The Nutritional Status of Adult Patients in Patan Hospital, Nepal

by

Jane Keylock

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Glasgow Caledonian University

Table of Contents

List of Tables iii

List of Figures iv

List of Appendices v

Acknowledgements 1

Abstract 2

Chapter 1 Introduction 4
1.1 Introduction to Nepal 4
1.2 Introduction to United Mission to Nepal 6
1.3 Purpose of study 8
1.4 Background to nutritional status and anthropometric measurements 9

Chapter 2 Literature Review 12
2.1 Implications of malnutrition 12
2.2 Treating malnutrition 13
2.3 Incidence of hospital malnutrition 14
2.4 Assessing for malnutrition and the use of anthropometric measurements 15
2.5 Using anthropometric measurements in developing countries 19
2.6 The nutritional situation in Nepal 20

Chapter 3 Focus of the Study 22
3.1 Project aims 22
3.2 Project objectives 22
3.3 Research questions 23

Chapter 4 Methodology 25
4.1 Study design 25
4.2 Weight and height 26
4.3 Triceps skinfold thickness 27
4.4 Mid-upper arm circumference 29
4.5 Criteria for individuals categorised as malnourished 31
4.6 Waist-hip ratio and waist circumference 32
4.7 Correlation between particular sub-groups and incidence of malnutrition 33
4.8 Nutritional status and hospital stay 34
4.9 Ethical permission and data analysis 34

Chapter 5 Results 36
5.1 The sample 36
5.2 The nutritional status of various sub-groups 41
5.2.1 Nutritional status and gender 41
5.2.2 Nutritional status and specialty 42
5.2.3 Nutritional status and age 43
5.2.4 Nutritional status and level of income 44
5.3 The effect of hospital stay on nutritional status 45
5.4 The effect of hospital stay in different sub-groups 48
5.5 The number of patients at risk from cardiovascular disease 49

Chapter 6 Evaluation 50
6.1 Discussion 50
6.2 Limitations 59
6.3 Conclusion 61

Implications for Patan Hospital 62

References 63

Appendix 68

Tables

Table 4.1 Male reference values for triceps skinfold thickness 28

Table 4.2 Female reference values for triceps skinfold thickness 29

Table 4.3 Male reference values for mid-arm muscle circumference 30

Table 4.4 Female reference values for mid-arm muscle circumference 31

Table 4.5 Criteria and categorisation of malnutrition 32

Table 5.6 The nutritional status pf the patients 40

Table 5.7 The nutritional status of males and females 41

Table 5.8 The nutritional status of medical, surgical and gynaecology patients 42

Table 5.9 The nutritional status of private patients 42

Table 5.10 The nutritional status of patients aged 18-30, 31-45, 46-60, 61-75 and 76+ 43

Table 5.11 The nutritional status of patients who received charity and those who did not 44

Table 5.12 The mean percentage weight loss of all the patients and those in each category of nutritional status 45

Table 5.13 The mean actual weight loss of all the patients and those in each category of nutritional status 46

Table 5.14 Patients who changed category of nutritional status while in hospital 47

Table 5.15 The significance as determined by ANOVA tests of weight change between members of different sub-groups 48

List of Figures

Figure 1.1 Political Map of Asia 4

Figure 1.2 Gross Domestic Product of various nations 5

Figure 1.3 Map of Nepal 7

Figure 4.4 The cut-offs for men and women for becoming alert to the risk of cardiovascular disease and for taking action 33

Figure 5.5 The proportion of patients in each specialty 36

Figure 5.6 The number of patients in each age group 37

Figure 5.7 Correlation between BMI and triceps skinfold thickness 38

Figure 5.8 Correlation between BMI and MAMC 38

Figure 5.9 The number of malnourished, healthy and overweight patients 39

Figure 5.10 Normal Q-Q plot of weight change 47

Figure 5.11 The number of patients in each zone denoting risk of cardiovascular disease 49

List of Appendices

Appendix 1. Preparation of 'Paustik Sanjiwani' 68

Appendix 2. Consent Form 69

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Abstract

Recently a nutritional supplement was introduced at Patan Hospital. To highlight the need for such a supplement and promote it's use, the prevalence of nutritional depletion among patients on admission to hospital was measured. Furthermore, any changes in nutritional status during hospital stay were investigated and assessment was made as to whether any particular groups of patients are at risk from malnutrition.

Two hundred and fourteen male and female patients aged over 18 years were measured on admission to Patan Hospital, Nepal during 16th July and 8th September 2001. A number of anthropometric measurements were taken on those patients who fulfilled the criteria to determine Body Mass Index, triceps skinfold thickness, mid-upper arm muscle circumference, waist circumference and waist-hip ratio. Patients were asked about recent weight loss. BMI and the arm measurements were used to assess each individual's nutritional status and determine the incidence of malnutrition among newly admitted patients. These measurements were repeated on patients whose hospital stay was longer than seven days to investigate if hospital stay has an adverse affect on nutritional status. Analysis was performed to determine whether any particular groups are at particular risk from malnutrition. The waist and hip measurements were used to predict those patients who were at risk from cardiovascular disease.

Fifty three per cent of the patients who were admitted to Patan Hospital were malnourished (BMI less than 18.5 kg/m² and triceps skinfold thickness or mid arm muscle circumference less than the 10th centile) although the mean BMI was 19.4 kg/m². The nutritional status of medical and surgical patients was poorer than gynaecology patients ($p = 0.010$ and $p = 0.033$ respectively). Older patients were significantly more malnourished than younger patients

(between 18-30 age group and 61-75 age group $p = 0.007$, and between 31-47 age group and 61-75 age group $p = 0.0034$). The mean percentage weight change was a loss of 2.53% of their body weight on admission, although in absolute terms this is only 1.16kg. The severely malnourished group seemed to lose most weight (5.2%) although this wasn't significant.

Only 17.1% of the patients whose waist and hip measurement were taken had a waist circumference indicative of a risk of cardiovascular disease. 4.3% of men had a waist-hip ratio which predicted a risk of cardiovascular disease although the result for women reflects the inaccuracies of using such parameters in different ethnic groups.

The results highlight the need for nutritional support in Patan Hospital. The importance of poor nutritional status on hospital outcome needs to be stressed among medical staff so that the detection, treatment and monitoring of undernourished patients becomes routine.

Chapter 1. Introduction

1.1 Introduction to Nepal

Nepal is an independent kingdom covering 140,800 (Nepal District Profile 1999) km² on the southern slopes of the Himalayan mountains (Lonely Planet 2001). It is bounded on the north by China (Tibet), on the south and west by Utar Pradesh and Bihar states, India and on the east by Sikkam state and West Benegal, India (Figure 1).

Figure 1.1. Political Map of Asia (Philip's Modern School Atlas 1988)

Throughout it's history, Nepal has experienced conflict not only from neighbouring countries but from internal sources as well. As the current political situation continues to be unstable, Nepal faces many ongoing problems.

With a current population of 23.2 million (Nepal Census on Population and Housing 2001), Nepal is believed to be one of the least developed nations in the world, with forestry and subsistence farming occupying ninety per cent of the population. The country is vulnerable to calamity caused by climatic extremes: drought in 1992, followed by torrential rains in 1993 caused floods in which bridges were destroyed and 1,600 people died (The Times 1994). If a comparison is drawn between the Gross Domestic Product (GDP) of various nations, the economic hardship that Nepal faces can be illustrated (Human Development Report 1998):

Figure 1.2. Gross Domestic Product of various nations

Country	GDP
U.S.A.	$9 trillion ($25,850 per head)
England	$1254 billion ($21,200 per head)
South Africa	$146 billion ($3,395 per head)
India	$1.7 trillion ($1,720 per head)
Nepal	$26.2 billion ($1100 per head)

Alongside the poor economic situation are the poor health and nutrition situations. In the general population the nutrition and health of adults is of particular importance since it is this age group that is primarily responsible for the economic support of the rest of society. In non-industrialised societies, physical capacity and endurance are critical to the ability of adults to sustain the socio-economic and cultural integrity of their community (World Health Organization 1995). Any depletion in muscle mass may compromise an individual's physical capabilities.

It is estimated that forty nine per cent of the population is living in poverty and the life expectancy of the Nepali population is 57 years (Human Development Report 1998). Nineteen per cent of Nepali women show evidence of chronic energy deficiency while thirty one per cent of girls aged 10 to 14 years of age and fifteen per cent of girls aged 15 to 18 years of age have a Body Mass Index (BMI) below the 5th percentile (Family Health Survey 1996). Seventy one per cent of pregnant women, eighty two per cent of lactating mothers and fifty eight per cent of infants are reported as displaying anaemia (Nepal Nutrition Intervention Project – Sarlahi 1997) while the National Prevalence Survey (1986) estimated that the total goitre rate was forty per cent. The Nepal Multiple Indicators Surveillance Survey (1997) suggested that eighteen per cent of children under 5 years of age have diarrhoea while the Family Health Survey (1996) indicates that thirty four per cent of children show symptoms of acute respiratory infection.

1.2 Introduction to United Mission to Nepal

The extreme poverty exacerbated by natural disaster and political disruption, has led many aid agencies and non-governmental organisations to attempt to improve the standard of living of the Nepali people. One such organisation is the United Mission to Nepal (UMN). Set up by eight mission organisations in 1954, the UMN has grown to include 51 member bodies and affiliated member bodies from 17 countries. The UMN objective is "to serve the people of Nepal, especially the marginalised in underserved areas, to enable individuals and communities to secure their basic needs in a sustainable manner through participation in effective and self-reliant Nepali organisations" (UMN 2000). The main areas of work are education, engineering and industrial development, health services and rural development.

One particular focus of the UMN Health Service is the Nutrition Programme which aims to serve and support nutrition-related activities at national, district, community and household level, giving special emphasis to women of reproductive age and growing children. The Programme promotes behavioural change at all levels of the community using culturally acceptable and evidence-based approaches that build on local capacity.

The work of the UMN Health Service incorporates Patan Hospital, Patan which provides primary and secondary health care services to Lalitpur District (a region south of Kathmandu) and Kathmandu valley area (Figure 2) but also receives patients from all over the country.

Figure 1.3. Map of Nepal (Nepal Home Page 2001)

The hospital has two hundred and eighty nine beds and a busy outpatient department that cares for over two hundred thousand patients a year. In response to the changing needs it is gradually becoming more specialised and has added an intensive care unit, orthopaedic

services, and a private ward in the past two years. The private ward was planned to provide increased income which would be channelled in to support patients who are dependent on charity, and to ensure that the hospital can continue to serve the whole community.

1.3 Purpose of the study

With the ongoing development and expansion of Patan Hospital, the expatriate nutritionist, working for UMN, grew increasingly concerned over the nutritional status of the patients. Coupled with the seemingly poor nutritional status in the general population is the fact that as healthcare as paid for by the patients, many indivduals wait until their condition is very serious before seeking medical help. Concern was particularly expressed in view of the limited available options for nutritional support and the distinct lack of manufactured nutritional supplement products. This led the nutritionist to formulate a supplement drink based on 150kcals (628kJ) and 6g protein per 100ml, with one hundred per cent adult recommended daily allowance (RDA) for micronutrients in 1000ml to ensure that those patients in most need could receive some nutritional support (see Appendix 1). However, with evidence based practice being widely advocated, it seemed necessary to quantify the incidence of malnutrition in patients admitted to Patan Hospital and assess any changes in their nutritional status during hospital stay. The results could provide evidence for the development and promotion of nutrition in hospital while raising awareness among doctors and nursing staff leading to greater use of the nutritional supplement.

