo ndizosanjidwa bwino lomwe (zikuluzikulu komalizira). Onetsetsaninso kuti muli ndi ndandanda wa zinthu khumizo kuti mudzagwiritse ntchito pa nthawi yomwe mudzawafunse kuti akumbukire zomwe anaona zija.

2."Chonde onani zinthu khumi zili mmbale zi ndipo muyesetse kuti mudzazikumbukire nthawi ina. Zinthuzi ndi zoti mumaziona nthawi ndi nthawi ndiye mwayenera kudzidziwa. Mutha kumadzigwira kapena kumazitchula mokweza ngati kutero kungakuthandizeni kukumbukira. Sikuti tifuna kuti mukumbukire nthawi yomwe ino ayi koma tikufunsani pakapita nthawi pang'ono. Tichita kukufunsani kuti mudzikumbukire nthawi yake ikakwana. Panopo tikupatsani mphindi imodzi kuti muzione zinthuzu kuyambira tsopano.

3. Apatseni nthawi yokwanira mphindi imodzi

4. Ikatha mphindi imodzi, vindikirani mbaleyo ndipo muyiike posaoneka.

85. <u>KUTSEKULA LOKO</u>

Kutsekula loko pa nthawi kumathandiza kuti tidziwe umo dzala zana zimagwirira ntchito ndiponso mmene manja anu amagwirira ntchito.

"Tsopano tifuna tione mmene manja anu amagwirira ntchito pokupemphani kuti mutsegule loko ali apayi ndi ma kiyi awa. Tandionetseni dzanja lomwe mumagwirira kiyi. Ine ndigwira loko motere ndipo ndikufuna kuti mutenge kiyi ndikutsekula motere. "

1. ONETSANI KAPANGIDWE KAKE

"Ngakhale titatchere nthawi, ndikufuna kuti muyende mosamala ndiponso kuyesetsa kuti musagwetse kiyi. Kodi pali mafunso? Chabwino. Ndikati yambani chonde muyambe."

2. TCHERANI NTHAWI. KUYAMBIRA POTENGA KIYI MPAKA KUTSEKULA LOKO.

Ngati ulendo woyamba zinthu sizinayende bwino mutha kuwauza kuti ayambirenso.

Tcherani nthawi kuyambira pamene wofunsidwa anyamula dzanja kupita kumene kuli kiyi. Tsilizani pamene loko watsekulidwa.

86. <u>PLATE TAPPING TEST</u> (PSYCHOMOTOR SKILL)

We will use Plate Tapping Test to measure speed and coordination that require pyschomotor function.

KAYEZEDWE KAKE

1. Tiyenera kukhala ndi timapepala tozungulira tiwiri ndipo kukula kwake tikhale 20 cms (in diameter) ndiponso timatidwe bwinobwino patebulo. Mapepala wa akhale motalikirana kokwanira 80 cms ndipo pepala lina la folokona (10cms x 20 cms) likhale pakatikati pa mapepala awiriwa.

2. Ngati kungatheke, tebulolo lidzisunthidwa kuti likhale lokeza mmusi mwa nchombo.

3. "Imani patsogolo pa tebulo myang'anana ndi pepala la folokona ndipo miyendo yanu ikhale motalikirana pang'ono. Ikani dzanja lanu lomwe siligwira ntchito kwambiri pamwamba pa pepala la folokona ndipo mulisiye pompo. Ikani dzanja lanu lomwe limagwira ntchito kwambiri papepala lozungulira ndipo mudziyendetsa dzanja lanu kuchokera papepala limodzi kudzafika pa lina mmene mugathere. Muonetsetse kuti dzanja lomwe lili pakatilo likhale pomwepo ndipo mudzigwira pakati peniepeni pa mapepala ozungulirawo. Mukapanda kutero ndiye kuti sitiwerengera.

Ndikati konzekani ndiye kuti muike dzanja lanu lomwe limagwira ntchito kwambiri pa limodzi mwa mapepala ozungulira ndipo ndikati yambani ndiye kuti muyambe kuyendetsa dzanja lanu kuchokera pa pepala limodzi lozungulira kukafika pa lina mpakana kokwanira makumi awiri ndi kasanu (25). Muyesetse kuti kAFIke ka 25 ngakhale muzipanga pang'ono pang'ono.

Sikoyenera kuti mudziwerenga popeza ineyo ndiziwerenga mukweza kuti inu mudzimva. Panopo mupanga kamodzi koma kenaka tikupemphani kuti mupangenso kawiri. Kamene mutapange kofulumirako ndikamene tiwerengere. Zamveka. Konzekani. Yambani".

4. Tcherani watch mukati Yambani. Yambirani kuwerenga pomwe iwo ayambira. Kamodzi ndiye kuti kuchokera pomwe anayambira kukafika mbali inayo. Ayenera kugwira mbali zonse kokwanira makumi asanu (50) kapena titi ka 25 mukamawerengera maraundi.
5. Kumbukirani kuti dzanja lomwe liri pakatilo likhale pomwe mpaka kumaliza.
6. Achite izi kawiri koma apume pang'ono asayese kachiwiri (Hand dynamometry). Pomwe atenge nthawi yochepa ndiye zomwe tidzagwiritse ntchito.
7. Kukhoza kapena kumaliza ndi nthawi yomwe yakwanistidwa pamaraundi 25. Ngati alephera kugwira pepala ndiye raundi imeneyo siiwerengeredwa mpaka aonjezere ina kuti mpaka akwane 25.

