STUDY OF NUTRITIONAL STATUS AND FACTORS ASSOCIATED WITH ELDERLY PEOPLE LIVING IN OLD AGE HOMES OF ITAHARI MUNICIPALITY, NEPAL

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Study of Nutritional Status and Factors Associated with Elderly People Living in Old Age Homes of Itahari Municipality, Nepal

A dissertation submitted to the Central Department of Food Technology, Institute of Science and Technology, Tribhuvan University, in partial fulfillment of the requirements for the degree of BSc. Nutrition and Dietetics

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Approval Letter

This **dissertation** is entitled ***Study of Nutritional Status and Factors Associated with Elderly People Living in Old Age Homes of Itahari Municipality, Nepal*** by **Ranju Rai,** has been accepted as the partial fulfillment of the requirements for the **B.Sc. degree in Nutrition and Dietetics.**

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(Ranju Rai)

Abstract

The growing elderly population worldwide has intensified concerns about malnutrition, which significantly affects physical health, functional ability, and quality of life. This study aimed to assess the nutritional status and identify associated factors among elderly individuals residing in old age homes of Itahari Municipality, Nepal. An analytical cross-sectional study was conducted among 108 elderly residents (aged 60 years and above) from three institutions—Shree Ram Janaki Briddha Ashram, Maya Ghar Nepal, and Krishna Pranami Ashram. Census sampling was used, and data were collected through a semi-structured questionnaire, anthropometric measurements, and dietary assessments using the Mini Nutritional Assessment and Body Impedance Analyzer. Data analysis was performed using SPSS version 22.

Among the participants, 75% were females and 25% males. The majority (52.8%) were aged 60–70 years, and 70.4% were literate. Based on the MNA, 13% were malnourished, 66.7% were at risk, and only 20.4% were well-nourished. According to BMI (Asian cut-off), 34.3% were normal, 15.7% overweight, 33.3% obese and 16.7% were underweight. The mean dietary intake showed inadequacy across all macronutrients, insufficient protein and calorie intake (100%). Visceral fat and body fat percentages were also elevated in many participants, indicating a risk of obesity-related conditions.

Statistical analysis revealed that education ($p = 0.006$) and physical activity ($p = 0.008$) were significantly associated with nutritional status. Elderly individuals with lower educational attainment and those performing less than one hour of daily physical activity were more likely to be malnourished. Other factors such as gender, marital status, and disease condition did not show significant associations.

The study concludes that malnutrition and its risk are highly prevalent among elderly individuals living in institutional settings of Itahari Municipality. Poor dietary intake, limited physical activity, and low education levels were the main determinants. Regular nutritional assessment, improved meal quality, nutrition education, and promotion of daily physical activity are recommended to enhance the health and well-being of the elderly population.

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List of Abbreviations

Abbreviation	Full form
BIA	Bioelectrical Impedance Analysis
BMD	Bone Mineral Density
BMI	Body Mass Index
BST	Behavioral Susceptibility Hypothesis
CC	Chest Circumference
CCT	Central Campus of Technology
CVD	Cardiovascular Disease
DBM	Double Burden of Malnutrition
DDS	Dietary Diversity Scores
DM	Diabetes Mellitus
HDL	High-density lipoprotein
HOD	Head of Department
LDL	Low-Density Lipoprotein
MNA	Mini Nutrition Assessment
PA	Physical Activity
TU	Tribhuvan University
UNICEF	United Nations Children's Fund
WC	Waist Circumference
WHO	World Health Organization
WHR	Waist Hip Ratio
ESPEN	European Society for Clinical Nutrition and Metabolism
CI	Confidence Interval
OR	Odds Ratio
SD	Standard Deviation
SPSS	Statistical Package for the Social Sciences
NCDS	Non-Communicable Diseases
RDA	Recommended Dietary Allowance

Part I

Introduction

1.1 Background of the study

Aging is a natural, lifelong process that starts at conception and concludes with death. Growing older and maturing are connected to aging. As a result, we have all aged since our birth. (Chalise, 2018) Growing older at the cellular, organ, or body level throughout a lifetime is known as aging. The majority of developing nations have recognized the age of 65 as the criterion of "elderly" people, according to the World Health Organization. The elderly can be divided into three groups: young old (60–74 years old), old old (75–84 years old), and oldest old (>85 years old). The United Nations suggested a cut-off point for the elderly population at 60 years of age or older (Naja *et al.*, 2017).

The nutritional status of elderly people is crucial for healthy aging, enabling them to maintain productive lives and reduce the progression of chronic diseases. Given that the quality of life tends to decline with age, it becomes particularly crucial for elderly individuals. (Karki *et al.*, 2024). Nutrition plays an important role in the overall well-being of human beings, more so in the elderly (Bhatta *et al.*, 2023). Nutritional status is a key component that reduces morbidity and mortality among the elderly, and good nutritional status is the foundation of a healthy life (Dhakal et al., 2023). Both physical and overall well-being are impacted by nutrition. Nutrition is especially important as one ages since age-related physiological changes can lead to malnutrition (Agarwal *et al.*, 2013). Elderly people are at especially high risk for malnutrition. The consequences of malnutrition may include increased risks for morbidity and mortality, decreased cognitive function, and reduced immune function. (Kaiser *et al.*, 2010)

In a global assessment on the incidence of malnutrition in older adults in various contexts, (Kaiser *et al.*, 2010) discovered that over half of the research participants were either malnourished (22.8%) or at risk for malnutrition (46.2%). It appears that this distribution varies significantly depending on the context. The geriatric rehabilitation environment had the highest percentage of senior individuals suffering from malnutrition (50.2%), followed by the hospital setting (38.7%). In a similar vein (Dent *et al.*, 2012) found that 40.0% of hospitalized elderly patients had it. According to (Kaiser *et al.*, 2010), the frequency in

nursing homes was 13.8%. The elderly who lived at home had the lowest frequency (5.8%).

1.2 Statement of the problem and justification

The number of people in the world who are 60 years of age or older is expected to double from 1 billion in 2020 to 2.1 billion by 2050, indicating that the population is aging quickly (Anon., 2025) (*Ageing and Health*, n.d.). In low- and middle-income nations like Nepal, where health services are still adjusting to the special demands of the elderly, this demographic transition poses serious public health issues. People are more susceptible to malnutrition as they become older because of a complex interaction of social, psychological, physiological, and economic variables (Kaiser *et al.*, 2010).