1.4 Background to nutritional status and anthropometric measurements

Malnutrition is the condition caused by an imbalance between what an individual requires to maintain health and what the body receives through the diet. The imbalance can be an excess of nutrients, leading to obesity, or a deficit, leading to undernourishment, starvation or dehydration. Malnutrition in patients can have an adverse effect on disease outcome. The patients who are malnourished on admission may be so for a variety of reasons. It may be a result of the complaint with which they are admitted, or have been pre-existing due to socio-economic factors such as poverty and sacrificing their own health for the sake of their children. During hospital stay, a change in nutritional state can occur for similar reasons as in the developed world such as nausea, apathy, lack of appetite, difficulty in chewing or swallowing and depression or merely catabolic loss.

Nutritional status can be determined by measuring body composition using anthropometric methods. Anthropometry is defined as " the measurement of the human body with a view to determine its average dimensions at different ages and in different classes or races" (Oxford English Dictionary, 1980). The amount of muscle mass and fat mass alter according to the level of nourishment of an individual. When weight is lost both adipose tissue and muscle are used for fuel. During illness the loss of protein-rich tissue is of particular importance as these tissues are responsible for control and maintenance of organ metabolism which is the determining factor for survival if the individual is of low body weight. Moreover, muscle mass is a more reliable indicator of malnutrition than fat mass, as fat is more readily expendable that fat-free mass and correlates poorly with physiological function, hospital morbidity, or mortality (WHO 1995). The triceps skinfold thickness gives an indication of

the energy reserve stored in the form of fat, and the arm muscle size reflects the reserve of muscle protein.

Body fat content can be assessed via the Body Mass Index (BMI), waist/hip ratio, waist circumference and triceps skinfold thickness (TSF) (Baxter 1999, WHO 1997). The BMI is derived from weight and height measurements and although it is not a direct measure of body fat, it is the index that best correlates with body fat as measured by body density (WHO 1995). If the height cannot be measured conventionally, for example if the patient is too weak to stand, the demi-span which is measured from the edge of the right collar bone to the base of the fingers on the left hand, can be used to predict skeletal size (Bassey 1986). As BMI is a weight for height index it cannot distinguish whether an overweight measurement is due to a large muscle or fat mass. Similarly, a low BMI will not be able to reflect the proportion of lost mass in terms of muscle or fat. A single measurement of BMI is of limited use for assessing the individual's risk of ill-health or likely benefit from medical intervention or supplementary feeding. A better predictor of individual risk is the degree of unintentional weight loss of an adult.

An individual's muscle mass, and hence their main protein reserve, is assessed by measuring the mid-upper arm muscle circumference (MAMC) which can be calculated from the circumference of the upper arm and the triceps skinfold thickness and compared to reference standards based on population groups (Bishop 1981 and Burr 1984). The equation used assumes the arm to be cylindrical and subtracts the skinfold from the mid-arm circumference (MAC). Measuring the thickness of the skinfold gives an indication of the amount of subcutaneous fat which is assumed to have a constant relationship to total body fat and hence is an indicator of how well-nourished a person is. It has been observed that the distribution of

fat, rather than the total quantity of fat might be more significant factor in overall health risk. This is only pertinent when dealing with overweight individuals rather than underweight. Greater health risk appears to be associated when fat is stored in the central abdominal area therefore the ratio between waist and hip circumference is a predictor of the individual's risk from chronic diseases associated with obesity. More recently, waist circumference alone has been perceived to be a more reliable predictor of body fat (Lean 1996).

2.1 Implications of malnutrition

It is now widely recognised that sub-optimal nutritional status impairs tissue function and wound healing, leads to immunosuppression thus increasing the risk of infection, and causes defective muscle function with reduced respiratory and cardiac reserve (Keys *et al* 1950, Jeejeebhoy 1988, Chandra 1997, Gottdiener *et al* 1978, Himes 1999, Heymsfield *et al* 1978, Heys *et al* 1995, Arorra & Rochester 1982,). In addition to the effect on physical function, malnourished individuals are withdrawn and apathetic and have reduced mental capabilities (Brozek 1990, Unosson *et al* 1994). These consequences of malnutrition can have an adverse effect on the outcome of hospitalised patients (Giner *et al* 1996, Windsor *et al* 1988).

Hirsch *et al* (1992) found a higher mortality among postoperative patients classified as malnourished at a hospital in Chile. It has been suggested that this relationship between nutritional status and mortality is U-shaped, with increased death rates among both the leanest and the heaviest persons (Landi *et al* 2000). A significantly higher number of complications have been seen in malnourished patients than in well-nourished patients (Naber *et al* 1997, Giner *et al* 1996) and according to Reilly *et al* (1988), patients who were perceived as having a likelihood of malnutrition were 2.6 times as likely to have a predefined minor complication or 3.4 times as likely to have a predefined major complication. Obviously, this impacts on the length of hospital stay. Indeed, Braunschweig *et al* (2000) found that declines in nutritional status during hospitalisation were associated with higher hospital charges, longer length of stay and greater risk of complication. Participants who were admitted as nutritionally compromised and improved had lower hospital charges and

fewer complications than patients who continued to decline nutritionally. This agrees with the findings of Tucker and Miguel (1996), Chima *et al* (1997) and Robinson *et al* (1987). In the study of Reilly *et al* (1988) the likelihood of malnutrition status increased excess costs and charges per patient by $1738 and $3557 respectively and overall it has been suggested that adequate nutritional support would save the average American Hospital one million dollars per year (Allison *et al* 1999). In the UK it has been estimated that prolonged hospital stay costs the National Health Service £266 million pounds (Lennard-Jones 1992).

2.2 Treating malnutrition

The outcomes are only improved when appropriate nutrition intervention is administered as demonstrated when dietary supplementation in elderly patients, with a fractured neck of femur, significantly improved clinical outcome (Delmi *et al* 1990). The fortification of normal food served to elderly patients significantly increased their energy intake and body weights (Odlund Olin *et al* 1996). The use of nutritional supplements and enteral feeds has been shown to improve nutritional status in patients in hospital with a significant reduction in mortality in undernourished elderly patients (Potter *et al* 1998). Many options are available ranging from a specially planned diet of traditional foods to total parenteral nutrition, with choices in between such as nutrition counselling, oral supplementation, total or supplemental enteral nutrition support via nasogastric or ostomy tube feeding and parenteral feeding (Gallagher-Alfred *et al* 1996). Despite the ability, since the late 1960s, to provide adequate nutrition to all hospitalised patients (Braunschweig *et al* 2000) malnutrition is still common.

2.3 Incidence of hospital malnutrition

The incidence of malnutrition in hospitals was identified more than twenty years ago (Butterworth 1974, Hill *et al* 1977, Bistrian *et al* 1976) and seemed to be a problem that was not only confined to the UK healthcare system. Twenty three per cent of patients electively admitted for surgery at the University Hospital in Rome were found to have moderate to severe protein-calorie malnutrition (Mobarhan *et al 1987).* Moreover, the nutritional status of these patients had not improved at discharge indicating an inadequate level of nutritional support during their stay. Subsequent studies showed a lack of response to these findings; the study of McWhirter and Pennington (1994) in particular provoked major concern amongst healthcare professionals. They found forty per cent of patients to be undernourished on admission to hospital and two-thirds of all patients to lose weight during hospital stay. Clearly, patients admitted to hospital may already be malnourished or at risk of developing malnutrition as a result of their illness. The incidence of malnutrition was not confined to the surgical wards: this study encompassed general surgery, general medicine, respiratory medicine, orthopaedic surgery, and medicine for the elderly. Perhaps more worryingly, only eighteen per cent of the undernourished patients were referred for nutrition intervention. Similar findings were observed in other studies. Naber *et al* (1997) found, at admission, forty five per cent of patients were malnourished while measurements taken by Gariballa *et al* (1998) showed a high proportion of stroke patients were undernourished at admission and most patients showed a marked and significant deterioration in nutritional status within four weeks of hospitalisation. Vlaming *et al* (1998) observed fifteen per cent of men and eighteen per cent of women admitted to the accident and emergency department of a London teaching hospital to be underweight while Strain *et al* (1998) studied both surgical and medical patients and found that 68.4% lost weight while in hospital.

Despite this abundant amount of evidence, there is still no improvement in the nutritional care of hospitalised patients. Recently, of the thirteen per cent of patients who were measured as malnourished on admission, seventy per cent were not recognised as undernourished by ward staff and consequently went unmanaged by the Dietetics team (Kelly *et al* 2000). In a study by Corish *et al* (2000), despite only eleven per cent of admitted patients being categorised as malnourished, sixty three per cent of all the patients involved in the study lost weight in hospital. However, referral for nutritional intervention occurred in twenty per cent of patients including forty per cent of the undernourished group.

2.4 Assessing for malnutrition and the use of anthropometric measurements

While these studies all show a certain level of malnutrition among hospitalised patients, they employ a variety of methods to achieve their results. For example, Naber *et al* (1997) used a Subjective Global Assessment based on the interpretation of a questionnaire concerning food intake and complaints such as vomiting, diarrhoea and loss of weight, in conjunction with two indexes which included the biochemical measurement of serum proteins. Serum albumin may reflect nutritional status or disease severity (Corish *et al* 2000). The authors admit that only seriously ill patients are hospitalised in the Netherlands (location of study); others are treated as outpatients, thus the sample is a population group who may have particular difficulties with self-feeding. Gariballa *et al* (1998) use both anthropometric and biochemical measurements to determine malnutrition. McWhirter and Pennington (1994) relied solely on anthropometric measurements in their study. Both Gariballa *et al* (1998) and McWhirter and Pennington (1994) use a BMI of less than 20 kg/m² to define those patients who are underweight. In 1995 the World Health Organisation (WHO) defined normal weight as BMI 18.5 - 25 kg/m², thereby reducing the lower limit of normal from BMI 20 kg/m². Studies

carried out after the publication of WHO report (1995) use the more recent criteria to assess for malnutrition although Kelly *et al* (2000) categorise individuals as being at risk of undernutrition if they have a BMI of normal weight (18.5 - 25 kg/m²) but have experienced greater than three kilograms weight loss in the previous three months. Consequently, comparisons between these studies should be drawn loosely due to the varying criteria which are used to define malnutrition.

The WHO now recommend the use of the reference data for BMI defined in 1995 (de Onis & Habicht 1996) although its use can be criticised as it assumes that everyone of the same height has the same ideal body weight within an acceptable range (Baxter 1999). If height is unobtainable then the use of demi-span as a predictor of skeletal size is acceptable (Bassey 1986). No WHO recommendation exists for the reference data to be used on the upper arm. Several reference data sets exist; in the UK Dietitians predominantly refer to the parameters of Bishop *et al* (1981). These were derived from measurements made in the early 1970s of healthy Caucasian Americans. The parameters of Frisancho (1981) are commonly used too, and again the sample was comprised of a civilian non-institutionalised population of whites.