RECORD PLATE TAPPING RESULT (FIRST TRY)

87. **HAND DYNAMOMETRY**

The Equipment

Tili ndi chipangizo ichi chotchedwa Hand Dynamometer chomwe ntchito yake ndi kupima mphamvu/nyonga zammanja mwanu. Nyongazo zimayezedwa mumakilogalamu.

KAPIMIDWE KAKE

Tidzayeza mphamvu mmanja onse awiri ndipo tidzabwereza katatu pa dzanja lili lonse. Izi zimathandiza kuti munthu azolowere kagwiridwe kake ndiponso kuti ziyende bwino. Pomalizira tidzakulorani kuti muyesere komaliza.

"Monga tanenera tsopano tifuna kuti tikuyezeni mphamvu/nyonga. Poyamba mupinde nkono wanu kuti utsamire pamimbapa. Kenaka yesani kugwira chitsulochi kuti tione ngati chili pa saizi ya dzanja lanu. Kodi mukuganiza kuti lakhala bwino dzanjalo?"

1. Awuzeni kuti akhale pansi. Inu mukhale mowayang'ana ndipo poyamba muwauze za chitsulocho ndi ntchito imene chimagwira.
2. Asonyezeni mmene angaikire mkono ndiponso kagwiridwe kake.
3. Avekeni chingwe chachitsulo nkhosi mwao ndipo manja awakhazike poyenerera pamwendo motsamira thupi. *(The wrist should be in about 15 degrees of extension)*
4. Ikani dzanja muchitsulo ndipo sunthani chitsulocho monga ndi mulingo wa dzanja lawo. Polumikizira pa chala pachiwiri pakhale popindika bwino bwino *(approximately at a right angle)*

"Tsopano tikupemphani kuti mukhale ngati mukufinya chitsulocho ndi mphamvu zanu zonse pakanthawi kochepa. Muyesetse kuti mufinye ndi mphamvu zanu zonse (mmene mungathere). Tibwereza izi katatu ku dzanja lili lonse kenaka tikupemphani kuti muyesere komaliza ku dzanja lomwe mumagwiritsa ntchito nthawi zonse." Koma musawalole kuti kuti afinye chitsulocho kupitirira kamodzi.

5. Muwayeze: Katatu ku dzanja limene amagwiritsa ntchito, Katatu ku dzanja limene siligwira ntchito kwambiri. Kamodzi ku dzanja limene limagwira ntchito kwambiri.
6. Muwachemerere powaimbira mmanja, kapena kukuwa kuti alimbikire kwambiriwa ndiponso muwaonetse chitsulocho kuti adziwe nyonga zawo musanabwezere pa 0 (zero) nthawi zonse.

86b. **SECOND PLATE TAPPING TEST**

"Tsopano tifuna kuti mubwerezenso zogwira mapepala ozungulira zija. Tikudziwa kuti pano mutha kupnag mofulumirirako ndiye tiyeni tione mmene mungafulumirire. Koma kumbukirani kuti dzanja lokhala pakati lisamayende yende koma linalo ndiye lidziyenda kuchokera papepala limodzi kufika pa lina mofulumira umo mungathere. Onetsetsani kuti mukugwira pakati pa mapepala ozungulirawo. Monga mmene munapangira poyamba.

panoponso mupanga kokwanira makumi awiri ndi zisanu (25). Mwakonzeka. (Tcherani nthawi). Yambani." (Code 333, 888 as in first try).

84 OBJECT MEMORY TEST

"Paja mukukumbukira kuti tinakuonetsani zinthu zokwanira khumi (10) pakanthawi pang'ono kapitako. Tinakupatsani mphindi imodzi kuti muzione kenaka kuti mudzazikumbukire. Kodi zimenezi mukuzikumbukira? Tsopano tikufuna kuti tione kuti pa zinthu zomwe tinakuonetsani ndi zinthu zingati zomwe mungathe kukumbikira. Muzingozitchula ndikanena kuti muyambe.

Panonso tikupatsani mphindi imodzi kuti mukumbulire zinthu zomwe tinakuonetsani. Mwakonzeka?" Tcherani nthawi. Yambani. Mukamati "Yambani." Lembani nambala ya zinthu zomwe zakumbukiridwa. Muzikhwatcha zomwe zatchulidwa pa ndondomeko wanu. Mutha kuwathandiza ponena chabe (osati kuwauzira) pa nthawi imene akuyesetsa kukumbukira.

Zonse zokhudzana ndi kupima nyonga zathera pamenepa. Sungani zipangizo zopimira nyonga pamalo abwino ndipo konzekerani za kuyeza thanzi la munthu.

ONETSETSANI KUTI ZONSE ZOPIMIRA THUPI ZAKONZEDWA BWINO LOMWE.

(For Anthropometry, see English procedure)

APPENDIX 3: REFERRAL LETTER TO HEALTH CENTRES

University of Malawi

BUNDA COLLEGE OF AGRICULTURE

REFERRAL FORM FROM THE STUDY OF NUTRITIONAL STATUS AND FUNCTIONAL ABILITY OF THE ELDERLY IN LILONGWE DISTRICT

TO: The Clinical Officer, Mitundu Rural Hospital/ The Medical Assistant, Mtenthera Health Centre/ The Medical Assistant, Nsaru Health Centre

FROM: Nurse in-charge (Mrs Kunkeyani, SRN)

DATE:...../...../96

REQUEST FOR TREATMENT

As you may be aware, we are currently conducting a survey whose objectives are to assess nutritional status and functional ability of the elderly in selected villages around your rural hospital/ health centre. One of the aspects of the study is clinical examination which involves general assessment and taking blood pressure measurements.