In Nepal, an increasing number of older people are being placed in institutional care, such as old age homes, as a result of shifting family arrangements, urbanization, and migration. These institutions may not have the necessary funding or staff to guarantee the best possible nutritional treatment, even while their main goals are to offer shelter and necessities. Furthermore, aging frequently brings with it physical restrictions, sensory impairments, chronic illnesses, and polypharmacy, all of which can negatively impact nutritional status and food consumption (Haboubi, 2010). Elderly malnutrition is a serious problem as it is linked to greater mortality, delayed wound healing, lower functional status, weakened immunity, and increased morbidity (Volkert *et al*., 2019). The significant frequency of undernutrition and danger of malnutrition among older people in institutions has been documented in a number of international research (Donini *et al.*, 2013). However, there is a dearth of thorough information about the nutritional status of senior citizens residing in assisted living facilities in Nepal, and the variables affecting their nutritional well-being are still not well understood. Designing focused treatments and enhancing the quality of life in this group requires determining the nutritional status and related risk variables, including functional ability, psychological well-being, dietary diversity, chronic illnesses, and social support. Thus, the purpose of this study is to evaluate the nutritional status and investigate the risk factors that are related to it among senior citizens who live in old age homes in Itahari, Nepal. The results of this study will add to the body of knowledge required to direct initiatives and policies meant to encourage healthy aging in institutional settings.

1.3 Objectives of the Study

1.3.1 General Objective

To assess the nutritional status and identify the factors associated with malnutrition among elderly people living in elderly homes in Itahari Municipality.

1.3.2 Specific Objective

1. To assess the nutritional status of elderly individuals (aged 60 years and above) residing in elderly homes in Itahari Municipality, using anthropometric, dietary, and nutritional assessment tools.
2. To examine the prevalence of malnutrition and the risk of malnutrition among elderly residents.
3. To identify socio-demographic factors (e.g., age, gender, marital status, and educational level) influencing their nutritional status.

1.4 Research Questions

i. What is the nutritional status of elderly individuals (aged 60 years and above) residing in elderly homes in Itahari municipality, as measured by anthropometric, dietary, and nutritional assessment tools?

ii. What is the prevalence and level of malnutrition among elderly residents in elderly homes in Itahari municipality?

iii. How do socio-demographic factors such as age, gender, marital status, and educational level influence the nutritional status of elderly individuals in elderly homes?

1.5 Significance of the study

- To provide information regarding the nutritional status and associated factors of elderly people residing in old age homes of Itahari municipality.
- To help raise awareness among people of the current scenario of nutrition and health-related problems in the elderly homes.
- To help identify the risk groups and extent of nutritional risks for further intervention.
- To encourage other researchers and youths to conduct further research on similar topics
- To serve as a baseline for other organizations and institutions.

1.6 Limitations of the study

- The data cannot be generalized to other populations since findings may not represent all elderly people of the community.
- Biochemical assessments were not conducted due to limited resources, which restricted the ability to evaluate the participants nutritional status.

Part II

Literature Review

2.1 Concept of aging

The process of aging is the aging of cells, organs, or the entire body over the course of a lifetime (Naja *et al.*, 2017). The emergence of life approximately 3.5 billion years ago marked the beginning of the universal process of aging. A build-up of the various harmful alterations brought on by aging in the cells and tissues gradually reduces function and may even result in death. Development, genetic flaws, environmental factors, illness, and an innate process called aging can all be blamed for variations in aging (Harman, 2001). The famous American gerontologist Bernard Strehler defines aging using four postulates:

1. The phenomenon of aging is universal, meaning that each member of a species must experience aging to varying degrees.
2. The causes of aging must be endogenous; they cannot be influenced by external sources. This means that aging must be intrinsic.
3. Aging must be progressive: Throughout a person's life, changes that cause aging must take place gradually (but they must also happen to young people, albeit in modest amounts).
4. Ageing must be harmful: that is, a phenomenon linked to aging will only be regarded as a contributing factor to the aging process if it is "bad" for the individual (Viña *et al.*, 2007).

2.2 Ageing scenario in the world, Asia, and Nepal

The number of people 80 years of age and older is expected to more than triple over that time. The number of individuals aged 80 and above is expected to more than triple between 2024 and 2074 (Chernopolski *et al.*). It's estimated that by 2050, more than 20% of India's population The globe is aging quickly. Between 2015 and 2030, the number of people in the world aged 60 years or over is projected to grow by 56%, from 901 million to 1.4 billion, and by 2050, the global population of older persons is projected to more than double its size in 2015, reaching nearly 2.1 billion(Chernopolski *et al.*). In East and Northeast Asia, the percentage of the elderly will be much greater, with one in three individuals being over 60.

The majority of these individuals will be women without pensions or other forms of social security (UNFPA Asia, n.d.). In the Asia Pacific region, there will be 1.3 billion persons 60 and older by 2050, more than double the current figure. One in ten persons will be 60 or older by the middle of this century, while one in four will be. The proportion of individuals over 65 nearly quadrupled globally between 1974 and 2024, rising from 5.5% to 10.3%. According to United Nations demographic forecasts, this figure will double once again between 2024 and 2074, reaching 20.7%. They will be 60 years of age or older. Interestingly, it is anticipated that the number of people over 80 would increase by almost 29% between 2022 and 2050 (UNFPA India., n.d.)

In Nepal, the percentage of the elderly population is rising quickly. According to the 2021 census, there are 2.97 million elderly persons in Nepal, a 38.2% rise from the 2011 census. In Nepal, the percentage of the population that is older reached 10.21%. The average population growth rate in Nepal during the past ten years has been 0.92%, while the senior population has grown at a rate of 3.29% annually. However, Nepal's average life expectancy is currently at 71 years, infant mortality is about 23 per thousand live births, and overall fertility is below replacement level. Nepal's median age is 25, and the country's aging index rose sharply from 23.3 in 2011 to 36.7 in the country's 2021 census. According to these statistics, aging is happening quickly, and the trend of young people migrating abroad may cause the caring load to rise quickly in the days ahead. In this regard, the government of Nepal must concentrate on population control, as well as the provision of social security and high-quality services for the country's aging population. The elderly population in Nepal is growing at an average annual rate of 3.29%, compared to the overall population growth rate of 0.92% (Chalise, 2023). Nepal's total population is estimated to be approximately 29.6 million as of 2025 (Nepal Population (2025), n.d.). In light of the results of a recent study by (Karki *et al.*, 2024) and the National Population and Housing Census 2021: In 2021, 2.97 million persons in Nepal were 60 years of age or older, making up 10.21% of the country's total population. Compared to the 2011 census, this is a 38.2% increase. The old population is growing at a pace of 3.29% annually, which is far faster than the 0.92% growth rate of the overall population (Mahjabeen, 2023).