The physiological changes that occur with ageing mean that the usual anthropometric assessment variables used in younger patients may not be appropriate in the assessment of nutritional status in the elderly. Launer and Harris (1996) compared anthropometric data with aging and found that height and BMI decreased with age. The redistribution of body fat with age renders skinfold thickness measurements less valid in the elderly compared with younger persons (Corish, Flood *et al* 2000). The reference data used in defining the nutritional status of those aged sixty five years or more is limited with the most commonly used data being that of Burr and Philips (1984) derived from subjects in south Wales.

According to Ulijasek and Kerr (1999) there is a clear hierarchy in the precision of different nutritional anthropometric measures, with weight and height being most precise. Arm and waist circumference are marginally less accurate while the authors comment skinfolds are associated with such large measurement error that interpretation is problematic. In subjects with moderately firm subcutaneous tissue the triceps skinfold measurement is easy to perform; individuals with flabby easily compressible tissue or with especially firm tissue present a problem for obtaining valid measures of skinfold thickness (Lukaski 1987).

Durnin *et al* (1997) investigated whether there was a need to be very precise in the location of the skinfold thickness measurement by taking readings at the 'correct site' in the sample and twenty millimetres distant from this site. It was found that although many of these comparisons were significantly different from each other, the actual amount of difference was comparatively small. The maximum difference was never greater than three per cent fatness which the authors deem as being of technical unimportance although they admit it may have greater importance when single or multiple skinfolds are used as indicators by themselves rather than when using them to estimate total body fat percentage or fat-free mass. Lohman (1981) disagrees, stating that the choice of location of the skinfold site is a chance for error to occur. He goes on to suggest that there may be a variance in the techniques of different examiners (inter-examiner bias). Because hospitalised patients are often unable to assume the upright position recommended for anthropometric measurements, the effect of patient position on accuracy of triceps skinfold and arm circumference measurements was investigated by Jensen *et al* (1981). They indicate that these measurements can be measured as accurately, reproducibly and comparably in the supine position as in the standard position.

Arm circumference alone does not yield a precise diagnosis of malnutrition. The combination of arm circumference and triceps skinfold thickness can be used as an indicator of protein-energy malnutrition (Lukaski 1987). When the relationship between mid upper arm circumference and body mass index for groups of adults from developing countries, athletes and hospitalised patients in USA was investigated, a robust and linear correlation (except for male patients) between mid upper arm circumference and BMI was observed (WHO 1995). It is assumed that the mid-arm is circular; the triceps skinfold is twice the average fat rim diameter; the mid-arm muscle component is circular and bone atrophies in proportion to muscle in protein-energy malnutrition. In fact, it has been shown that there is some degree of error in each of these assumptions (Lukaski 1987).

Waist circumference is a convenient and simple measure which is unrelated to height and is an approximate index of intra-abdominal fat mass and total body fat. Furthermore, changes in waist circumference reflect changes in risk factors for cardiovascular disease and other forms of chronic disease (Lean *et al* 1995). Populations differ in the level of risk associated with a particular waist circumference therefore globally applicable cut-off points cannot be developed. People of South Asian descent living in urban societies have a higher prevalence of many of the complications of obesity than other ethnic groups (WHO 1997). Indeed, when anthropometric measurements are performed on populations differing from those populations used to derive the reference data, the accuracy of the results is still unclear (James *et al* 1994).

2.5 Using anthropometric measurements in developing countries

Harries *et al* (1985) attempted to assess whether the anthropometric cut-off points are applicable in developing counties using the Frisancho (1981) parameters for the upper limb. A large proportion of apparently healthy subjects from Nigeria fell below the 5th centile indicating that the proposed cut-offs are of dubious value as nutritional indicators in the developing world. However, this study assumed that the subjects were indeed healthy. Although the use of BMI for assessing undernutrition in adults is now being applied worldwide there is still doubt as to whether alone it is both a sensitive and specific measure of adult malnutrition. James *et al* (1994) sampled adults from five African countries, India, China and Papua New Guinea and devised a classification suing the standard deviations of the distributions of mid upper arm circumference around the mean values for the international aggregated data set in combination with BMI. This may provide a more refined classification of chronic energy deficiency that would be appropriate for the Third World. Ferro-Luzzi and James (1996) developed this classification further to allow for screening of malnutrition in individual adults under extreme conditions e.g. famine.

Norgan (1994) investigated body mass index and body composition in different populations. One finding was that in general, Asians have a low correlation between BMI and body composition. In addition, rural and low-socio-economic Indians were found to have some of the lowest mean BMI and greatest proportions of the population with BMI below 16 kg/m ^{2}. When adjusted for shape by using height to stature (sitting height ÷ total height) it was concluded that it was unlikely that shape was an influencing factor although Indian populations are very diverse. Norgan does admit that the data on third world populations is

are scant. In the study of Majumder *et al* (1986), the effect of altitude on body dimensions was investigated in populations at low lying altitudes (1000-2000m) in north-east Nepal and West Bengal (India) and higher altitude in Khumbu, a region of the eastern Himalayas lying between 3,500 and 4,050 metres. It was found that altitude has a strong effect on body dimensions.

These studies on body dimensions of various populations may become out-dated as many low-income countries are experiencing a nutrition transition as they improve economically. Urbanisation and growth in income leading to a greater degree of mechanisation has resulted in reduced physical activity and a change in diet. Japan experienced an accelerated transition although has not shown as large a rise in fat consumption and an increase in chronic diseases as others following suit e.g. China, Thailand (Popkin 1994). In China it is suggested that obesity has increased in the high-income urban population while under-nutrition has increased in the low-income rural population.

2.6 The nutritional situation in Nepal

The data on Nepal is limited. The Health of Nepal Survey (Brown *et al* 1968), summarised the diet at that time as generally lacking in sufficient high quality protein, calcium, vitamin A, riboflavin, and ascorbic acid. The authors attribute the apparently adequate iron, thiamin, and niacin intakes to consumption of large amounts of unmilled rice. However, with the introduction of electricity and the practice of milling rice, this situation has worsened. More recently, a study performed by a variety of collaborating institutions looked at micronutrient status in Nepal (HMG *et al* 1998). The prevalence of a BMI of less than 18.5 kg/m^2 among women was found to be 24.7%. The iodine intake for the population was found to be

adequate as urinary iodine excretion was 100-300 µg/l (< 20 µg/l = severe iodine deficiency disorder (IDD), 20-49 µg/l = moderate IDD, 50-99 µg/l = mild IDD (Hetzel B S 2000)). However, in the report it was stressed that the iodised salt programme should continue. It was also reported that the rate of palpable goitre has increased. There has also been an improvement in the clinical vitamin A status among pre-school children due to periodic high dose vitamin A capsule supplementation activity with a virtual disappearance of xerophthalmia among re-school children who had received a vitamin A capsule. Serum retinol levels were low indicating a chronic inadequacy of dietary vitamin A. The prevalence of night-blindness was high among pregnant women while one per cent of all school-aged children had night-blindness with prevalence increasing with age. It was recommended that supplementation with capsules should continue twice a year and over all districts including women of child-bearing age.

It was suggested that anaemia affects two out of three women and three out of four pre-school children. The prevalence of anaemia is higher among pregnant women (74.6%) than non-pregnant women (66.7%) therefore women that enter pregnancy with poor iron stores are at much greater risk of anaemia. Children aged six to twenty three months had the highest prevalence of anaemia (eighty eight per cent). The authors recognise the clear need for iron supplementation and fortification as well as regular de-worming. They conclude that there has been little improvement in nutritional status of children as measured by stunting and underweight in the last twenty three years suggesting that past programmes and policies have been insufficient.

Chapter 3. Focus of The Study

3.1 Project Aims:

The aims of the project are as follows:

- To determine the prevalence of nutritional depletion among patients on admission to hospital
- To assess adverse changes in nutritional status during hospital stay
- To assess the number of patients who are at risk from cardiovascular disease using waist circumference and waist-hip ratio

3.2 Project Objectives:

The objectives of the project are as follows:

- To determine the baseline prevalence of malnutrition by using Body Mass Index, recent weight loss, triceps skinfold thickness and mid-arm muscle circumference as parameters.
- To determine any difference in nutritional status between members of the following sub-groups of patients admitted to Patan Hospital patients: age, gender, medical speciality and level of income using statistical analysis thereby determining where the limited means for nutritional support need to be focused.
- To establish the implications for both Patan Hospital and other hospitals of the nutritional needs of their patients
- To highlight the effect of a hospital stay on nutritional status

3.3 Research Questions

RQ1. What percentage of non-elective patients admitted to Patan Hospital during 16th July to 8th September 2001 were in each category of nutritional status?

RQ2. What was the mean percentage weight change and absolute weight change in patients whose full duration of stay in Patan Hospital was 7 days or more and fell between 16th July to 8th September 2001?

RQ3. Was there any significant difference in the weight change between the different categories of nutritional status?

RQ4. Was there any significant difference in:

- the number of patients who were malnourished, healthy or overweight
- the mean percentage weight change

between the following age groups:

18 - 30 years

31 - 45 years

46 - 60 years

61 – 75 years

76 + years?

RQ5. Was there any significant difference in:

- the number of patients who were malnourished, healthy and overweight
- the mean percentage weight change

between males and females?

RQ6. Was there any significant difference in:

- the number of patients who were malnourished healthy, overweight
- the mean percentage weight change

between surgical, medical, and gynaecology patients?

RQ7. Was there any significant difference in:

- the number of patients who were malnourished, healthy and overweight
- the mean percentage weight change

between patients who received charity and those who did not?

RQ8. What number of patients were at risk from cardiovascular disease?

Chapter 4. Methodology

4.1 Study design

Data was collected on adult patients aged over eighteen years admitted to Patan Hospital during the period 16th July to 8th September 2001. The wards included in the study were the admissions ward, medical, surgical, gynaecology wards and the private ward. The patients were classified as medical, surgical or gynaecological and all other specialties were excluded e.g. orthopaedics. Further exclusion included patients with gross oedema, pregnant women, those physically unable to co-operate with having measures taken (e.g. those unable to stand for weight assessment) and those admitted electively. The patients who fulfilled the inclusion criteria were approached and asked for their written consent to take part in the study (see Appendix 2). For the patients who could not write to sign their name, their thumbprint was used as a signature instead. Translation was provided by Sanjay Nidhi, the Nutrition Assessment Officer employed by the UMN Nutrition Programme. Measurements were taken within forty eight hours of admission in those individuals who were willing to participate and they were taken in the following order:

- mid-upper arm circumference
- triceps skinfold thickness
- weight
- height
- waist circumference
- hip circumference

The measurements were performed by Jane Keylock and the values were recorded by Sanjay Nidhi. The measurements on the arm were taken with the patient sitting up in bed and all the others were performed standing. In all patients clothing was minimal. The day prior to the start of the study was used as a trial period.

4.2 Weight and height

Weight was measured using Seca 761 stand-on scales. The scales were calibrated on arrival in Nepal by measuring an innate object of known weight. Height was measured using a Harpenden pocket stadiometer. For those individuals where the use of a stadiometer was impractical skeletal size was predicted as described by Bassey (1986) by measuring demispan with the use of a demispan tape manufactured by Chasmors Ltd. The right sternal notch was located and marked with a pen. The left arm was raised to a horizontal position and the tape measure placed at the finger root between the middle and ring finger of the left hand. The tape measure was extended to the mark on the right collar bone (right sternal notch) checking that the arm was flat and the wrist was straight. The height was calculated from the demispan using the formula:

Females: Height (cm) = (1.35 x demispan (cm)) + 60.1

Males: Height (cm) = (1.40 x demispan (cm)) + 57.8

Weight and height were used to determine body mass index using the formula:

$$BMI = \text{weight (kg)}/(\text{height (m)})^2$$

These were compared to the recommended values for BMI (WHO 1995) and the correct interpretation established.