The purpose of this memo therefore is to request you to give treatment and advice to the following person .... from ..... village who has the following problem(s) .....

Your assistance on this issue will be greatly appreciated.

H. Kunkeyani (SRN)

D.M Chilima (Mrs), In-charge of the project.

APPENDIX 4: COMMON ILLNESSES MOST SUBJECTS SUFFERED FROM IN THE PRECEDING 12 MONTHS

Type of illness	*Males n=94*	*Females n=190*	*All n=284*
Painful legs	59 (62.8)	128 (67.4)	187 (65.8)
Stomach problems	43 (45.7)	99 (52.1)	142 (50.0)
Joint pain	63 (67.0)	135 (71.1)	198 (69.7)
Stiff joint	42 (44.7)	108 (56.8)	150 (52.8)
Headache	62 (66.0)	157 (82.6)	219 (77.1)
Chest pains	47 (50.0)	111 (58.4)	158 (55.6)
Backache	63 (67.0)	158 (83.2)	221 (77.8)
Heart problems (palpitation)	13 (13.8)	64 (33.7)	77 (27.1)
Malaria	60 (63.8)	154 (81.1)	214 (75.4)
Coughs	67 (71.3)	155 (81.6)	222 (78.2)
Other illnesses	25 (26.6)	29 (15.3)	54 (19.0)

Other illnesses included gout, teeth problems and anxiety

APPENDIX 5: RESPONDENTS WHO HAVE HAD MAJOR ILLNESSES

Type of illness	*Males n=47*	*Females n=104*	*All n=151*
Diabetes	0	1 (1.0)	1 (0.7)
High blood pressure	3 (6.4)	7 (6.7)	10 (6.6)
Heart attack	2 (4.3)	5 (4.8)	7 (4.6)
Broken hip	1 (2.1)	3 (2.9)	4 (2.6)
Anaemia	4 (8.5)	14 (13.5)	18 (11.9)
Tuberculosis	3 (6.4)	3 (2.9)	6 (4.0)
Arthritis	2 (4.3)	3 (2.9)	5 (3.3)

APPENDIX 6: THE MOST IMPORTANT PERSON FOR WOMEN

Person	*Married n=78*	*Separated/divorced or widowed n=112*
None (self)	10 (12.8)	16 (14.3)
Spouse	14 (17.9)	0
Son	10 (12.8)	23 (20.5)
Daughter	28 (35.9)	34 (30.4)
Son/daughter in-law	1 (1.3)	1 (0.9)
Grandchild	1 (1.3)	13 (11.6)
Brother/sister	4 (5.1)	10 (8.9)
Other relatives	2 (2.6)	6 (5.4)
Friends	1 (1.3)	3 (2.7)
Other people	1 (1.3)	1 (0.9)
Male and female children	5 (6.4)	5 (4.5)
Spouse, children and all relatives	1 (1.3)	0

APPENDIX 7: WHO ASSISTS THE RESPONDENTS WHEN THEY ARE ILL

Person	*Males n=94*	*Females n=190*	*All n=284*
Alone (self)	2 (2.1)	13 (6.8)	15 (5.3)
Spouse	67 (71.3)	11 (5.8)	78 (27.5)
Son	5 (5.3)	21 (11.1)	26 (9.2)
Daughter	8 (8.5)	90 (47.4)	98 (34.5)
Son/daughter in-law	2 (2.1)	7 (3.7)	9 (3.2)
Grandchild	1 (1.1)	14 (7.4)	15 (5.3)
Brother/sister	2 (2.1)	18 (9.5)	20 (7.0)
Other relatives	4 (4.3)	4 (2.1)	8 (2.8)
Daughter and other people	0	10 (5.3)	1 (0.4)
Grandchildren and other relatives	0	1 (0.5)	1 (0.4)
Both male and female children	3 (3.2)	1 (0.5)	13 (4.6)

Other relatives included mother, aunt and in-laws

APPENDIX 8: RANGE OF ALL ANTHROPOMETRIC MEASURES BY SEX

Measure	*Males*	*Females*
Weight (kg)	38.9 - 78.0	25.9 - 77.7
Height (cm)	152.7 - 182.0	139.6 - 168.8
Armspan (cm)	165.9 - 195.4	146.2 - 182.1
Demispan (cm)	73.0 - 89.2	65.5 - 82.2
MUAC (cm)	19.9 - 32.1	17.0 - 33.8
Triceps (mm)	3.3 - 26.1	3.9 - 33.0
BMI (kg/m^2)	14.7 - 28.0	12.3 - 31.9
BMIARM (kg/m^2)	13.9 - 24.4	11.5 - 26.4
Demiquet (kg/m^2)	61.6 - 124.6	-
Mindex (kg/m)	-	39.5 - 99.6
AMC (cm)	18.6 - 29.6	15.5 - 27.8
AMA (cm^2)	27.5 - 69.6	19.0 - 61.6
CAMA (cm^2)	17.5 - 59.6	12.5 - 55.1
MUAFA (cm^2)	3.6 - 36.6	3.2 - 46.1
AFI (%)	8.7 - 44.6	11.0 - 55.5

APPENDIX 9: GEOMETRIC MEANS (SD) FOR ALL TRANSFORMED VARIABLES (ANTHROPOMETRY AND FUNCTION)