2.3 Malnutrition

Malnutrition is defined as a state in which a deficiency, excess, or imbalance of energy, protein, and other nutrients causes adverse effects on body form, function, and clinical outcome (Stratton *et al.*, 2003). It is more common and increasing in the older population; currently, 16% of those and 2% of those years are classified as malnourished. These figures are predicted to rise dramatically in the next 30 years. Almost two-thirds of general and acute hospital beds are used by people aged. (Corcoran *et al.*, 2019) Malnutrition in the elderly further increases an individual's risk of naturally developing general poor health or chronic diseases, such as sarcopenia and cardiovascular disease (Agarwal *et al.*, 2013). Malnutrition can describe an overall state of poor nutritional status, including under-nutrition and over-nutrition of macronutrients and/or micronutrients. According to the American Society for Parenteral and Enteral Nutrition and the Academy of Nutrition, a minimum of two of six criteria, low energy intake, weight loss, loss of muscle mass, loss of subcutaneous fat, fluid accumulation, and hand grip strength, need to be fulfilled to diagnose an individual as being malnourished (Volkert *et al.*, 2019)

According to (WHO (1996), there are four forms of malnutrition. They are as follows:

- Under-nutrition: This is a condition that result when insufficient food is eaten over an extended period of time. In extreme case, it is called starvation.
- Over-nutrition: This is a pathological state resulting from the consumption of excessive quantities of food over an extended period. The high incidence of obesity, atheroma, and diabetes in Western societies is attributed to over nutrition.
- Imbalance: It is the pathological state resulting from a disproportion among essential nutrients, with or without absolute deficiency of any nutrients (Jelliffe and Organization, 1966)

2.4 Under-nutrition in geriatric people

Under nutrition is a common and serious concern in the elderly population, influenced by physiological, psychological, and socioeconomic factors. Age-related changes such as reduced appetite, impaired dentition, swallowing difficulties, and diminished sensory perception often result in inadequate dietary intake. Additionally, chronic illnesses,

polypharmacy, and depression further exacerbate the risk of malnutrition in older adults (Rasheed and Woods, 2014).

Undernutrition in the elderly leads to sarcopenia, frailty, functional decline, longer hospital stays, and increased mortality (Chen *et al.*, 2025). Therefore, early identification and nutritional interventions are essential to improve health outcomes in this vulnerable group.

2.5 Micronutrient Deficiency Disorder

Micronutrient deficiencies are a major concern among the elderly due to physiological changes, reduced dietary intake, chronic diseases, and medication use. Common deficiencies include vitamins D, B12, folate, iron, calcium, and zinc, which significantly affect morbidity and quality of life in older populations (Sing and Fischer, 2013).

Vitamin D deficiency is highly prevalent in the elderly, largely due to reduced skin synthesis, limited sun exposure, and dietary inadequacy. Studies estimate that more than 50% of older adults worldwide have insufficient vitamin D levels, increasing the risk of osteoporosis, fractures, and sarcopenia (Cashman *et al.*, 2016). Similarly, vitamin B12 deficiency is common, particularly in institutionalized elderly, due to malabsorption associated with atrophic gastritis and long-term use of proton pump inhibitors. Low B12 levels are linked with anemia, cognitive decline, and neuropathy (Stover, 2008).

Iron deficiency, though less prevalent, can arise from inadequate intake or chronic blood loss, leading to anemia and fatigue. Calcium deficiency is also significant, contributing to osteoporosis and fractures (Voulgaridou *et al.*, 2023).

In South Asia, including Nepal, micronutrient malnutrition in older adults is aggravated by socioeconomic barriers, limited access to nutrient-rich foods, and lack of awareness. A community-based study in Nepal reported high rates of anemia and vitamin D deficiency among the elderly, highlighting the need for nutritional interventions (Shrestha *et al.*, 2024).

2.6 Over nutrition:

An energy imbalance known as overnutrition occurs when calorie and nutrient consumption surpasses the body's needs. This usually manifests as central (abdominal) obesity, overweight, or obesity in older persons. Because of their links to chronic diseases, diminished physical functioning, and a lower quality of life, these problems are becoming

more and more common among the elderly and pose significant public health issues. As individuals age, basal metabolic rate and lean body mass decline while fat mass— especially visceral fat increases, often even without a significant increase in calorie consumption (Villareal *et al.*, 2005)

Hormonal changes, age-related sarcopenia, and reduced physical activity are frequently the causes of this alteration. Despite being widely used to measure obesity, body mass index (BMI) may understate the health hazards associated with fat in older adults. In this age range, central obesity, which is frequently determined by waist circumference or waist-to- hip ratio, is a more accurate indicator of metabolic and cardiovascular risk (De Hollander *et al.*, 2012). Numerous detrimental health effects, including type 2 diabetes mellitus, hypertension, dyslipidemia, cardiovascular disease, decreased mobility, systemic inflammation, and cognitive decline, are linked to overnutrition in the elderly (Villareal *et al.*, 2005; De Hollander *et al.*, 2012).

2.7 Risk Factors Affecting Nutritional Status in the Elder

The nutritional status of elderly people is influenced by aging, chronic diseases, low socioeconomic status, poor diet, and social isolation. Studies show that limited dietary diversity, physical inactivity, and inadequate care in old age homes increase the risk of malnutrition among older adults (Fávaro-Moreira *et al*., 2016; Tamang *et al*., 2019).

2.7.1 Socioeconomic factors

The primary source of health problems in the elderly is socioeconomic level; there are clear correlations between income, economic standing, and health (Chen *et al.*, 2025). Elderly people have a variety of socioeconomic demands that should be taken into account, such as the availability of healthcare, needs for clothes, food, housing, transportation, and community facilities, as well as a variety of abuses (Chen *et al.*, 2014; Rabie *et al.*, 2016). Targeted social pensions are successful in lowering poverty among older adults and their households. It is occasionally asserted that pensions, like other monetary transfers, might provide additional favorable well-being results, such as enhanced health status (Shrestha *et al.*, 2024).

2.7.2 Pathological factors

The cumulative impact of chronic conditions, including diabetes, hypertension, hyperlipidemia, and atherosclerosis, on an individual's functionality can also be seen as the aging process (Drewnowski and Evans, 2001). The aging process negatively impacts the immunological defense system. There is compelling evidence that a compromised immune system might lower life expectancy and disease resistance in older adults (Amarya *et al.*, 2015). Disease processes, including those observed in musculoskeletal and skin wear and tear or cardiovascular disease, overlap with natural changes in the body's condition with aging, such as those related to the immunological, circulatory, and endocrine systems (Freemont and Hoyland, 2007).

2.7.3 Psychological factors

Old age and psychological well-being are intimately associated (Joseph and N., 2022). Studies show that among older people and cultures, depression is more common, life satisfaction is lower, and adjustment issues are more common (Jena, 2018). Due to living alone, a lack of close family ties, or diminished links to their culture of origin, many people suffer from loneliness and sadness as they age, making it difficult for them to actively engage in community activities. People inevitably lose touch with their networks of friends as they become older, and they also find it harder to make new acquaintances and fit in with new groups (Singh and Misra, 2009).