BMI	< 16.00	Grade 3 Thinness (Severe)
BMI	16.0 – 16.99	Grade 2 Thinness (Moderate)
BMI	17.0 – 18.49	Grade 1 Thinness (Mild)
BMI	18.5 – 24.99	Normal range for individual
BMI	25.0 – 29.99	Grade 1 Overweight
BMI	30.0 – 39.99	Grade 2 Overweight
BMI	≥40.00	Grade 3 Overweight

4.3 Triceps skinfold thickness

The triceps skinfold thickness was measured using Holtain calipers and was performed on the left arm. The left elbow was bent to ninety degrees and the forearm placed palm down across the trunk with the upper arm approximately parallel to the trunk. Using a measuring tape, the point mid-way between the tip of the acromion process (bony protrusion of the upper shoulder) and the tip of the olecranon process (bony point of the elbow) over the triceps muscle was marked. The left arm was extended alongside the body, with the palm facing

upwards. A double fold of skin and subcutaneous adipose tissue was gently grasped between the fingers and thumb once centimetre above the mid-point mark. The fold of skin was on the back of the arm, in the midline and parallel to the long axis of the upper arm. It was ensured that the subcutaneous tissue was separated from the underlying muscle. The jaws of the calipers were placed perpendicular to the length of the skinfold at the level of the marked mid-point while maintaining the grasp of the skinfold and the reading read to the nearest millimetre two or three seconds after applying the caliper. The measurement was repeated three times and an average reading taken. Values were compared with those in tables of normal values for triceps skinfold thickness standardised for sex and age (for ages 18-74 years) drawn from published data on the population of United States (Bishop *et al* 1981). For those individuals over the age of seventy four, the parameters of Burr *et al* (1984) were used.

Table 4.1. Male reference values for triceps skinfold thickness (mm)

AGE GROUP (YEARS)	PERCENTILE						
	5th	10th	25th	50th	75th	90th	95th
18-74	4.5	6.0	8.0	11.0	15.0	20.0	23.0
18-24	4.0	5.0	7.0	9.5	14.0	20.0	23.0
25-34	4.5	5.5	8.0	12.0	16.0	21.5	24.0
35-44	5.0	6.0	8.5	12.0	15.5	20.0	23.0
45-54	5.0	6.0	8.0	11.0	15.0	20.0	25.5
55-64	5.0	6.0	8.0	11.0	14.0	18.0	21.5
65-74	4.5	5.5	8.0	11.0	15.0	19.0	22.0
75-79	3.6	4.2	5.3	7.0	9.2	11.7	13.6
80-84	3.5	4.1	5.1	6.6	8.5	10.7	12.3
85+	3.4	3.9	5.0	6.5	8.4	10.6	12.2

Table 4.2. Female reference values for triceps skinfold thickness (mm)

AGE GROUP (YEARS)	PERCENTILE						
	5th	10th	25th	50th	75th	90th	95th
18-74	11.0	13.0	17.0	22.0	28.0	24.0	37.0
18-24	9.4	11.0	14.0	18.0	24.0	30.0	34.0
25-34	10.5	12.0	16.0	21.0	26.5	33.5	37.0
35-44	12.0	14.0	18.0	23.0	29.5	35.5	39.0
45-54	13.0	15.0	20.0	25.0	30.0	36.0	40.0
55-64	11.0	14.0	19.0	25.0	30.5	35.0	39.0
65-74	11.5	14.0	18.0	23.0	28.0	33.0	36.0
75-79	7.5	8.6	11.1	14.6	19.1	24.5	28.4
80-84	6.2	7.2	9.5	12.7	17.1	22.4	26.2
85+	6.0	7.0	8.8	11.5	14.9	19.0	21.8

The following percentiles were used to assess the level of depletion:

Values below the 5th percentile – evidence of depletion

Values below 10 percentile – minimal depletion (Gray and Gray *1979*)

4.4 Mid-upper arm circumference

The circumference measurements were performed with the use of a TALC insertion tape (Teaching Aids At Low Cost). As with the triceps skinfold thickness, the upper arm circumference measurements were all performed on the left. With the left elbow bent to ninety degrees and the forearm and upper arm in the same position as previously, the point mid-way between the tip of the acromion process and the tip of the olecranon process was marked using a measuring tape. The left arm was extended and at the marked mid-point the tape was pulled around the arm without compressing the tissues. The circumference was recorded to the nearest 0.2cm.

Using the mid-arm circumference and the triceps skinfold thickness, the mid-arm muscle circumference was ascertained. The triceps skinfold measurement was converted from millimetres to centimetres and the following formula was used:

$$MAMC\ (cm) = MAC\ (cm) - (TSF\ (cm) \times 0.314)$$

Values were compared with those in tables of normal values for mid-arm muscle circumference measurements standardised for sex and age (for ages 18-74 years) drawn from published data on the population of United States (Bishop *et al* 1981). For those individuals over the age of seventy four, the parameters of Burr *et al* (1984) were used.

Table 4.3. Male reference values for mid-arm muscle circumference (cm)

AGE GROUP (YEARS)	PERCENTILE						
	5th	10th	25th	50th	75th	90th	95th
18-74	23.8	24.8	26.3	27.9	29.6	31.4	32.5
18-24	23.5	24.4	25.8	27.2	28.9	30.8	32.3
25-34	24.2	25.3	26.5	28.0	30.0	31.7	32.9
35-44	25.0	25.6	27.1	28.7	30.3	32.1	33.0
45-54	24.0	24.9	26.5	28.1	29.8	31.5	32.6
55-64	22.0	24.4	26.2	27.9	29.6	31.0	31.8
65-74	22.5	23.7	25.3	26.9	28.5	29.9	30.7
75-79	18.2	19.0	20.5	22.1	23.7	25.2	26.0
80-84	17.6	18.4	19.9	21.5	23.1	24.6	25.4
85+	17.2	18.0	19.3	20.8	22.3	23.6	24.4

Table 4.4. Female reference values for mid-arm muscle circumference (cm)

AGE GROUP (YEARS)	PERCENTILE						
	5th	10th	25th	50th	75th	90th	95th
18-74	18.4	19.0	20.2	21.8	23.6	25.8	27.4
18-24	17.7	18.5	19.4	20.6	22.1	23.6	24.9
25-34	18.3	18.9	20.0	21.4	22.9	24.9	26.6
35-44	18.5	19.2	20.6	22.0	24.0	26.1	27.4
45-54	18.8	19.5	20.7	22.2	24.3	26.6	27.8
55-64	18.6	19.5	20.8	22.6	24.4	26.3	28.1
65-74	18.6	19.5	20.8	22.5	24.4	26.5	28.1
75-79	16.1	16.9	18.4	20.0	21.6	23.1	23.9
80-84	15.1	16.0	17.5	19.2	20.9	22.4	23.3
85+	14.1	15.0	16.5	18.2	19.9	21.4	22.3

The following percentiles were used to assess the level of depletion:

Values below the 5th percentile – evidence of depletion

Values below 10th percentile – minimal depletion (Gray and Gray *1979*)

4.5 Criteria for Individuals Categorised as Malnourished

With the assistance of the Nutrition Assessment Officer the patient was asked about their weight history. It was especially noted if the patient had lost more than three kilograms in the last three months. If the individual could not quantify their weight history during this time they were asked whether they would describe their weight lost as: none, a little, moderate, or severe and moderate and severe amounts were deemed as representing a weight loss of greater than three kilograms.

Using a combination of the methodologies taken from McWhirter and Pennington (1994) and Kelly *et al* (2000) a patient was categorised as malnourished according to the following criteria:

Table 4.5. Criteria and categorisation of malnutrition

Level of Malnutrition	BMI		TSF or MAMC percentile
Mildly undernourished	<18.5	+	<10th centile
or	18.5 – 24.99 + >3kg wt loss in last 3 months	+	< 10th centile
Moderately undernourished	<17.0	+	< 5th centile
Severely undernourished	< 16.0	+	< 5th centile

4.6 Waist-hip ratio and Waist circumference

A standard measuring tape was used to measure the waist circumference and the hip circumference of the patients. These measurements were taken only once during hospital stay as they serve to indicate for the risk of cardiovascular disease and are not used to assess an adverse effect of hospital stay on nutritional status. As weight is vital in determining nutritional status, when the patients assumed the upright position this measurements was taken first. For those patients who could no longer stand once their weight had been ascertained the waist and hip measurements were not performed. The waist circumference was taken at the umbilicus while the hip circumference was taken at the maximum gluteal

girth. These two measurements were presented as a ratio and compared with cut-offs devised by Bjontorp (1984) to determine the degree of fat stored in the abdominal region. A ratio of greater than 1.0 in men and 0.8 in women is indicative of a rapid increase in the risk of ischaemic heart and cerebrovascular disease.

Lean *et al* (1998) describe waist circumference cut-offs at two levels of risk.

Figure 4.4. The cut-offs for men and women for becoming alert to the risk of cardiovascular disease and for taking action

	Level 1-Alerting Zone	Level 2 – Action Zone
Men	≥94 cm	≥102 cm
Women	≥ 80 cm	≥ 88 cm

4.7 Correlation between particular sub-groups and incidence of malnutrition

To determine any correlation between certain sub-groups of the hospital population and therefore where the current limited means for nutritional support should be focused, the following information was recorded:

- Age
- Gender
- Medical speciality
- Charity

To investigate if nutritional status is affected by the level of income, whether a patient received charity from social services to pay their hospital bill was used as a cut-off to distinguish those individuals' who have a very low income. Social services were consulted and the patients who received charity on discharge were recorded.

4.8 Nutritional status and hospital stay

The weight and the measurements on the arm were repeated on discharge in those patients who had stayed in hospital for seven days or longer.

4.9 Ethical permission and data analysis

The medical notes were reviewed for pertinent information. Complete confidentiality and anonymity was ensured and if participants wished to leave the study at any point then they were free to do so. The project was approved by the Ethical Review Committee at Nepali Health Research Council and the Ethics Committee from Glasgow Caledonian University. Statistical analysis was performed using the SPSS package and for each test the ninety five per cent confidence level was used. The demographics of the sample and the number of people in each nutritional category were determined by descriptive statistics. A two-tailed Pearson's correlation co-efficient was used to establish whether a correlation existed between BMI and both triceps skinfold thickness and mid-arm muscle circumference. A Kolmogorov-Smirnov test was performed to investigate if the changes in weight during a hospital stay followed a normal distribution. Chi-squared tests were used to assess for differences in nutritional status between different sub-groups i.e. age, gender, specialty, and

level of income and a series of one-way analysis tests were performed to see if mean percentage weight changes were affected by nutritional status, age, gender, specialty and level of income.

Chapter 5. Results

5.1 The Sample

A total of 214 patients were measured on admission to Patan Hospital which included 94 (43.9%) males and 120 (56.1%) females. 119 (55.6%) patients were classed as medical, 66 (30.8%) as surgical and 29 (13.6%) as gynaecological (Figure 5.5). 21 out of the 214 patients were measured on the private ward. The distribution among the different age groups can be seen in Figure 5.6.