Test	*Age group*	*Males* *n*	*Mean (sd)*	*Test for significance*	*Females* *n*	*Mean (sd)*	*Test for significance*
Triceps							
(mm)	55-59	12	7.0 (1.4)		51	11.7 (1.5)	
	60-69	40	6.6 (1.4)	f=0.18,	111	11.5 (1.6)	f=0.55, p=0.58
	70+	41	6.8 (1.5)	p=0.84	28	10.6 (1.6)	
	All	93	6.7 (1.4)		190	11.4 (1.6)	*t=-10.66, df=221.47, p<0.0001
MUAFA	55-59	12	8.6 (1.4)		51	13.9 (1.6)	
(cm^2)	60-69	40	7.8 (1.5)	f=0.30,	111	13.8 (1.7)	f=0.76, p=0.47
	70+	41	8.1 (1.6)	p=0.74	28	12.1(1.7)	
	All	93	8.0 (1.5)		190	13.4 (1.7)	t*=-9.31 df=230.19, p<0.0001
AFI	55-59	12	16.2 (1.3)		51	26.7 (1.3)	
(%)	60-69	40	16.0 (1.3)	f=0.14,	111	25.9 (1.4)	f=0.41, p=0.66
	70+	41	16.6 (1.4)	p=0.87	28	24.8 (1.4)	
	All	93	16.3 (1.4)		190	25.9 (1.4)	t=-11.51, df=281, p<0.0001
Plate	55-59	12	15.9 (1.7)[a]		49	18.0 (1.2)[a]	
tapping	60-69	38	17.7(1.2)[a]	f=7.99,	107	19.5 (1.2)[b]	f=5.18,
time	70+	38	20.2 (1.2)[b]	p=0.001	23	21.1 (1.3)[b]	p=0.007
(secs)	All	88	18.4 (1.2)		189	19.3 (1.2)	t=-1.63, df=265, p=0.105
Key time	55-59	12	3.4 (1.5)[a]		51	8.2 (1.8)	
(secs)	60-69	40	5.5 (1.8)[ab]	f=5.29,	111	9.6 (1.9)	f=1.48
	70+	40	6.9 (2.0)[b]	p=0.006	27	10.2 (2.0)	p=0.23
	All	92	5.7 (1.9)		189	9.3 (1.9)	t=-5.92, df=279, p<0.0001

Tests for significance: t = t-test for sex differences

f = Analysis of variance for differences in means according age and sex, means with similar letters are not significantly different

APPENDIX 10: AGE AND GENDER-SPECIFIC PERCENTILE DISTRIBUTION OF SOME ANTHROPOMETRIC MEASUREMENTS

Measurement	***Males***					***Females***			
	Percentiles					***Percentiles***			
Age group	***Cases***	***25***	***50***	***75***		***Cases***	***25***	***50***	***75***
Weight									
55-59	12	51.5	56.9	59.5		51	46.0	49.0	53.2
60-69	40	48.9	53.0	57.0		111	43.3	48.6	54.4
70+	41	49.1	51.8	57.3		28	42.0	47.3	50.6
All	93	49.3	53.0	57.5		190	43.7	48.5	53.4
Height									
55-59	12	163.9	167.8	169.8		51	151.6	155.4	159.5
60-69	40	160.2	165.3	168.2		111	151.7	155.4	159.3
70+	40	160.7	164.9	170.2		26	151.6	154.9	158.3
All	92	161.8	165.4	169.6		188	151.7	155.3	159.1
Armspan									
55-59	11	174.6	178.9	181.4		51	160.8	166.0	171.4
60-69	36	173.5	176.9	180.9		110	160.2	165.0	168.9
70+	39	171.2	176.8	181.3		24	161.6	164.5	168.6
All	86	173.4	177.0	181.0		185	160.6	165.0	169.2
Demispan									
55-59	11	79.4	81.0	83.0		51	72.1	74.0	76.7
60-69	36	77.8	79.8	81.3		110	72.1	74.1	75.9
70+	39	78.2	79.8	81.8		24	71.9	73.7	76.7
All	86	79.1	79.9	81.9		185	72.0	74.0	76.1
MUAC									
55-59	12	24.2	26.4	27.3		51	24.2	26.5	27.6
60-69	40	23.1	25.0	26.6		111	23.4	25.8	28.5
70+	41	23.2	24.9	26.4		28	22.3	24.8	26.4
All	93	23.2	25.0	26.6		190	23.5	25.8	27.7
Triceps									
55-59	12	5.9	6.8	8.2		51	9.9	11.1	16.3
60-69	40	5.5	6.1	7.6		111	8.3	11.3	16.2
70+	41	5.4	6.3	8.2		28	7.1	11.2	16.2
All	93	5.5	6.3	8.0		190	8.3	11.2	16.2