2.7.4 Diabetes

Diabetes affects at least 20% of the population over the age of 65 (Kalra and Sharma, 2018). As people age, the prevalence of type 2 diabetes and prediabetes rises. Age-related insulin secretion deficiencies and increasing insulin resistance brought on by sarcopenia and changes in body composition are the main causes of hyperglycemia (Mordarska and Godziejewska-Zawada, 2017). Diabetes management in the elderly should focus on the prevention and limitation of geriatric syndromes (medical conditions encountered in elderly persons), hypoglycemia (low blood glucose), and neurocognitive dysfunction (impairment in the functioning of the nervous system and brain (Kalra and Sharma, 2018).

2.7.5 Hypertension

The incidence of hypertension in the geriatric population is very high and is a significant determinant of cardiovascular risk in this group (Sowers, 1987). Hypertension is an important modifiable risk factor for cardiovascular morbidity and mortality and for chronic occlusive peripheral arterial disease, congestive heart failure, aortic aneurysm, and chronic kidney disease. The risk of death from ischemic heart disease (IHD) or stroke increases dramatically in a log-linear fashion for blood pressure (BP) levels higher than 115/75 mm Hg, even in individuals without known vascular disease at baseline (LEWINGTON, 2002). Senescent changes in the cardiovascular system, leading to decreased vascular compliance and decreased baroreceptor sensitivity, contribute not only to rising blood pressure but also to an impairment of postural reflexes and orthostatic hypotension. Senescent changes in the cardiovascular system, leading to decreased vascular compliance and decreased baroreceptor sensitivity, contribute not only to rising blood pressure but also to an impairment of postural reflexes and orthostatic hypotension (Sowers, 1987).

2.7.6 Marital status

Married persons are reported to have a lower incidence of mental disorders, illness, and mortality than single people. Additionally, those who are separated or divorced had the highest self-rated health status rate, followed by bereaved people. Additionally, married people report higher levels of life satisfaction and less psychological suffering than single people (Pandey *et al.*, 2023).

2.7.7 Smoking, Drinking, and Tobacco Habits

Seniors who smoke have a higher chance of dying from cardiovascular disease and cancer than people who have never smoked. Additionally, smoking is linked to worse health outcomes and lowers older persons' quality of life (Peixoto *et al.*, 2005).

There is a very complicated relationship between smoking and food consumption. The most distinctive of tobacco's constituents, nicotine is a highly poisonous alkaloid that has both depressive and ganglionic stimulant properties. According to recent research, exposure to tobacco smoke is linked to a significant decrease in monoamine oxidase, an enzyme involved in mood regulation. Such impacts have been shown to cause dysregulation of appetite or attitudes toward food (Dallongeville *et al.*, 1998). Alcoholism and tobacco use are linked to

health issues such as disruptions in lipid, glucose, and protein metabolism, which might impact the dependent person's nutritional status (Sampson, 2020)

2.7.8 Dietary Intake

Food frequency questionnaire and 24-Hour dietary recall were used for the assessment of dietary intake. The food frequency questionnaire was used to obtain information on the type of foods consumed by the respondents in the preceding days and the frequency of consumption of those foods. All the types of foods listed were read out and asked the participants to point out the foods they eat and the frequency of consumption of those foods within a week or fortnightly (Shim, J. S., Oh, K., & Kim, H. C.,2014).

For 24 24-hour dietary recall, the respondents were asked to recall the foods they had taken in the past 24-hours. Respondents were also asked about the leftovers of the food items they had taken. Prompts were given to make it easy to remember the time and amount of the food item they had eaten. Portion size of the food was estimated as per the utensils that were calibrated prior to the study. A record form was created and all the information was recorded in the form for further analysis (Gibson, 2005; Thompson & Subar, 2017; Shim, Oh, & Kim, 2014)

With the help of information obtained from dietary assessment, nutrients like fat, energy, calories, and carbohydrates were calculated. Nutrients like fat, protein, carbohydrate and total calories were calculated and classified according to WHO recommendations. It is recommended that 15-30 % of total calories should be included from fat (WHO 2017). Similarly, it is recommended that 55-75% of total calories should be included from carbohydrate (Manna and Kalita, 2016). Protein intake should be 1.1 g/kg (WHO 2002).

2.7.9 Dietary Habit

A vegan or completely vegetarian diet consists solely of plant-based foods such as fruits, vegetables, grains, seeds, nuts, and legumes (dry beans and peas), whereas a non- vegetarian diet also includes meat and meat derivatives. Animal products are minimal or nonexistent in the majority of vegetarian diets. Additionally, they have higher levels of fiber, other minerals, phytochemicals, and lower levels of cholesterol, saturated fats, and total fats (Shah *et al.*, 2025). Some ethnic groups, faiths, and other groups avoid non- vegetarian diets. A

decrease in total and resting energy requirements (physical inactivity, loss of lean muscle mass, and increased adiposity) makes older persons more susceptible to nutrient deficiencies. This causes them to gradually cut back on food intake while their vitamin and mineral requirements either stay the same or rise (Starr *et al.*, 2015). Inadequate dietary consumption is linked to several illnesses, such as osteoporosis, sarcopenia, malnutrition, and cognitive impairment (Baugreet *et al.*, 2017).

2.7.10 Physical activity

Physical activity has been indicated as a strategy to promote health in the elderly. As well as to encourage the maintenance of functional capacity, and acts in the prevention and control of various diseases (Busse *et al.*, 2009). Physical activity is of paramount importance to good health, increasing work capacity and extended longevity (O *et al.*, 2019). It doesn't require much work to start exercising. On most days of the week, we only need to engage in moderate physical exercise for 30 minutes. Raking leaves, cycling, gardening, and brisk walking are a few examples of such hobbies. (Gibbons *et al.*, 2013)

Additionally, aerobics, swimming, cycling, and hiking are all equally beneficial for burning calories and reducing obesity, which is a risk factor for chronic diseases like diabetes and high blood pressure. However, people's level of physical activity has decreased due in large part to sedentary lifestyles, a lack of interest in outdoor activities, the use of passive modes of transportation, and rising urbanization. Currently, about 14% of Nepalese people lead lives that are not physically active enough. Over the past thirty years, Nepal's mean body mass index has also been steadily rising in tandem with a corresponding rise in non-communicable diseases (Chataut *et al.*, 2012)

2.8 Anthropometric Indices

In wealthy nations, obesity has become a pandemic. Obesity and overweight are recognized to have serious negative effects on one's physical and mental well-being. Although the exact process underlying the development of obesity is unknown, it is thought to be a condition with several underlying causes. The increased global prevalence of obesity is mostly due to environmental variables, lifestyle choices, and cultural context. As a first screening tool for nutritional status, anthropometry is a simple, affordable, dependable, and efficient technique. Numerous anthropometric measures, such as the body mass index (BMI), waist circumference, and waist-to-hip ratio, have been established to characterize obesity and the

distribution of body fat (WHR) (Lee *et al.*, 2021). In women, abdominal obesity is defined as a waist circumference of 80 cm or more, and in men, it is 90 cm (Brussels 2006). WHR more than 0.9 for men and larger than 0.85 for women are considered indicators of abdominal obesity. The hip circumference is measured at the maximum buttock circumference, at a level concerning the floor (Nishida *et al*., 2010). The person's body mass index is determined using their height and weight measurements. The ratio of height in meters squared to weight in kilograms is known as the BMI. This is a useful metric for classifying long-term energy deficits. BMI is thought to be a reliable measure of nutritional status (Pablo *et al.*, 2003).