Figure 5.5. The Proportion Of Patients In Each Specialty

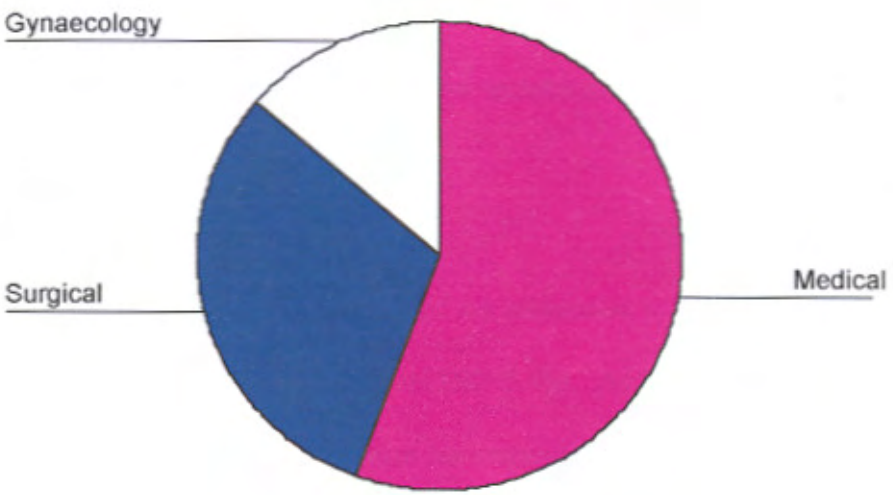
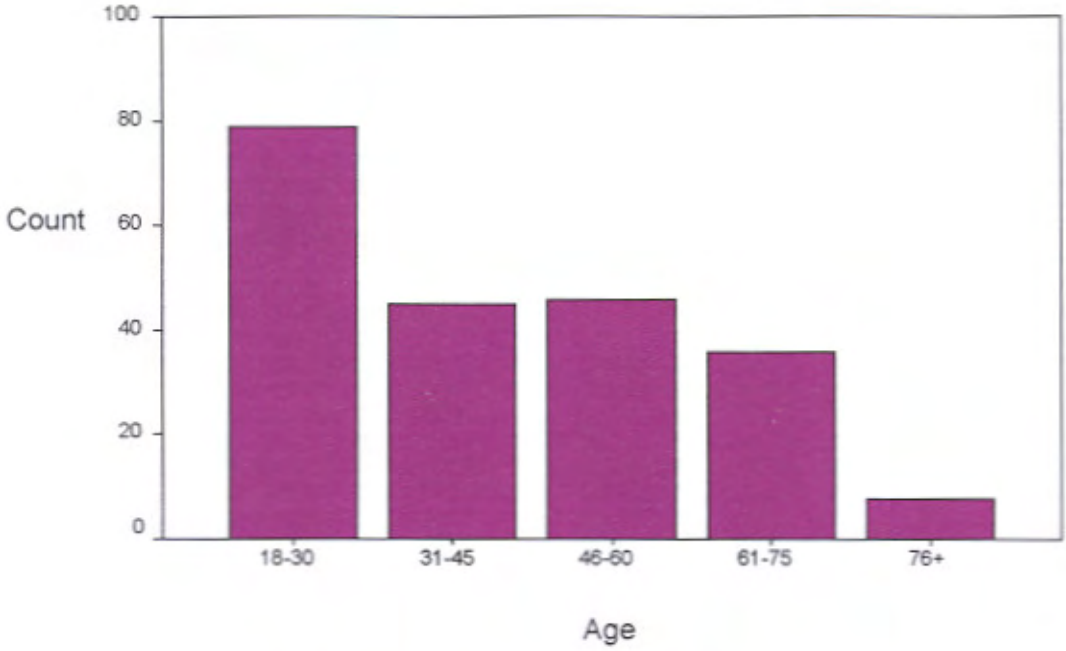


Figure 5.6. The Number of Patients In Each Age Group



Of the 214 individuals measured, 6 patients died and 41 (18.7%) were measured on discharge. 22 patients (10.3 %) received some charity towards the cost of their hospital bill and 8 (3.7 %) patients were administered the nutritional supplement drink during their hospital stay.

The mean weight of the 214 patients measured on admission to Patan Hospital was 47.7 kg (SD 10.36) and the mean BMI was 19.4 kg/m² (SD 3.49). As the categorisation of nutritional status is based on both BMI and upper arm measurements, a 2-tailed Pearson's correlation co-efficient was undertaken to show if the nutritional status determined by BMI is similarly reflected by the arm measurements. There is a correlation between both measurements on the upper arm and BMI as shown in Figures 5.7 and 5.8. The p value indicates that there was a significant correlation between BMI and upper arm measurements in the sample population.

Figure 5.7. Correlation between BMI and Triceps Skinfold Thickness (Correlation co-efficient 0.699, p=0.00)

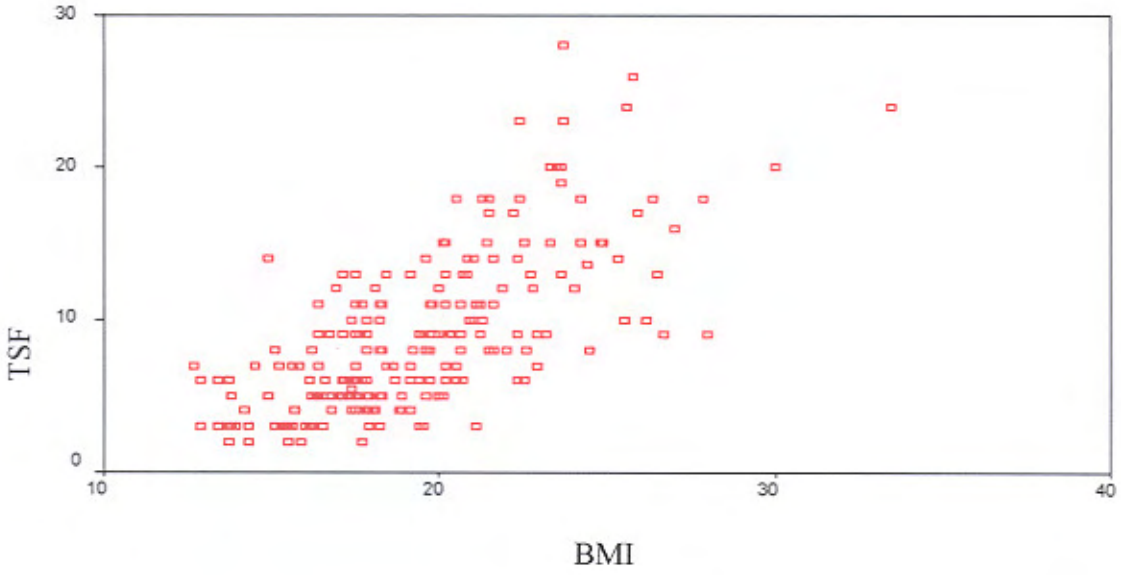
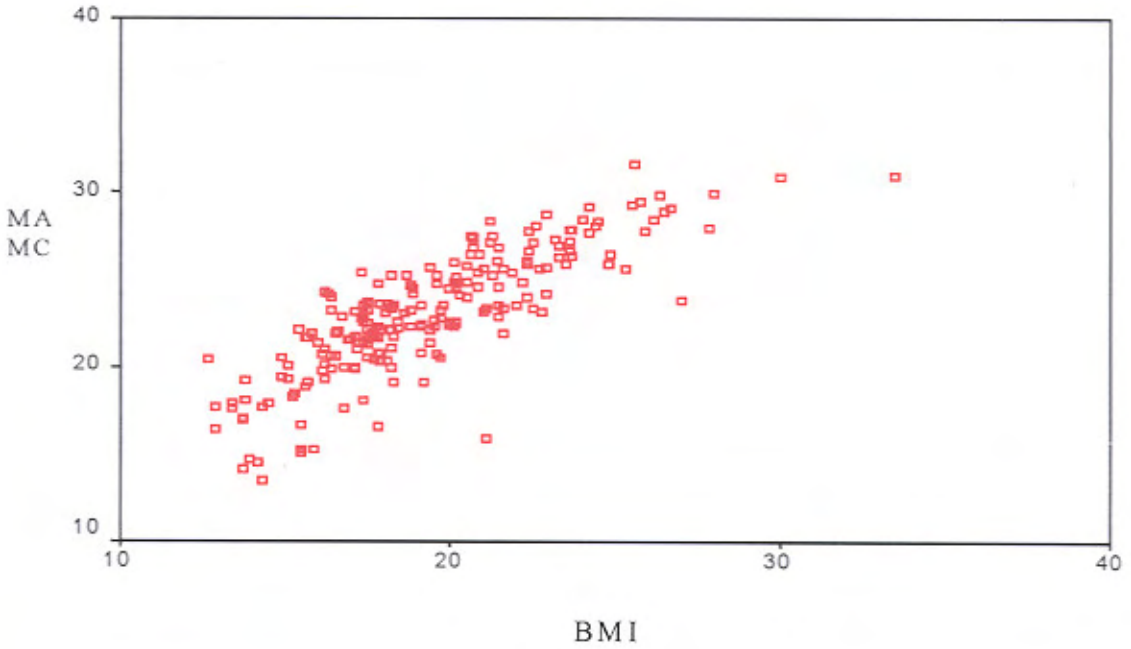


Figure 5.8. Correlation Between MAMC and BMI (Correlation co-efficient 0.832, p=0.00)



Using these parameters, the nutritional status of each patient was calculated. From Figure 5.9 below it can be concluded that 114 (53.3%) of the patients were malnourished, 87 (40.6%) were healthy (normal nutritional status) and 13 (6.1%) were overweight. Table 5.6 shows the number of patients in each category of nutrition status.