APPENDIX 11: AGE AND GENDER-SPECIFIC PERCENTILE DISTRIBUTION OF SOME DERIVED MEASUREMENTS

Measurement	*Males*					*Females*			
	Percentiles					*Percentiles*			
	Cases	*25*	*50*	*75*		*Cases*	*25*	*50*	*75*
BMI									
55-59	12	18.2	20.3	20.8		51	18.5	19.6	22.0
60-69	40	17.8	19.4	21.2		111	18.4	20.5	22.6
70+	40	17.9	19.7	21.0		26	18.1	19.0	20.9
All	92	17.9	19.7	21.1		188	18.4	19.8	22.1
Demiquet									
55-59	11	76.6	85.8	90.0		-	-	-	-
60-69	36	75.9	82.2	89.4		-	-	-	-
70+	39	77.9	83.7	88.2		-	-	-	-
All	86	77.3	83.4	89.2		-	-	-	-
Mindex									
55-59	-	-	-	-		51	60.7	65.2	71.1
60-69	-	-	-	-		110	59.1	66.3	73.5
70+	-	-	-	-		24	56.9	62.7	66.8
All	-	-	-	-		185	59.6	65.1	71.9
AMC									
55-59	12	21.7	23.5	24.9		51	20.7	22.0	23.4
60-69	40	21.3	22.8	24.2		111	20.8	22.0	23.7
70+	41	21.0	22.4	24.2		28	19.7	21.2	22.5
All	93	21.3	22.7	24.2		190	20.7	21.8	23.3
AMA									
55-59	12	37.6	44.2	49.2		51	34.1	38.5	43.6
60-69	40	36.1	41.4	46.8		111	34.5	38.6	44.6
70+	41	35.0	39.7	46.5		28	30.7	35.8	40.2
All	93	36.2	41.0	46.7		190	34.1	37.8	43.2
CAMA									
55-59	12	27.6	34.2	39.2		51	27.6	32.0	37.1
60-69	40	26.1	31.4	36.8		111	28.0	32.1	38.1
70+	41	25.0	29.7	36.5		28	24.2	29.3	33.7
All	93	26.1	31.0	36.7		190	27.6	31.3	36.7

APPENDIX 11: AGE AND GENDER-SPECIFIC PERCENTILE DISTRIBUTION OF SOME DERIVED MEASUREMENTS (continued)

Measurement		*Males*				*Females*			
		Percentiles				*Percentiles*			
		Cases	*25*	*50*	*75*	*Cases*	*25*	*50*	*75*
MUAFA									
	55-59	12	7.2	9.3	10.1	51	10.7	13.8	19.6
	60-69	40	6.3	7.4	9.4	111	9.6	13.4	21.0
	70+	41	5.9	7.7	10.0	28	7.4	11.9	19.1
	All	93	6.3	7.7	9.9	190	9.7	13.6	20.0
AFI	55-59	12	13.8	15.5	18.1	51	22.0	26.5	33.1
	60-69	40	13.4	15.1	17.4	111	19.8	26.1	33.3
	70+	41	12.9	16.0	19.3	28	18.5	25.0	34.7
	All	93	13.4	15.8	18.7	190	20.5	26.0	33.1

APPENDIX 12: MEANS (SD) FOR OTHER DERIVED MEASUREMENTS BY AGE GROUP AND SEX

Measurement	*Age group*	*Males* *n*	*Mean (sd)*	*Test for significance*	*Females* *n*	*Mean (sd)*	*Test for significance*
AMC	**55-59**	12	23.7 (2.6)		51	21.8 (2.0)	
(cm)	**60-69**	40	22.7 (2.0)	f=1.37,	111	22.1 (2.1)	f=2.09,
	70+	41	22.6 (2.0)	p=0.26	28	21.2 (1.9)	p=0.13
AMA	**55-59**	12	45.0 (10.4)		51	38.2 (6.9)	
(cm^2)	**60-69**	40	41.2 (7.0)	f=1.53,	111	39.3 (7.5)	f=2.17,
	70+	41	40.8 (7.2)	p=0.22	28	36.1 (6.7)	p=0.12
MUAFA	**55-59**	12	9.1 (3.5)		51	15.2 (6.4)	
(cm^2)	**60-69**	40	8.4 (3.8)	f=0.30,	111	16.1 (8.9)	f=0.76,
	70+	41	9.1 (5.7)	p=0.74	28	14.0 (7.9)	p=0.47

APPENDIX 13: MEANS FOR ANTHROPOMETRY DATA BY MARITAL STATUS AND SEX

Measurement	*Sex*	*Married*		*Separated/divorced*		*Widowed*		*Test for*
		n	*Mean (sd)*	*n*	*Mean (sd)*	*n*	*Mean (sd)*	*significance*
Weight	**males**	77	54.4(7.3)	5	52.9 (5.6)	11	52.7(7.9)	f=0.35, p=0.71
	females	78	50.4(7.7)	22	46.8 (6.5)	90	48.4 (8.)	f=2.40, p=0.09
Height	**males**	76	165.8 (6.1)	5	169.6 (4.7)	11	163.1 (4.2)	f=2.16, p=0.12
	females	78	156.2 (4.9)	22	155.1 (5.7)	88	154.4 (5.5)	f=2.36, p=0.10
Armspan	**males**	70	177.8 (6.6)	5	175.6 (5.6)	11	176.1 (5.3)	f=0.55, p=0.58
	females	77	166.0 (6.7)	22	164.5 (5.8)	86	163.6 (7.0)	f=2.42, p=0.09
Demispan	**males**	70	80.1 (3.1)	5	79.4 (1.2)	11	80.0 (2.2)	f=0.14, p=0.87
	females	77	74.5 (3.0)	22	73.8 (2.8)	86	73.5 (3.3)	f=2.34, p=0.10
MUAC	**males**	77	25.0 (2.3)	5	25.2 (2.4)	11	24.9 (3.0)	f=0.03, p=0.97
	females	76	26.5 (2.9)	22	24.9 (3.2)	90	25.6 (3.3)	f=2.93 p=0.06
Triceps	**males**	77	7.4 (3.6)	5	6.0 (1.6)	11	7.1 (2.9)	*f=0.37, p=0.69
	females	78	13.2 (5.1)	22	11.2 (5.2)	90	12.5 (6.2)	*f=1.67, p=0.19
BMI	**males**	76	19.8 (2.5)	5	18.4 (2.3)	11	19.8 (2.5)	f=0.73, p=0.48
	females	78	20.6 (2.9)	22	19.4 (2.5)	88	20.2 (3.2)	f=1.49, p=0.22
Demiquet	**males**	70	85.0-	5-	83.6	11	82.2 (9.6)-	f=0.29, p=0.75-
Mindex	**females**	77	67.3	22	63.4 (8.3)	86	65.6 (10.7)	f=1.90, p=0.15
AMC	**males**	77	22.7 (2.0)	5	23.3 (2.0)	11	22.6 (2.9)	f=0.19, p=0.83
	females	78	22.3 (2.0)	22	21.3 (2.2)	90	21.7 (2.1)	f=12.4, p=0.06
AMA	**males**	77	41.4 (7.1)	5	43.4 (7.4)	11	41.4 (11.2)	f=0.16, p=0.85
	females	78	39.9 (7.2)	22	36.6 (7.8)	90	37.7 (7.1)	f=2.84, p=0.06
CAMA	**males**	77	31.4 (7.1)	5	33.4 (7.4)	11	31.4 (11.2)	f=0.16, p=0.85
	females	78	33.4 (7.2)	22	30.1 (7.8)	90	31.2 (7.1)	f=2.84, p=0.06
MUAFA	**males**	77	8.9 (4.9)	5	7.4 (2.4)	11	8.5 (3.4)	*f=0.24, p=0.79
	females	78	16.5 (7.4)	22	13.3 (7.4)	90	15.2 (8.8)	*f=2.17, p=0.12
AFI	**males**	77	17.3 (6.4)	5	14.4 (2.7)	11	17.0 (5.7)	*f=0.53, p=0.60
	females	78	28.2 (8.2)	22	25.4 (8.3)	90	27.1 (9.6)	*f=1.05, p=0.35