2.9 Assessment of nutritional status

An individual's nutritional status is often influenced by a number of variables that interact at various levels. Public health depends on understanding how nutrition affects the development of various diseases and evaluating the nutritional status of an individual, family, and society. One of the first steps in developing any public health policy to prevent malnutrition is assessing the nutritional condition of the community. Determining the type, extent, and distribution of malnutrition in various geographic areas to identify at-risk groups and identify contributing variables is the main goal of such an evaluation. Furthermore, fractural evidence of the precise extent of malnutrition is necessary to alert lawmakers and administrators to the need to allocate funds and human resources and to make suitable plans. The information below can be used to evaluate nutritional status;

Direct method: The direct method focuses on the individual and measure objective indicators such as biochemical, dietary evaluation method, anthropometric, and clinical examinations (Waterlow, 1997).

a) Indirect method: Use community indicators, such as dietary consumption, morbidity and mortality rates, and specific mortality and vital statistics, to represent the nutritional state or requirements of the population (Waterlow, 1997).

b) Ecological factors: e.g., socioeconomic level, housing and environmental cleanliness, access to healthcare and education, and infections caused by conditioning (Waterlow, 1997).

2.10 Anthropometric method of nutritional assessment

Anthropometry is the most widely applicable, affordable, and non-invasive approach for determining the size, proportion, and comparison of the human body (*Physical Status*, n.d.). The anthropometric measurements change according to race, sex, age, and nutritional status. Furthermore, these assessments can yield data on historical dietary histories that are not as reliably available through other evaluation methods. Although the techniques cannot be utilized to diagnose particular nutritional deficiency states, they can occasionally detect moderate to severe levels of malnutrition (Gibson, 2005).

2. 11 Bioelectrical impedance analysis

BIA is a simple, affordable, and non-invasive method of estimating body composition. For bedside measures based on the body's proportions of water, fat, and muscle, it performs admirably. The capacity of the human body to conduct an alternating electrical current is necessary for BIA. Bone, air, and fat tissues are more difficult for the current to pass through than tissues with a high water and electrolyte content, such as muscles and blood. As a result, the body's capacity to conduct current rises as its fat-free mass does. BIA offers helpful information on total body water, body cell mass, and fat mass after adjusting for age, sex, and ethnicity (Reber *et al.*, 2019).

2. 12 Mini Nutritional Assessment in geriatric people

An efficient and simple-to-use technique for determining whether elderly individuals are malnourished or at risk of becoming so is the Mini Nutritional Assessment. The MNA includes geriatric-specific assessment questions about mobility, subjective health, independence, quality of life, cognitive function, and nutritional and health issues. The ESPEN advises using the MNA for regular geriatric evaluations. The MNA may be finished in 10 to 15 minutes, but because of the time required, it is not often used in acute care settings. Rubenstein and colleagues identified a subset of 18 questions from the complete MNA that had high sensitivity, specificity, and correlation to the full MNA in order to eliminate this issue and create a six-question MNA-SF (Kaiser *et al.*, 2009). Measurements of body weight and size, inquiries regarding food, drinks, and recognized risk factors for malnutrition, as well as self-assessment questions, make up the 18 components that make up the MNA. Points are awarded for each item and are then totaled to a maximum of 30 points. The test taker's

final MNA score defines their nutritional status as either normal (> 23.5 points), at risk of malnutrition (17–23.5 points), or malnourished (< 17 points). The first six questions from the complete MNA format are the only ones used in the MNA-SF. The maximum score in this case is 14 points. The MNA test handbook advises the examiner to perform a thorough evaluation using all 18 MNA items if the patient has less than or equal to 11 points, which is considered to be the typical nutritional state of 12–14 points (Lundin *et al.*, 2012). The questionnaire for the Short Form MNA is shown in Appendices B:

2.13 Indicators of nutritional status in geriatric people

2.13.1 Body Mass Index

Body mass index, which is calculated as weight (kg) divided by height (m^2), indicates illness risk in both underweight and obese people. According to scientific data analyzed by WHO, Asian populations differ from European populations in the relationships between BMI, body fat percentage, and health hazards. The consultation's findings indicated that the percentage of Asians who are at a high risk of developing type 2 diabetes and heart disease is significant at BMIs below the current WHO overweight cutoff value of approximately 25 kg/m^2 (WHO, 2004).

The Asian cut-offs for BMI are:

Table 2.1: Classification of Asian BMI cut-offs

Classification	BMI (kg/m^2)	Risk of comorbidities
Underweight	<18.5	Low Risk
Normal	18.5-22.9	Acceptable Risk
Overweight	23-24.9	Increased Risk
Obese	≥25	High Risk

(Source: WHO, 2004)

2.13.2 Body circumference (waist and hip)

A flexible, non-elastic measuring tape can be used to measure hip and waist circumferences. The maximal circumference of the buttocks is used to calculate the hip circumference. The plane between the inferior rib border and the umbilical scar was used to calculate the waist circumference. Individuals with potential health hazards were identified using the waist

circumference, with threshold values of > 88 cm for women and ≥ 102 cm for males (Lean *et al.*, 1995). CC has been proposed, together with arm circumference, to be a valid nutritional screening instrument for malnutrition in the elderly (Bannerman *et al.*, 2002).

2.13.3 Waist to Hip Ratio

The waist-to-hip ratio, or WHR, is increasingly being used to estimate a potential increase in abdominal fat in order to identify people who may be at risk for developing dyslipidemias, arterial hypertension, non-insulin-dependent diabetes mellitus, and/or coronary issues. Desirable WHR readings are less than 1.00 for men and less than 0.85 for women (Molarius *et al.*, 1999).

2.13.4 Body Fat Percentage

BMI guidelines are based on the basic assumption that body mass, after adjusting for stature squared, has a strong correlation with body fatness and the resulting morbidity and death. Some people, with more muscle mass, are overweight but not overfat. Some individuals possess a normal BMI; nonetheless, a significant portion of their body weight is composed of fat. In particular, there are no widely recognized published body fat ranges; those that are based on demographic percentiles, empirically established boundaries, and z scores have significant drawbacks.

A study assessing body composition using bioelectrical impedance analysis (BIA) in a population aged over 60 years reported that the mean body fat percentage was 31.0 ± 4.5% in men (average age ~70 years) and 43.9 ± 4.3% in women (average age ~68 years), highlighting the gender differences in fat accumulation among the elderly population. (Deurenberg *et al.*, 1990)

PART III

Materials and Methods

3.1 Research Method

A community-based cross-sectional and descriptive survey was conducted to determine the nutritional status and factors associated with the nutritional status of elderly people aged above 60 in the old age homes of Itahari Municipality. The survey was conducted using a semi-structured questionnaire and other tools, such as anthropometric tools and a BIA machine, to collect the data.