Figure 5.9. The Number of Malnourished, Healthy and Overweight Patients

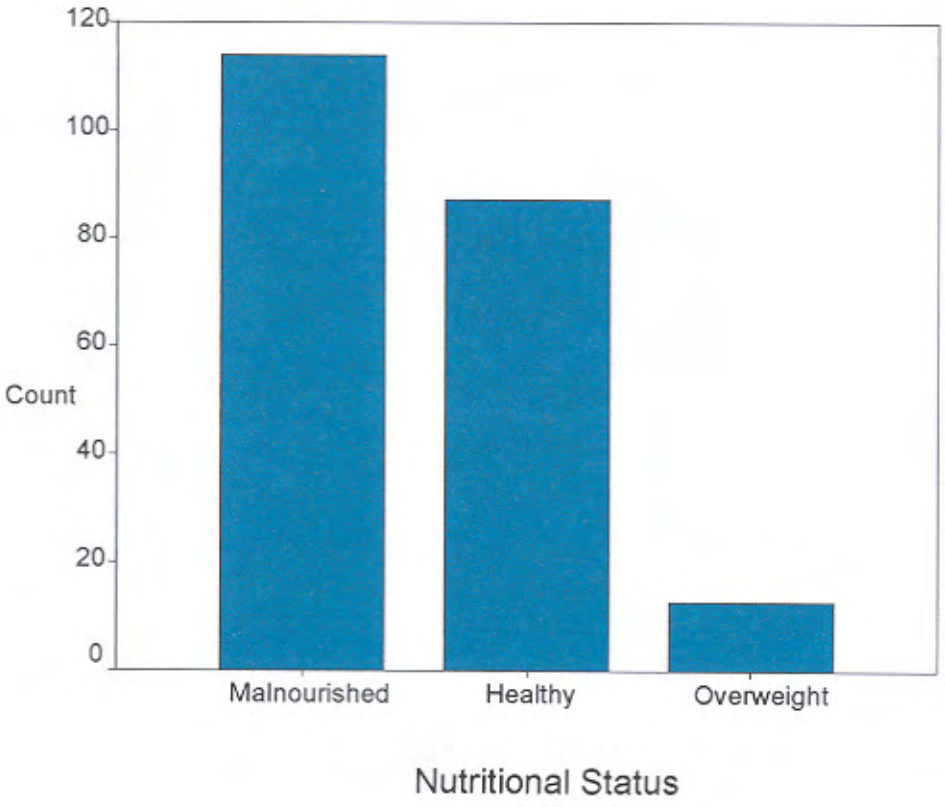


Table 5.6. The Nutritional Status of the Patients

Nutritional Status	Number of Patients	Percentage of Patients
Severely malnourished	30	14
Moderately malnourished	16	7.5
Mildly malnourished	68	31.8
Normal (healthy)	87	40.7
Grade 1 overweight	11	5.7
Grade 2 overweight	2	0.3

Of the 6 people that died, 1 was normally nourished, 2 were mildly malnourished, 2 were moderately malnourished and 1 was severely malnourished.

5.2 The Nutritional Status of various Sub-Groups

5.2.1 Nutritional Status and Gender

Table 5.7. shows the number of patients in each category of nutritional status according to gender.

Table 5.7. The Nutritional Status of Males and Females

Category of Nutritional Status	Gender	
	Male n (%)	Female n (%)
Malnourished	56 (60)	58 (48)
Healthy	32 (34)	55 (46)
Overweight	6 (6)	7 (6)

A Chi-squared test was performed to assess whether there was any significant difference in nutritional status between males and females. The value of $p=0.214$ indicates that there is no significant difference in the nutritional status of males and females.

5.2.2 Nutritional Status and Specialty

Table 5.8. The Nutritional Status of medical, surgical and gynaecology patients

Category of Nutritional Status	Specialty		
	Medical n (%)	Surgical n (%)	Gynaecology n (%)
Malnourished	70 (59)	36 (55)	8 (28)
Healthy	41 (34)	28 (42)	18 (62)
Overweight	8 (7)	2 (3)	3 (10)

The value resulting from a Chi-square test performed on the above contingency table, was p=0.03 indicating a significant difference in the nutritional status of patients in different specialties. Further Chi-squared tests showed that there was no significant difference between the nutritional status of patients on the medical and surgical wards (p=0.381) but there was a significantly higher prevalence of malnutrition in medical patients than gynaecology patients (p=0.010) and a significantly higher prevalence of malnutrition in surgical patients than gynaecology patients (p= 0.033). The result that the nutritional status of private patients was higher than non-private patients was found to be significant (p=0.002) (Table 5.9).

Table 5.9. The Nutritional Status of private patients

Nutritional Status	No. of Patients on Private Ward
Malnourished	4
Healthy	12
Overweight	6

5.2.3 Nutritional Status and Age

Table 5.10. shows the number of patients in each nutritional category according to age.

Table 5.10. The Nutritional Status of patients aged 18-30, 31-45, 46-60, 61-75 and 76+

Nutritional status	Age				
	18-30 n (%)	31-45 n (%)	46-60 n (%)	61-75 n (%)	76+ n (%)
Malnourished	36 (45)	21 (47)	27 (59)	27 (75)	3 (38)
Healthy	40 (51)	20 (45)	17 (37)	7 (19)	3 (38)
Overweight	3 (4)	4 (8)	2 (4)	2 (6)	2 (24)

The value resulting from a Chi-square test performed on the above contingency table was p=0.025 indicating that there is a significant difference in the nutritional status between patients of different ages. Chi-squared tests revealed there was no significant difference between the nutritional status of patients in the 18-30 age group and those in the 46-60 age group (p=0.331). There was a significantly lower prevalence of malnutrition among patients aged 18-30 than those aged 61-75 (0.007) or those aged 76+ (p=0.049). There was no significant difference between patients in the 31-45 age group and those in the 46-60 age group (p=0.438) or in the 76+ age group (0.415) but there was a significantly higher prevalence of malnutrition in the 61-75 age group (0.034) than the 31-45 age group.

5.2.4 Nutritional Status and Level of Income

Table 5.11. shows the number of patients in each nutritional category according to level of income.

Table 5.11. The Nutritional Status of patients who received charity and those who did not.

Nutritional Status	Level of Income	
	Received charity n (%)	Didn't receive charity n (%)
Malnourished	16 (73)	97 (51)
Healthy	6 (27)	81 (42)
Overweight	0 (0)	13 (7)

The value resulting from a Chi-square test performed on the above contingency table was $p=0.111$ indicating that there is no significant difference in the nutritional status between patients on different levels of income as reflected in those who received charity and those who did not.

5.3 The Effect of Hospital Stay on Nutritional Status

The weight of the patient can change during their hospital stay. The mean percentage weight change in the 41 patients who were measured on discharge was a loss of 2.53 % (Table5.12.) (actual mean weight loss = 1.16kg, Table 5.13).

Table 5.12. The mean percentage weight loss of all the patients and those in each category of nutritional status.

Category of Patient	Mean % weight loss	S.D.	n
All Patients	2.53	4.97	41
Severely malnourished	5.20	6.18	6
Moderately malnourished	2.66	4.20	3
Mildly malnourished	2.35	6.81	14
Normally nourished	1.77	2.34	14
Grade 1 overweight	2.76	3.89	2
Grade 2 overweight	0.75	3.76	2

Table 5.13. The mean actual weight loss of all the patients and those in each category of nutritional status.

Category of Patient	Mean actual weight loss (kg)	S.D.	N
All Patients	1.16	2.18	41
Severely malnourished	2.00	2.09	6
Moderately malnourished	1.00	1.50	3
Mildly malnourished	1.04	3.07	14
Normally nourished	0.93	1.19	14
Grade 1 overweight	1.75	2.47	2
Grade 2 overweight	0.75	3.18	2

A one-way analysis of variance test (ANOVA) was carried out to see if there was any significant difference in the weight changes between the different categories of nutritional status. Using a confidence level of 0.05, it was found that there was no significant difference as denoted by $p = 0.821$. The results of this test are not accurate if the data is skewed i.e. do not follow a normal distribution. A Kolmogorov-Smirnov test was performed to investigate if the values for percentage weight change were skewed. It showed the distribution was normal ($p= 0.998$) as depicted by the Normal Q-Q plot (Figure 5.10).

Figure 5.10. Normal Q-Q Plot of Weight Change

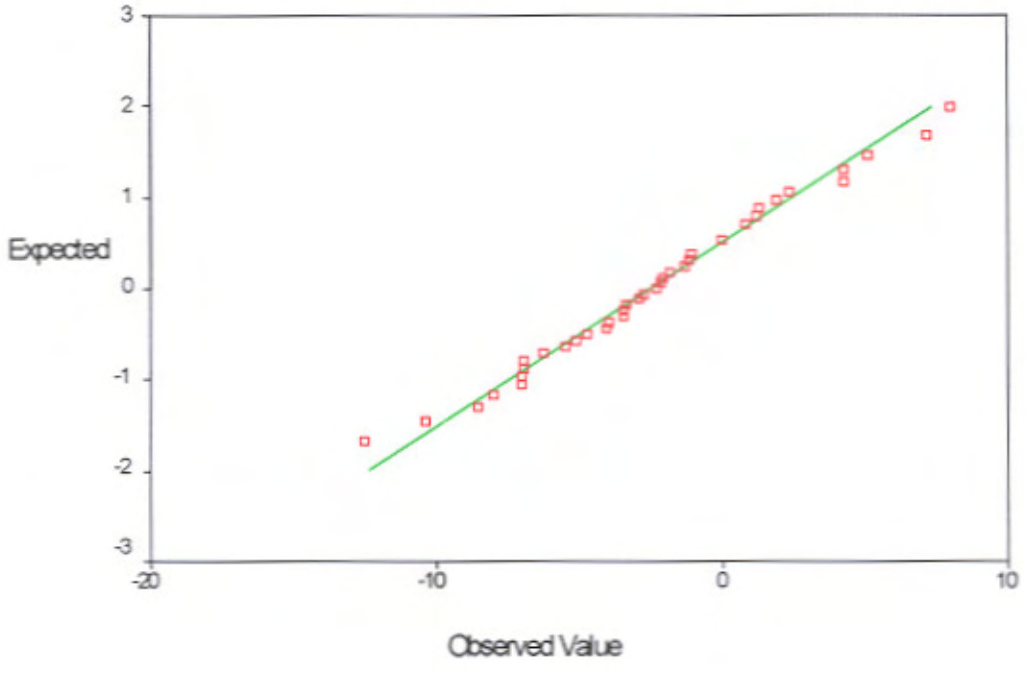


Table 5.14. below shows those individuals who changed nutritional category while in hospital.

Table 5.14. Patients who changed category of nutritional status whilst in hospital

Category Change	No. of Patients
Didn't change category	32
Mild to Severe	1
Moderate to Severe	2
Mild to Moderate	3
Grade 1 overweight to normal	1
Grade 2 overweight to Grade 1	1

5.4 The Effect of Hospital Stay In Different Sub-Groups

A series of one way analysis of variance tests were performed to assess if a change in nutritional status is affected by medical specialty, gender, age, or level of income. The indicator used to represent an alteration in nutritional status was mean percentage weight loss. As it has already been previously shown that there is a correlation between BMI and arm circumference, then weight alone, as a determinant of BMI, can be used as a marker of altered nutritional state. Table 5.15 shows if mean percentage weight change is affected by medical specialty, age, or level of income.

Table 5.15. The significance as determined by ANOVA tests of weight changes between members of different sub-groups

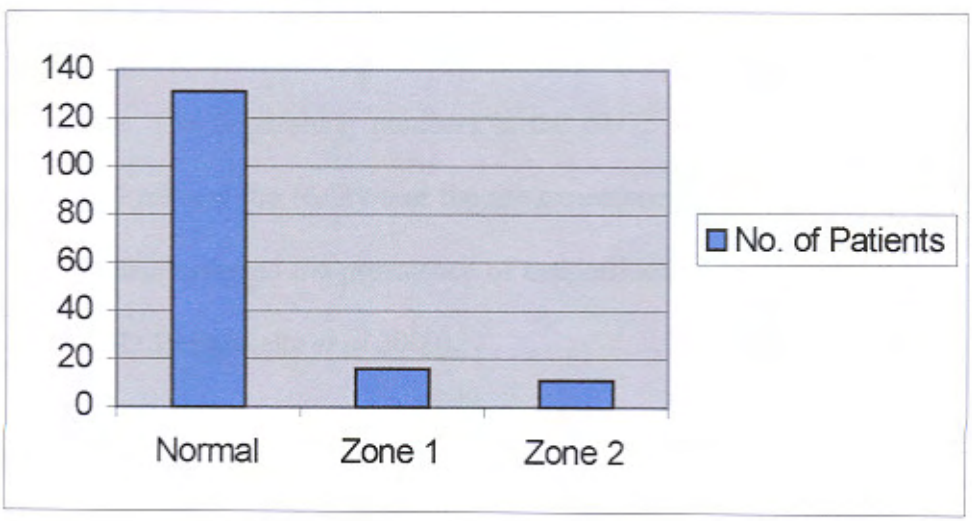
Sub-group	ANOVA value
Specialty	0.822
Age	0.766
Gender	0.615
Charity	0.568

From this table it can be seen that in each of the sub-groups, none of the patients are more at risk than others from an adverse effect on their nutritional state whilst in hospital.