Tests for significance: f = Analysis of variance for differences in means according to marital status and sex, * Analysis of variance done on transformed data Medians for the measurements by marital status 2 = Married, 3 = Separated/divorced, 4 = Widowed

Measurement	**Males**			**Females**		
	2	3	4	2	3	4
Triceps	6.3	6.0	5.9	12.1	10.1	11.3
MUAFA	7.7	7.5	7.0	14.3	11.5	13.5
AFI	15.8	13.3	15.9	28.7	24.5	25.6

APPENDIX 14: MEANS FOR ANTHROPOMETRY DATA BY MARITAL STATUS (MARRIED VS THOSE WITHOUT A SPOUSE) AND SEX

Measurement	*Sex*	*Married*		*Without a spouse*		*Test for significance*
		n	*Mean (sd)*	*n*	*Mean (sd)*	
Weight	**males**	77	54.4 (7.3)	16	52.8 (7.1)	t=0.84, df=91, p=0.40
	females	78	50.4 (7.7)	112	48.0 (8.1)	t=2.02, df=188, **p=0.04**
Height	**males**	76	165.8 (6.1)	16	165.2 (5.2)	t=0.39, df=90, p=0.69
	females	78	156.2 (4.9)	110	154.6 (5.5)	t=2.08, df=186, **p=0.04**
Armspan	**males**	70	177.8 (6.6)	16	175.9 (5.2)	t=1.05, df=84, p=0.30
	females	77	166.0 (6.7)	108	163.9 (6.7)	t=2.16, df=183, **p=0.03**
Demispan	**males**	70	80.1 (3.1)	16	79.8 (1.9)	t=0.41, df=84, p=0.68
	females	77	74.5 (3.0)	108	73.6 (3.2)	t=2.14, df=183, **p=0.03**
MUAC	**males**	77	25.0 (2.4)	16	25.0 (2.7)	t=0.10, df=91, p=0.92
	females	78	26.5 (2.9)	112	25.4 (3.3)	t=2.21, df=188, **p=0.03**
Triceps*	**males**	77	6.8 (1.5)	16	6.5 (1.3)	t=0.51, df=91, p=0.61
	females	78	12.2 (1.5)	112	10.9 (1.6)	t=1.66, df=188, p=0.10
BMI	**males**	76	19.8 (2.5)	16	19.4 (2.5)	t=0.71, df=90, p=0.48
	females	78	20.6 (2.9)	110	20.1 (3.1)	t=1.32, df=186, p=0.19
Demiquet	**males**	70	85.0 (11.9)	16	82.6 (8.7)	t=0.73, df=84, p=0.47
Mindex	**females**	77	67.7 (9.6)	108	65.2 (10.3)	t=1.68, df=183, p=0.10
AMC	**males**	77	22.7(2.0)	16	22.8 (2.7)	t=-0.20, df=91, p=0.84
	females	78	22.3 (2.0)	112	21.6 (2.1)	t=2.31, df=188, **p=0.02**
AMA	**males**	77	41.4 (7.1)	16	42.0 (9.9)	t=-0.29, df=91, p=0.77
	females	78	39.9 (7.2)	112	37.5 (7.2)	t=2.30, df=188, **p=0.02**
CAMA	**males**	77	31.4 (7.1)	16	32.0 (10.0)	t=-0.29, df=91, p=0.77
	females	78	33.4 (7.2)	112	31.0 (7.2)	t=2.30, df=188, **p=0.02**
MUAFA*	**males**	77	8.1 (1.5)	16	7.7 (1.4)	t=0.47, df=91, p=0.64
	females	78	14.8 (1.6)	112	12.8 (1.7)	t=1.91, df=188, p=0.06
AFI*	**males**	77	16.4 (1.4)	16	15.7 (1.3)	t=0.53, df=91, p=0.60
	females	78	26.9 (1.4)	112	25.3 (1.4)	t=1.32, df=188, p=0.19