3.2 Study Period

This study was done from March 25th to August 25th, 2025, following the receipt of ethical clearance.

3.3 Study Location

The study was conducted in old age homes of Itahari Municipality, comprising Krishna Pranami Ashram, Shree RamJanaki Briddha Ashram, Maya Ghar Nepal.

3.4 Study Population

The study population was the elderly people aged above 60 years residing in the old age homes of Itahari municipality.

3.5 Sampling

A census sampling technique was applied, considering the limited number of elderly individuals in old-age homes. All eligible residents who meet the inclusion criteria was included in the study.

3.6 Sample size calculation

The calculation of sample size was done by Cochran's statistical formula and finite

Cochran's Formula for Sample Size $n_0 = Z^2 * p*(1-p) / d^2$

Where:

- Confidence level (Z) =1.96 (Z-value for 95% confidence level)
- Estimated prevalence (p)=0.8 (Shrestha *et al*., 2024)
- Margin of error (d) =0.08

  Infinite population $n_0 = Z^2 * p*(1-p)/d^2$

  $n_0 = 98$

With 10% non-response rate,

sample size= 108

3.7 Criteria for sample selection

a) Inclusion Criteria:

- Elderly individuals aged 60 years and above residing in the selected old age homes of Itahari Municipality.
- Individuals who provide written or verbal consent to participate.

b) Exclusion Criteria:

- Elderly individuals with severe illness or bedridden conditions that prevent participation in interviews or physical measurements.
- Elderly individuals who refused to participate.
- Individuals with severe cognitive impairment affecting their ability to respond to questions accurately.

3.8 Data Collection method or technique

Data was collected in 2 steps, first with the preliminary interview of the respondents guided by a semi-structured questionnaire, followed by the measurements of anthropometry and body composition analysis. The data on socio-demography and anthropometry- Weight, Height, Waist

and Hip circumference, body composition, structured questionnaire, and dietary intake was collected.

3.9 Tools and instruments for data collection

The following tools and equipment were used for collecting data in the survey:

- Weighing Scale: A digital weighing balance with a maximum capacity of 180 kgs and having the least count of 0.1 kg will be used for measuring weight (Ulijaszek & Kerr.,1999).
- Height Measuring Scale or Stadiometer: A wooden plank stadiometer of maximum capacity for measurement of 197 cm and having the least count of 0.1 cm will be used to measure height of the study population (CDC, 2020; Casadei & Kiel, 2019).
- Measuring Tape: A non-stretchable flexible measuring tape with the list count of 1 mm of measurement of will be used for the measurement of waist and hip circumference (FANTA, 2018)
- Body Impedance Analyzer (BIA machine): The BIA machine will be used to measure the body composition of fat and other nutrients (Khalil *et al*., 2014; Pouragha *et al*., 2021).
- Measuring Cups: 1 set of measuring cups will be used as a reference for estimation of the food intake of the survey population during the dietary assessment (Shim *et al*., 2014; FAO, 2018).

3.10 Data entry and Analysis

Data entry and analysis was done through the use of Microsoft Excel 2016 and IBM SPSS. Before entering and analyzing the data, the qualitative data was coded and transcribed through use of labels. Chi square test and Fisher's Exact Test were done to determine the causal link between explanatory factors.

3.11 Research Variables

i) Dependent variables: The dependent variables in the study were:

- Socio-economic and demographic variables
- Dietary intake
- Behavioral Characteristics
- Physical activity

ii) Independent variables: The independent variables of the study were:

- Body Mass Index
- Waist Circumference
- Waist Hip Ratio
- Body Fat Composition

3.12 Pre-testing

The pre-testing was done among the mentioned group of elderly people, before starting the study to ensure reliability, efficiency, feasibility, validity, and consistency. The tools and techniques planned to be used in the study was tested before the final confirmation of their use. The questionnaire, anthropometric tools, and instruments were used during the pre-testing in the pilot survey. Any ambiguity, lack of sensitivity, or specificity identified in the pre-testing of the questionnaire were corrected through changes in the structure of the questions. Any instruments with faults and errors detected were replaced. The pre-testing period acted as a pilot survey to generate more in-depth ideas and dimensions about the factors associated with the Nutritional status of elderly people, which was be added to the questionnaire used in the actual survey.

3.13 Ethical Consideration

The study was carried out only after approval from the campus. Legal permission from the Municipality Office was obtained before the study. Informed consent was taken from the participants after explaining to them the objectives of the research, procedures, risks, benefits, inconvenience or discomfort, and even their right to denial for participation in the study. The anonymity of the study participants was well maintained. Confidentiality and security of the data and information provided were assured. The data and information provided were protected from unauthorized assessment, use, disclosure, theft, modification, or manipulation.

Part IV

Results and Discussions

A cross-sectional study to assess the nutritional status of geriatric people was conducted in 108 people (females-81, males-27) of old age homes in Itahari Municipality. The results obtained from this study are explained in the following headings.

4.1 Demographic Characteristics

There were relatively more people of age group 60-70 years i.e, 52.8% (57). The 70–80-years age group consisted of 25.9% (28) and the lowest was more than 80 years group i.e 21.3% (23). Age distribution of the study population is shown in the table 2. There were relatively more janajati i.e, 36.1% (39). (52.8% (57) were from Brahmin and chhetri. And others consisting of muslim and madhesi were 11.1% (12). There were relatively more hindu i.e 73.1% (79) among the surveyed population and Pranami were found i.e 20.4% (22). Muslim were found less, i.e 6.5% (7) only. Among 108 participants, 25% (27) were males and 75% (81) were females. There were more female participants involved in this study. Majority of the study population were married 51.9% (56), 38.9% (42) were unmarried and 9.3% (10) were widow/widower. The frequency distribution of demographic characters of the study is shown in table no. 4.1.

Table 4.1: Frequency Distribution of Demographic characters of the study population (n=108)

Demographic character	Frequency	Percent
Age		
60-70 years	57	52.8
70-80 years	28	25.9
80 and above	23	21.3
Ethnicity		
Brahmin/Chhetri	57	52.8
Janajati	39	36.1
Others	12	11.1
Religion		
Hindu	79	73.1
Pranami	22	20.4
Muslim	7	6.5
Gender		
Male	27	25
Female	81	75
Marital Status		
Married	56	51.9
Unmarried	42	38.9
Widow/Widower	10	9.3

4.2 Socioeconomic Characteristics

The study showed that 25% (27) were homemaker, 66.7% (72) were involved in agriculture and only 8.3% (9) were involved in services. The majority of participants (70.4%) were literate, whereas 29.6% had no formal education, indicating that most of the study population possessed basic reading and writing skills. The study showed that 75.9% (82) of the participants had nuclear family and rest 24.1% (26) had joint family. |30.6% (33) of the participants were involved in yoga, 38.9% (42) in meditation, and the same proportion of participants were involved in walking, i.e, 30.6% (33).