5.5 The number of patients at risk from cardiovascular disease.

The number of patients who were measured for risk from cardiovascular disease was 158. Those patients not at risk from cardiovascular disease were 131 (82.9%), those who were in Zone 1, the Alerting Zone, was 16 (10.2%) and those in Zone 2, the Action Zone, was 11 (6.9%) (Figure 5.11).

Figure 5.11. The Number of Patients in Each Zone Denoting Risk of Cardiovascular Disease (Zone 1, Alerting Zone, Zone 2 Action Zone.



As an additional tool, waist-hip ratio can be used. 4.3% of men had a waist-hip ratio above the cut-off indicative of a risk from cardiovascular disease (1.0) while 49.4% of women had a waist-hip ratio above their indicative cut-off (0.8).

Chapter 6. Evaluation

6.1 Discussion

It is likely that the greater number of females (120) than males (94) in the sample can be attributed to the fact that the gynaecology ward was included in the study, while it can be seen in Figure 5.5. that the largest proportion of patients came from the medical ward (30.8%). It may be the case that more of the patients on the medical ward fulfilled the inclusion criteria than the other wards, as many of the surgical patients may have been elective or post-operative and therefore not able to stand. Similarly, many of the patients on the gynaecology ward may have been elective or pregnant. Figure 5.6. which shows the distribution of patients across the age ranges, reflects a life expectancy of 57 years. Most individuals fell into the 18 –30 years of age group (36.9%) while the mean age fell in the 31-45 age range. The diminishing numbers in the 61-75 age group (16.8%) and the 76+ age group (3.7%) reflects the reality that the life expectancy is less than this age. This compares to a study which assessed the prevalence of malnutrition in Glasgow where the mean age was 53.7 years (SD 19.9) (Kelly *et al* 2000).

The fact that of total number of patients who were measured on admission, only 19% were measured on discharge, is probably due to the fact that as patients have to pay for their healthcare they would prefer to stay in hospital for the shortest amount of time possible. This, combined with the increasing demand for bed-space, may result in a patient being discharged when the treatment is complete and the patient is able to be cared for at home rather than in developed countries where a period of convalescence may occur, even if it is only a matters of a few days. As the Nepali culture is such that the family is extensive and

very supportive, some degree of nursing care can be continued at the patients home, as can palliative care.

The mean BMI of the total sample was 19.4 kg/m^2 which compares to 24.5 kg/m^2 in the Glasgow study (Kelly *et al* 2000) and 25.2 kg/m^2 for men and 25.4 kg/m^2 for females in a London based study (Vlaming *et al* 1998). Although there is some encouragement that the Nepali mean BMI falls in the healthy range, it does appear towards the lower end of this range and is clearly less than the mean BMI in studies carried out in developed countries. Indeed, before the Who recommended that the lower cut-off for the healthy range should be 18.5 kg/m^2, this value would not have appeared in the healthy range when the lower cut-off was 20 kg/m^2.

The overall prevalence of undernutrition on admission to hospital was 53%. 114 out of 214 patients were malnourished, 30 of whom were severely malnourished. In the McWhirter and Pennington (1994) study it was found that the prevalence of undernutrition was 40% therefore from these findings it is apparent that the nutritional situation in acute settings is worse in a developing country such as Nepal. One reason for this may be the already high prevalence of malnutrition in the general population (24.7% of women having a BMI of less than 18.5 kg/m^2 (HMG *et al* 1998)) as a result of factors such as the availability and accessibility of food, financial reasons, and poor sanitation and living conditions. The traditional Nepali diet is balanced and can be deemed as healthy, consisting of rice, pulses, fruits, vegetables and dairy products in the form of yoghurt and milk taken in tea. Meat is eaten infrequently.

As these are hospital patients then clearly their medical conditions may have a role to play in their nutritional status. As in any population, the disease process can result in catabolism which if not compensated for can lead to malnutrition. Related factors can be influential such as lethargy or loss or appetite, vomiting and diarrhoea. Contrary to the situation in developed countries, there is still a significant abundance of communicable diseases, for example dysentery and typhoid, in countries such as Nepal which may contribute to malnutrition due to their resulting symptoms particularly as these condition as associated with fever and a high body temperature resulting in catabolism.

As mentioned previously patients have to pay for their healthcare and consequently, an ill individual may delay seeking medical attention in the hope that their health improves and may only do so when their condition becomes serious. Poor access and travel means may result in a further dealy. In this situation their nutritional status may suffer accordingly so when they do present at hospital, malnutrition has already set in. Because of the above factors, it cannot be concluded that the level of malnutrition seen in hospitals is a reflection of undernutrition in the general population.

The findings of McWhirter and Pennington (1994) provoked a drive to increase nutrition support in hospitals. In their study the authors highlighted "a need for improved recognition of malnutrition and an appreciation of the treatment of nutrition related complications". It is evident that in Patan Hospital a similar need for appropriate nutritional support exists. In these patients the chances of complications, morbidity and mortality are increased due to undernutrition therefore measure should be taken to improve their nutritional status and decrease these risks. Only eight patients were receiving the nutritional supplement drink indicating a clear deficit in those patients who are receiving support and those who require it.

Medical staff need to be aware that half of the patients are malnourished and take the necessary steps to improve this situation.

The mean weight was 47.7 kg, which by Western standards is low, and yet the mean BMI was in the healthy range. The Nepali people are generally shorter and thinner than, say, Caucasians (Norgan 1994) even in a healthy state and therefore it may be more difficult to assess for malnutrition just by observation alone as small weight changes which are difficult to detect may be the difference between healthy and undernourished. The patient may have been malnourished for an extensive period of time before seeking medical attention, therefore by asking about recent weight loss or altered eating habits, its existence may not emerge. Malnutrition is a medical condition just like any other disease and therefore the hospital setting is an ideal place for the problem to be addressed. Ideally simple equipment such as calibrated accurate scales, stadiometers and equipment for performing arm measurements and appropriate reference data should be available and easily accessible. As well as education on the methods of nutritional assessment for medical staff there should be reassurance that this need not be time-consuming or difficult. Doctors not only need to be aware of the numbers of malnourished patients but also the effects of malnutrition so they understand the implications for their treatments and hence are more likely to address the issue. It can be seen that in the 6 patients who died, only one was healthy while the other were undernourished. Similarly, as nursing staff have most interaction with the patients, an awareness of nutrition needs to be raised so that they can detect undernutrition or poor eating habits and therefore provide the necessary encouragement and treatment. In addition, education regarding the treatment of malnutrition and the range of options available is important. In some cases encouragement and support from hospital staff with emphasis on family members to do the same may improve some individual's intake. Alternatively, simple

advice on some of the higher calorie and protein foods available may result in an improvement. Certainly the medical staff need to become more familiar with using "Paustik Sanjiwani", the nutritional supplement, and its use should be more widespread where there is a need and when it is possible to do so. Perhaps, when it is feasible for the hospital to do so, the use of enteral feeding may become more extensive providing there are no risks to the patients, for example increased risk of infection, although both with this and the use of the "Paustik Sanjiwani", the infrastructure needs to be in place to provde an adequate and effective service. As family member play a large role in the care of the patient, they could be encouraged to support the patient nutritionally by ensuring that supplements are taken and the maximum benefits are achieved from any dietary intake.

Although the measurements taken only reflected depleted fat and protein stores, it likely that there are widespread micronutrient deficiencies among the patients. Because of this, there could be a case for routine vitamin and mineral supplementation among patients to help immune function and metabolic processes.

It is important that if the patient suffers from any condition which may alter their eating pattern e.g. dysphagia or diabetes that appropriate advice is given so that malnutrition can be prevented. However, it is most imperative that these issues are dealt with sensitively as if a patient cannot afford more food then it would be insensitive to try to persuade them to increase their dietary intake. In this instance discussions need to take place between the patient and hospital staff on ways that the macronutrient and micronutrient content of their diet can be improved. However, it is acknowledged that money, time and staff are all limited resources. Clearly, the methods of treating malnutrition need to be practical and inexpensive. This applies not only in the hospital setting but for when the patient is at home after discharge

too. It seems practical that if nutritional education of the patients is going to take place in hospital, it should serve to improve their nutritional intake post discharge too. If it were possible to formulate a version of "Paustik Sanjiwani" which the patients can create at home using local ingredients then they could be taught the adapted recipe whilst in hospital.

The number of malnourished patients found in this study is likely to be an underestimation of the number of malnourished patients in Patan Hospital, as only those patients who could stand to have measurements taken were included. Patients who were seriously ill were not measured. As it is known that there is a negative correlation between severity of the condition and nutritional status due to increased metabolic rate (Elia M 1990), it is likely that there is a higher incidence of malnutrition among the more severely ill patients than those included in this study.

As two different indicators were used to assess for nutritional status, namely arm measurements and BMI, it is encouraging that seemingly the two parameters correlate. By using the two parameters in conjunction, hopefully the results will be more accurate than relying on one indicator on its own. The correlations show that BMI is more closely correlated with MAMC (0.832) than triceps skinfold thickness (0.699) which may reflect a different degree of normal fat storage and distribution in the Nepali population than the population in the developed world used to produce the BMI data. Because of this, some caution should be exercised when using parameters which were derived from different ethnic groups to assess for malnutrition (see Limitations).

Only 13 out of the 214 patients were overweight which is a relatively small proportion. The incidence of overweight in these patients is not likely to be a reflection of the level of obesity

in the general population as these patents may have experienced weight increase due to immobility resulting from their medical condition. However, where appropriate, these individuals should be given weight reduction advice to reduce the risk of cardiovascular disease and diabetes.

There is no significant difference between the nutritional status of males and females and therefore while an adequate diet is important in women especially those of a child-bearing age, medical staff should not ignore men. The focus of much of the nutritional work in the community is on women and children but as malnutrition has implications for all hospital patients then patients of both genders should be regarded with equal importance.

It is evident that patients on medical and surgical wards have a poorer nutritional status than those on the gynaecology wards. It would be incorrect to suggest that the difference is due to the women on the gynaecology ward taking particular interest in their nutrition because of the possibility of a pregnancy as the women measured on the this ward were of a wide age range, including post-menopausal women, and the women measured on other wards of child-bearing age would have the same viewpoint. Similarly, the patients on the medical and surgical wards may have been ill for some length of time, resulting in deteriorating nutritional status however, the same could apply for those patients on the gynaecology ward. It is interesting to note that patients on the private ward have a significantly better level of nutrition than patients in the rest of the hospital which does suggest that greater wealth is associated with an improved dietary intake, possibly as a result of a higher standard of living.