***Transformed data presented**

APPENDIX 15: REASONS FOR BEING UNABLE TO CARRY OUT ACTIVITIES OF DAILY LIVING BY NUMBER OF RESPONDENTS

Reason	*Activities of daily living*					
	Bathing	*Continence*	*Dressing*	*Toileting*	*Transfer*	*Walk*
Joint and muscular problems	4	1	4	2	8	44
Backache	1	1	1	2	1	4
Respiratory problems	1	-	1	1	1	1
Malaria	3	-	-	1	3	-
General body pains	1	-	1	1	2	4
High blood pressure	-	-	-	-	-	1
Diabetes	-	-	-	-	-	1
Heart problems	-	-	-	-	1	-
Eye problems	-	-	-	-	2	5
Blind	-	-	-	1	-	-
Lack of energy	-	-	-	-	1	10
Old age	2	1	-	1	1	4
More than one reason	2	1	2	2	3	1

APPENDIX 16: INSTRUMENTAL ACTIVITIES OF DAILY LIVING

Activity	*Males n = 78*	*Females n = 190*
Building houses etc.	18 (19.1)	0
Crafts	40 (42.6)	0
Farming	22 (23.4)	35 (18.4)
Fetching firewood	1 (1.1)	28 (14.7)
Smearing the floor of houses	0	85 (44.7)
Cooking	3 (3.2)	155 (81.6)
Doing laundry	1 (1.3)	55 (28.9)
Pounding maize	0	74 (38.9)
Sweeping the house or outside home	14 (14.9)	136 (71.6)
Fetching water	0	83 (43.7)
Other activities	29 (30.9)	26 (13.7)

Crafts included making baskets, mats etc.

Other activities included cutting grass, shelling maize, fetching relish, going to a maize mill, clearing around the house

APPENDIX 17: AGE AND GENDER-SPECIFIC PERCENTILE DISTRIBUTION OF SOME FUNCTIONAL TESTS

Measurement	***Males***					***Females***			
	Percentiles					***Percentiles***			
	Cases	***25***	***50***	***75***		***Cases***	***25***	***50***	***75***
Hand grip strength									
55-59	12	27.5	29.9	37.2		51	20.3	22.7	25.4
60-69	40	24.7	29.4	33.1		111	18.4	22.3	25.2
70+	42	22.8	26.4	29.9		28	17.0	20.0	21.5
All	94	24.7	28.1	32.1		190	18.9	21.9	24.8
Key time (manual dexterity)									
55-59	12	2.6	3.4	4.4		51	5.0	9.5	12.3
60-69	40	3.8	5.5	7.8		111	5.6	9.6	15.6
70+	42	4.6	5.9	11.1		28	6.3	13.0	17.9
All	94	3.6	5.5	8.8		190	5.6	9.9	14 9
Plate tapping time (psychomotor)									
55-59	12	14.4	16.5	18.2		49	16.2	18.1	20.2
60-69	38	15.5	17.3	19.0		107	16.8	19.6	21.3
70+	38	17.5	19.9	23.3		23	17.0	20.8	23.7
All	88	15.6	18.0	20.7		179	16.6	19.2	21.0
Objects									
55-59	12	6.3	7	7		51	6	7	8
60-69	40	5	7	8		111	6	6	8
70+	41	4	6	7		27	5	6	7
All	93	5	7	7		189	6	7	8

APPENDIX 18: THE CODING SYSTEM OF THE VARIABLES IN THE HIERARCHICAL MODELS FOR BOTH NUTRITIONAL STATUS AND FUNCTIONAL ABILITY

Variable description	*Code 0*	*Code 1*
Age (continuous variable)		
Socio-economic history		
Marital status	Married	Separated/divorced / Widowed
Educational status	At least primary education	None
Risk factors for poor health		
A history of smoking	No	Yes
Current smoking status	No	Yes
A history of alcohol consumption	No	Yes
Present alcohol status	No	Yes
Access to health services	Hospital/clinic	Traditional healer, groceries, self (traditional), no treatment
Chronic illness		
Illnesses in the previous 12 months - malaria, painful legs, coughing, backache, stiff joint, chest pain, heart problems, joint pain, stomachache, headache, other diseases	No	Yes
A history of anaemia, tuberculosis, diabetes, high blood pressure, heart attack, broken hip, arthritis	No	Yes
Disability	No	Yes
Present socio-economic status		
Source of income	More than one source of income	One or no source of income
Present occupational status	At least one occupation	None
Poor physical and mental health		
Illness in the previous 2 weeks	no	yes
Dentition	Have all the teeth	All or some teeth missing
Chewing problems	no	Yes, always & yes sometimes, adapted diet to exclude hard foods
Swallowing problems	No	Yes
General health	Good health	Minor health problems & Ill health
Self reported health	Good	Somewhat reduced or poor
Current use of drugs	No	Yes

APPENDIX 18: THE CODING SYSTEM OF THE VARIABLES IN THE HIERARCHICAL MODELS FOR BOTH NUTRITIONAL STATUS AND FUNCTIONAL ABILITY (continued)