The study shows that 59.3% (64) were living in the old age home for less than 5 years and 40.7% (44) were living for 5 or more years. The majority of the participants, 68.5% (74), were found to have no disease conditions, while 13% (14) were diagnosed with hypertension, 3.7% (4) with diabetes, 4.6% (5) with arthritis, and 10.2% (11) with respiratory diseases.

The frequency distribution of socio-economic characters of the study population is shown in table no. 4.2.

Table 4.2: Frequency Distribution of Socio-economic characters of the study population (n=108)

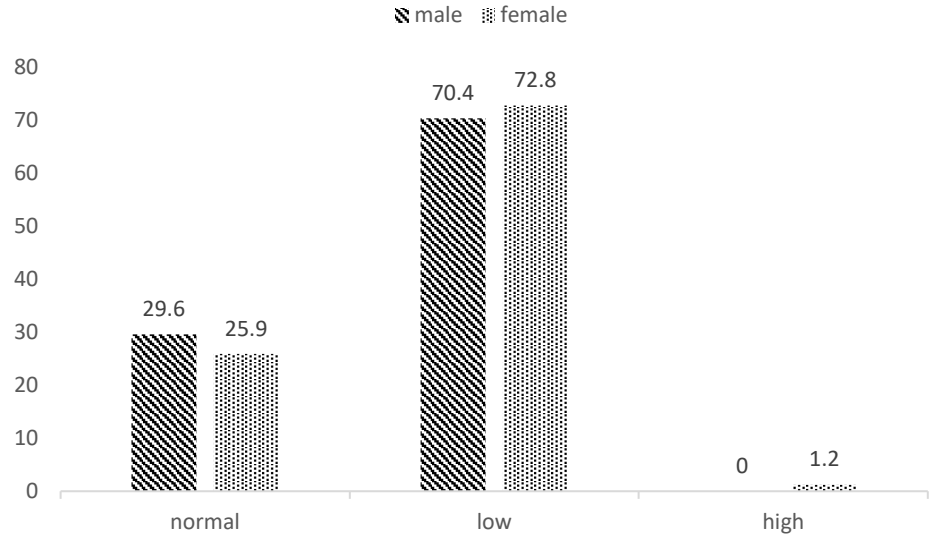
Socio-economic character	Frequency	Percent
Past Occupation		
Homemaker	27	25
Agriculture	72	66.7
Service	9	8.3
Education		
Illiterate	32	29.6
Literate	76	70.4
Family Type		
Nuclear	82	75.9
Joint	26	24.1
Physical Activity		
Yoga	33	30.6
Meditation	42	38.9
Walking	33	30.6
Duration of stay		
5 years or less	64	59.3
More than 5 years	44	40.7
Diseases		
None	74	68.5
Hypertension	14	13
Diabetes	4	3.7
Arthritis	5	4.6
Respiratory Diseases	11	10.2

4.3 Nutritional Status of the Study Population

4.3.1 Body Fat Percentage

The distribution of body fat categories differed slightly between genders. Among males (n= 27), the majority (70.4%) had low body fat, 29.6% had normal body fat, and none were classified as having high body fat. Among females (n = 81), 72.8% had low body fat, 25.9% had normal body fat, and 1.2% had high body fat. The nutritional status according to body fat percentage of the study population is given in figure 4.1.

Figure 4.1: Nutritional Status according to Body Fat Percentage of the Study Population (n=108)



4.3.2 Visceral Fat

For visceral fat males had a mean of 9.03 ± 4.83, ranging from 1.5 to 18.0, while females had a mean of 8.33 ± 5.11, ranging from 2.0 to 35.0. Although the mean VF was slightly higher in males, female participants showed a wider range of values, suggesting some individuals had very high visceral fat levels. The mean values of visceral fat of the study population are shown in table 4.3.

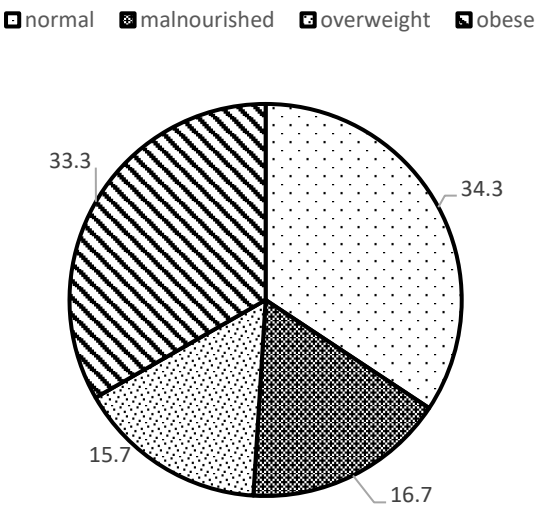
Table 4.3: Mean values of visceral fat of the study population (n=108)

Variable	Gender	Mean ± SD	Range
Visceral Fat %	Male	9.03± 4.83	1.5-18.0
	Female	8.33± 5.11	2.0-35.0

4.3.3 Asian BMI

Among the participants, 16.7% were malnourished, 34.3% had a normal nutritional status, 15.7% were overweight, and 33.3% were obese. This shows that more than half of the population is affected by either undernutrition or overnutrition, with obesity being more prevalent than overweight. The nutritional status according to the Asian cut-off of the study population is shown in figure 4.2.

Figure 4.2: Nutritional Status according to the Asian cut-off of the Study Population (n=108)



4.2.4 Mini Nutritional Assessment

Out of the total study participants, 13% were malnourished, while a majority, 66.7% were at risk of malnutrition. Only 20.4% of the elderly had a normal nutritional status. This indicates that more than three-fourths of the elderly population in the old age homes were either malnourished or at risk, reflecting a high burden of poor nutritional status in this group. In a similar study carried out in the Nuwakot district in 2017, 24% were malnourished and 65% were at risk of malnutrition (Ghimire *et al*., 2017). The nutritional status of the study population according to MNA is shown in table no. 4.4.