The general trend seems to be that there is a significant difference between younger patients and older patients with a greater incidence of malnutrition among the older patients. This could be due to the type of medical conditions found in these individuals or because elderly

patients are less able to cope with disease especially as a loss of protein rich tissue associated with age results in decreased efficiency when dealing with catabolism. Other factors such as poor dentition, lethargy, loss of appetite and poor mobility can all lead to malnutrition in an older person. Medical staff should be aware that people in the older age groups are more susceptible to malnutrition so that not only can their detection can be improved but preventative or curative measures can be taken.

There was no significant difference of the incidence of malnutrition among patients of a lower income as measured by whether they received charity. Malnutrition as determined by a low BMI and small arm measurements could be linked to a low standard of living and thus a low income. This hypothesis is backed up by the result that there is a statistical difference between the nutritional status of patients on the private ward. Whether patients receive charity may not be a suitable cut-off with which to distinguish between those that can afford sufficient food and those who cannot. From the results, it seems that patients who receive charity and those who do not, all experience factors which lead to malnutrition which may be social, environmental or financial.

The mean percentage weight loss was 2.53%. When this is converted to absolute weights (Table 5.13) it can be seen that the reduction in weight experienced by these patients is fairly small. This is encouraging for the hospital as it shows there is minimal deterioration nutritionally in the patients. Although their condition does not improve it does not get seriously worse and compared to the McWhirter and Pennington study (1994) where the mean percentage weight loss was 5.4% it is apparently better. It may be that the Nepali patients have been malnourished for some length of time and therefore any significant weight loss has occurred prior to reaching hospital. The deterioration of the severely malnourished

patients in Patan Hospital could be a continuation of the decline which was happening before they were admitted, which may explain the finding that severely malnourished patients lost more weight than the rest, although this wasn't statistically significant. This is contrary to the study in Dundee (McWhirter and Pennington (1994) where the severely undernourished patients showed least weight lost. This is probably due to these patients having been referred for nutritional support in the Scottish study. Weight changes that occur during a hospital stay may be due to poor dietary intake or due to medical factors associated such as the growth or extraction of a malignancy.

There was no significant difference in the weight change of any of the sub-groups measured which means that all patients should be viewed with equal importance. It should be remembered that the number of patients who were measured on discharge was 41 and therefore there were relatively small numbers in each sub-group i.e. specialty, category of nutritional status (Table 5.15), age, gender, level of income with which to perform statistical analysis.

According to waist circumference the number of patients who were at risk from cardiovascular disease was 27 (17.1%) which is a relatively small number of patients and therefore is consistent with the finding that 6.1% were overweight. When waist-hip ratios are used 4.3% of men were at risk from cardiovascular disease which is in keeping with the previous results. However, 49.4% of women were at risk which suggests that some degree of caution should be exercised when using waist-hip ratio in Nepali women as this is not consistent with the previous results. Furthermore, populations differ in the level of risk associated with a particular waist circumference (WHO 1997) therefore these predictors for cardiovascular disease should be used with some reserve. Those patients who are deemed as

at risk should receive some nutritional advice on lipid lowering and weight reduction to try and minimise their risk from cardiovascular disease. It would be interesting to repeat this aspect of the study in the future and plot trends in those patients who are at risk then taking the appropriate measures accordingly.

6.2 Limitations

The classification of patients into different categories of nutritional status is dependent upon their BMI, triceps skinfold thickness and mid-upper arm muscle circumference. The Body Mass Index was devised by Adolphe Quetelet, a Belgian Statistician in 1835 and since then has been refined by various Western figures to produce the present reference criteria. The reference data on the arm was derived from a population of Caucasian Americans in the 1970's. It is therefore questionable as to how close these parameters are to the healthy Nepali population and consequently how applicable these parameters are for assessing malnutrition in such populations. Consequently, for a study such as this which uses anthropometric measurements to assess the incidence of malnutrition in populations such as the Nepali people, it must be remembered that some degree of error probably does occur.

On one hand, the use of BMI in the Nepali population where healthy people are naturally short and of low body weight may over diagnose for malnutrition. On the other hand, as it is linked to height, then someone of a low weight may be diagnosed as healthy when actually they are malnourished. For short people, such as the Nepali's, the body weight may have to be too low to register as undernourished. Ideally, therefore, parameters need to be devised for all races, Caucasians, Indians, blacks, Chinese etc.

There are various areas in the design of the study where errors could occur. Firstly, there is intra-examiner error. The technique used to take the measurements may vary between patients. This could be due to increasing experience over the duration of the study, or conversely, increasing fatigue during the course of a day or over the weeks the study was conducted. There is also a chance that error could occur with the recording of data as it relied

upon one person reading the measurements out to another who then wrote them down. This is an opportunity for error, for example, if the scribe should mishear. Those patients who were measured on discharge were not measured at the same time of day or in the same clothes as when they were measured previously which could cause inaccuracies. Similarly, with the patients who were measured on admission, some were measured in the morning and some in the afternoon which may affect comparisons between the individuals. Demi-span was used to predict height in those patients who could not stand to have their height measured directly. This was frequently carried out in older patients who were quite frail. WHO (1995) suggest that the accuracy of the demi-span measurement decreases with the age of the individual.

As well as those individuals who did not meet the inclusion criteria or who declined to take part, other patients were not measured for various reasons. Some were at the operating theatre or had just returned, others had spent some length of time in the emergency room and therefore had been in hospital longer than others. In a minimal number of cases, some women could not take part as their husbands were not available to give consent.

Part of the study relied on a translator which allows error to occur during the interpretation of meanings and the conveying of concepts. This involved asking the patient about their recent weight history which was then helped to assess that individual's nutritional status depending on whether they had lost weight in the last three months. Not only could this have given rise to error by using a translator but if a patient could not quantify their weight history, they were asked to describe it as none, a little, a moderate amount or a severe amount. This method is very subjective and allows error to occur in how people interpret these classifications.

6.3 Conclusion

As 53% of the patients admitted to Patan Hospital were undernourished there is clearly a need for adequate nutritional support within the hospital. Although it appears that these patients do not significantly deteriorate nutritionally during their hospital stay, there is still a responsibility to address the poor level of nutrition amongst the patients. Not only are patient's resources limited but those at the hospital, in terms of staff, equipment and money, are too. Using the resources available, attempts should be made to effectively address the level of undernutrition in the hospital and as a nutritional supplement has recently been launched there, its increased use may be one approach. Even if systems are in place to treat malnutrition, they will be ineffective without the alliance of the medical staff. It is important for the medical staff to be able to evaluate whether a patient is malnourished, and be able to treat them, encourage them and monitor their progress. It is necessary that there is an understanding of the implications which malnutrition has on the medical outcome so that Doctors and nursing staff can appreciate the need for adequate nutritional support. Furthermore, an awareness of particularly susceptible patients such as older individuals and medical and surgical patients may help to focus limited resources.

Implications for Patan Hospital

- Medical staff to be aware that 53% of patients are malnourished
- Medical staff to appreciate the effect malnutrition has on treatment outcome
- Medical staff to be aware that older patients are more at risk from malnutrition than younger patients
- Medical staff to be aware that medical and surgical patients are most at risk from malnutrition
- Simple, cheap and non-invasive methods to be in place to evaluate patients nutritional status
- The development of systems for effective nutritional support either from food fortification, sip feeds such as 'Paustik Sanjiwani' or NG/PEG feeding
- Education of nursing staff of nutritional assessment, monitoring and support
- Education for doctors on the importance of clinical nutrition
- Education for family members on appropriate nutritional support
- Improved incorporation of nutrition education for nurse and doctors at the undergraduate level
- Future research to monitor trends in malnutrition and obesity/risk from cardiovascular disease

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Appendix

Appendix 1. Preparation of "Paustik Sanjiwani"

Ingredients per 500 ml volume:

		Kitchen measure
Whole milk	450g	450 ml jug
Egg	(approx) 50g	1 whole egg
Sarbottam Pitho*	30g	50 ml beaker
Sugar	30g	25 ml beaker
Vegetable oil	15g	20 ml syringe
Haematinic #	5g	5 ml syringe
Vitamin C	125mg	¼ of 500 mg tablet
0.1% w/v Potassium Iodide solution	1g	1 ml syringe

Preparation:

1. Place egg, sarbottam pitho, sugar, oil and half volume of mlik in cooking pot. Mix together and palce on medium heat. Bring to boil stirring continuously. Remove from heat as soon as mixture starts to bubble. Take care not to overcook.
2. Add remaining volume of milk, mixing well. Pour into individual bottles, stirring in between to ensure equal distribution of all particles between each bottle. Cover and leave to cool.
3. When cooled, add haematinic, vitamin C and potassium iodide to each bottle. Shake well.

Note: Sugar-free version for those with unstable blood sugars made by simply ommitting sugar (lower energy content).
For powdered milk version, use 60g whole milk powder per 500ml feed. Cook with other dry ingredients plus 250 ml water; then top up to full volume with boiled water.

* Sarbottam Pitho: a lcoally avaialble weaning food made of 2 parts soyabean, 1 part maize and 1 part wheat, roasted and ground into flour.

\# Haematinic: a medicinal syrup produced by Lomus Pharamceutical; contents per 5ml ferrous gluconate IP 50mg, folic acid IP 0.5mg, pyridoxine HCl IP 0.5 mg, zinc sulphate IP 15mg, elemental zinc 3.4 mg, cyanocobalamine IP 5µg, flavoured base.

Appendix 2. Consent Form (Nepali version and English version)

बिरामी मंजुरी फारम

पाटन हस्पिटलमा भर्ना भएका बिरामीहरुको पोषण अवस्थाको अध्ययन

१. हस्पिटलमा भर्ना गरिएका बिरामीहरुको पोषण अवस्था सम्बन्धमा अध्ययन गरिनेछ।
२. क) नदुख्ने किसिमले मेरो शरीरको नाप तौल गर्न सकने छन्।
ख) मैले बुझेको छु कि केही जानकारीहरु मेडिकल रेकर्डहरुबाट लिन सकिनेछ।
३. जुनसुकै अवस्थामा पनि गोप्यनियता र गुमनामी पूर्णत: कायम राखिनेछ र मैले चाहेको खण्डमा जुनसुकै समयमा पनि यस अध्ययन कार्यबाट अलगिन सक्ने छु।
४. यस सहभागितावाट र यो अध्ययनको परिणामबाट मलाई व्यक्तिगत तवरमा कुनै प्रत्यक्ष फाइदा हुने छैन।

मैले उपरोक्त जानकारीहरु पढेको छु वा मलाई स्पष्ट रुपमा पूर्ण जानकारी दिइएको छ र म/मेरो संरक्षक (नाता पर्ने) यस अध्ययनमा भाग लिनको लागि स्विकृति जनाउँदछु।

नाम: ..... मिति: .....

साक्षी: .....

The Nutritional Status of Patients In Patan Hospital

1. The nutritional status of the patients admitted in Patan Hospital will be assessed.
2. Non-painful measurements of my body can be taken.

2b. I know that some information may be noted from my medical records.

3. I understand that at all times complete confidentiality and anonymity will be upheld and should I wish to cease participation in this study I am free to do so.
4. I realise that the results of this study may not directly benefit me.

I have read or had the above information fully explained to me and give my consent to participate in this study.

Name of Patient..... Date.....

Witnessed By.....