Variable description	*Code 0*	*Code 1*
Poor physical and mental health		
Impaired sight	No	Yes, somewhat reduced, much reduced regard self as blind
Impaired hearing	No	Yes, has some difficulties, has great difficulties & deaf
Diastolic blood pressure (continuous variable)		
Memory problems	No	Yes
Number of objects recalled (continuous variable)		
Social network		
Ability to visit relatives or friends	Able to visit	Unable to visit
Whether they were visited by relatives or other people	Yes	No
Frequency of meeting friends outside their homes	Very often, every few days	Less than once a week & Very rarely, occasionally, never
Attendance of religious meetings	At least once in a while	Never
Whether they received any assistance	Assisted in one or more aspects	Not assisted at all
With whom they shared meals	With other people	Alone
Whether they had a confidant or not	Yes	No
Functional ability		
Ability to perform ADLs	ADLscore, addition of all ADL codes and treated as a continuous variable (1 to 6)	
Handgrip strength, key time (manual dexterity), plate tapping time (psychomotor function) [continuous variables]		
Activity level		
Ability to perform IADLs	able to perform at least one of the activities and having an occupation	Unable to perform any activity and having no occupation

APPENDIX 18: THE CODING SYSTEM OF THE VARIABLES IN THE HIERARCHICAL MODELS FOR BOTH NUTRITIONAL STATUS AND FUNCTIONAL ABILITY (continued)

Variable description	*Code 0*	*Code 1*
Activity level		
Mobility	Yes, easily, frequently, can use a stick (fully mobile)	No & Yes but with difficulty/ slowly/with helper/only infrequently
Social problems		
Poor life satisfaction	Satisfied & very satisfied	Very dissatisfied & dissatisfied
Having the following life concerns Preparation for death and spiritual life Health and diet Disability and increasing dependence Money and property Other family members Any other specify	No	Yes
Relationship with relatives	Good	Bad & Good to some extent (a little)
Living alone	No	Yes
Stressful events		
Having lost a spouse or a sibling in the previous 12 months	No	Yes
Having lost a child/grandchild in the previous 12 months	No	Yes
Having no help when ill	No	Yes
Depressed	No	Yes
Cared for	Yes & to some extent	No
Young generation's attitude towards the elderly	Respect and help	No respect
Food intake and availability		
Whether they received any food	Yes	No
Number of meals in the post-harvest period	Three times a day and above	Once or twice a day
Number of meals in the pre-harvest period	more than once a day	Once a day
Nutritional status (continuous variables e.g. body mass index)		

Appendix 19: A comparison between normal (BMI ≥ 18.5 kg/m^2) and undernourished respondents (BMI < 18.5 kg/m^2) in various variables (% with characteristic)

Variables	*Males*		*Females*		*Total*	
	0	*1*	*0*	*1*	*0*	*1*
Functional ability						
Impaired handgrip strength	18.0	32.3	18.4	38.5**	18.3	36.1**
Slow key time	26.2	22.6	22.8	30.8	23.9	27.7
Slow plate tapping time	23.0	29.0	24.3	34.6	23.9	32.5
Poor ADL score	13.1	19.4	7.4	5.8	9.1	10.8
IADL problems	8.2	6.5	5.9	9.6	6.6	8.4
Poor cognitive function	47.5	61.3	85.3	90.4	73.6	79.5
Remembering fewer objects	19.7	19.4	16.9	26.9	17.8	24.1
General health						
Stiff joint	34.4	64.5**	57.4	57.7	50.3	60.2
A history of anaemia	6.0	0	3.7	17.3	4.6	10.8*
Coughs	68.9	74.2	79.4	86.5	76.1	81.9
Malaria	63.9	64.5	79.4	84.6	74.6	77.1
History of smoking tobacco	54.1	87.1***	39.7	48.1	44.2	62.7
Present smoking habit	52.5	71.0	46.3	63.5	48.*2	66.3**
Past alcohol consumption	50.8	61.3	33.8	42.3	39.1	49.4
Current alcohol consumption	50.8	61.3	38.2	48.1	42.1	53.0
Chewing problems	50.8	64.5	56.6	61.5	54.8	62.7
Teeth missing	90.2	96.8	90.4	90.4	90.4	92.8
Self reported health	67.2	83.9	77.9	80.8	74.6	81.9
Stressful events						
Loss of a spouse/sibling	49.2	45.2	32.4	51.8**	37.6	49.4
Having lost a close relative	75.4	67.7	75.7	88.5	75.6	80.7
Socio-economic status						
Having one or no source of income	77.0	87.1	75.0	88.5*	75.6	88.0*
Having no present occupation	8.2	6.5	5.9	9.6	6.6	8.4
No education	32.8	38.7	57.4	61.5	49.7	53.0
Having no spouse	13.1	25.8	55.1	67.3	42.1	51.8

0 Normal

1 Undernourished

* P<0.05, ** P<0.01,*** P<0.001

Appendix 19: A comparison between normal (BMI ≥ 18.5 kg/m^2) and undernourished respondents (BMI < 18.5 kg/m^2) in various variables (% with characteristic) (continued)

Variables	*Males*		*Females*		*Total*	
	0	*1*	*0*	*1*	*0*	*1*
Social network/isolation						
Lack of family care	8.2	6.5	25.7	42.3*	20.3	28.9
Living alone	3.3	6.5	9.6	15.4	7.6	12.0
Not meeting friends outside the home	11.5	12.9	17.6	21.2	15.7	18.1
Fear of dependence and disability	13.0	29.0	13.2	15.4	13.2	20.5
Fear of health and diet problems	34.4	29.0	36.8	42.3	36.0	37.3
Food availability						
Having one meal in the pre-harvest period	24.6	25.8	37.5	60.8**	33.5	47.6*

* P<0.05, ** P<0.01,*** P<0.001

0 Normal

1 Undernourished