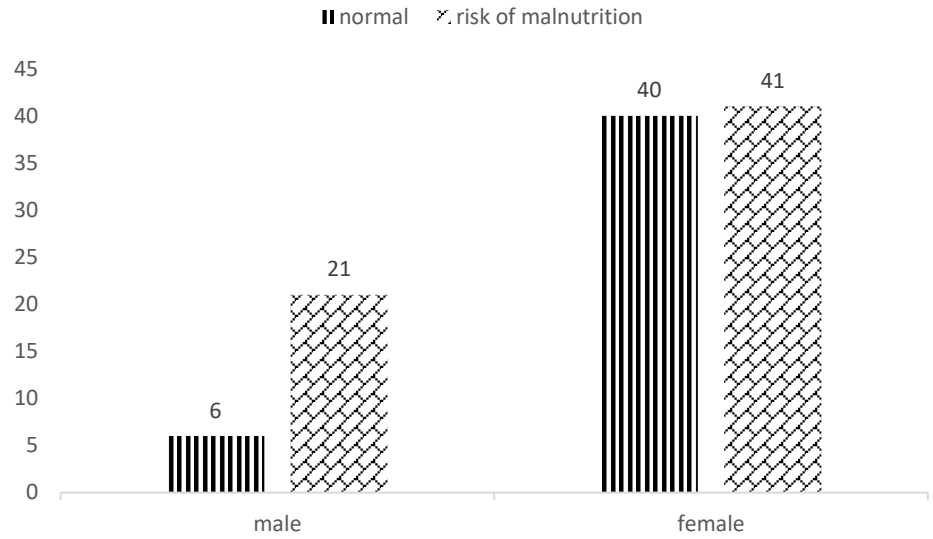
Table 4.4: Nutritional Status of the Study Population according to MNA (n=108)

	Frequency	**Percent**
Malnourished	14	13
At risk of malnutrition	72	66.7
Normal	22	20.4

4.2.5 Waist circumference

Based on WHO cut-off points for waist circumference, 38.0% (n = 41) of participants were females at risk of malnutrition, while 37.0% (n = 40) were normal females. Among males, 19.4% (n = 21) were at risk of malnutrition, whereas only 5.6% (n = 6) were within the normal range. This indicates that a higher proportion of females were in the risk category compared to males, suggesting a gender difference in abdominal adiposity and associated nutritional risk. The nutritional status based on waist circumference of the study population is given in figure 4.3.

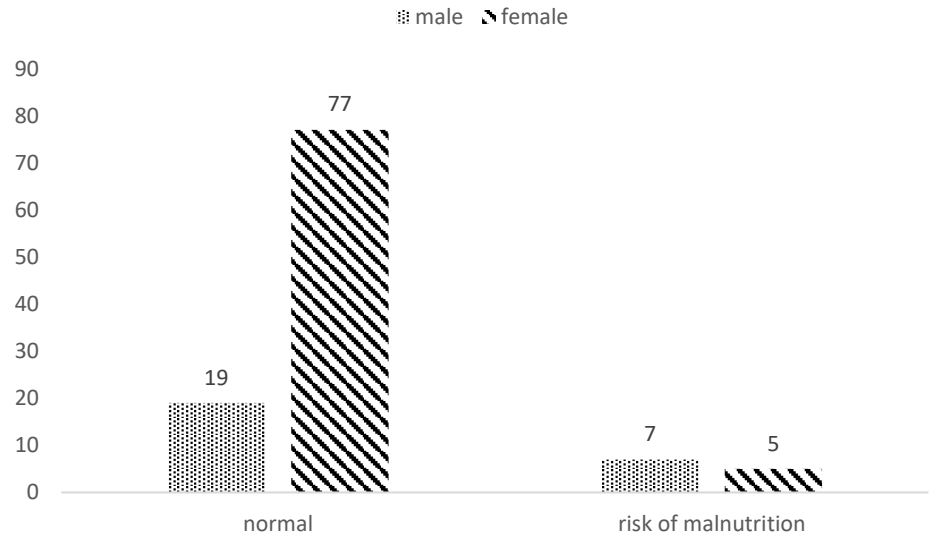
Figure 4.3: Nutritional Status Based on Waist Circumference of the Study Population (n=108)



4.2.6 Waist-Hip Ratio

Out of 108 participants, the majority of females (77, 71.3%) had a normal WHR, while 5 females (4.6%) were at risk of complications. Among males, 19 (17.6%) had a normal WHR, whereas 7 (6.5%) were at risk of complications. Overall, most participants (96 out of 108) had a normal WHR, indicating a lower risk of related health complications. The nutritional status of the study population based on the Waist-Hip ratio is given in fig.4.4.

Figure 4.4: Nutritional Status based on Waist-Hip Ratio of the Study Population (n=108)



4.3 Dietary Intake

4.3.1 Distribution of micronutrient intake among different old age homes

From the study, it was found that none of the participants (100%) had adequate calorie and protein intake, indicating complete inadequacy of protein and calorie consumption among the study population. The distribution of macronutrient intake among different old age homes is given in Table 4.5.

Table 4.5: Distribution of Macronutrient intake among different old-age home (n=108)

	Mean %			
Ashram	**Protein**	**Fats**	**Carbohydrate**	**Energy**
Krishna Pranami	30.4	39.5	153.7	1082
Maya Ghar Nepal	28.2	37.6	148.3	1040
Shree Ram Janaki	33.5	39.3	156.6	1096
Total	31.3	39.06	154.02	1081

The mean nutrient intake among the elderly varied across the three old age homes. At Pranami Ashram, the average protein intake was 30.40 ± 7.37 g, fat intake 39.56 ± 4.62 g, carbohydrate intake 153.71 ± 39.07 g, and energy intake 1082.67 ± 193.23 kcal. At Maya Ghar, the average protein intake was comparatively lower (28.22 ± 5.74 g), with fat at 37.17 ± 4.58 g, carbohydrate at 148.39 ± 29.14 g, and energy at 1040.00 ± 145.20 kcal. Meanwhile, Ram Janaki Ashram reported the highest mean protein intake (33.53 ± 8.38 g) and energy (1096.89 ± 204.40 kcal), along with fat (39.33 ± 4.78 g) and carbohydrate (156.60 ± 39.45 g). When combined, the overall mean nutrient intake across all three institutions (n=108) was 31.34 ± 7.78 g protein, 39.07 ± 4.72 g fat, 154.03 ± 37.56 g carbohydrate, and 1081.48 ± 190.46 kcal of energy.

4.3.2 Food frequency questionnaire

From the food frequency analysis, it was observed that all participants (100%) consumed cereals, pulses, green leafy vegetables, other vegetables, oil, and tea/coffee daily. Dairy products were consumed daily by 33.3%, regularly by 29.6%, and rarely by 37% of participants. Fruits were mostly consumed rarely (83.3%), with only 16.7% consuming them

regularly. More than half of the participants never consumed chicken (52.8%) and red meat (54.6%), while the remaining consumed them rarely. Fish and nuts were not consumed at all. Eggs were never consumed by 54.6% and rarely by 45.4% of participants. Ghee was regularly consumed by 16.7% and rarely by 83.3%. Sugar intake was high, with 96.3% consuming it daily. Processed foods were rarely consumed by 85.2% and never by 14.8%, while soft drinks were only consumed rarely (100%). The distribution of the food frequency questionnaire of respondents is shown in the table no. 4.6.

Table 4.6: Distribution of Respondents by Food Frequency Questionnaire of the Study Population (n=108)

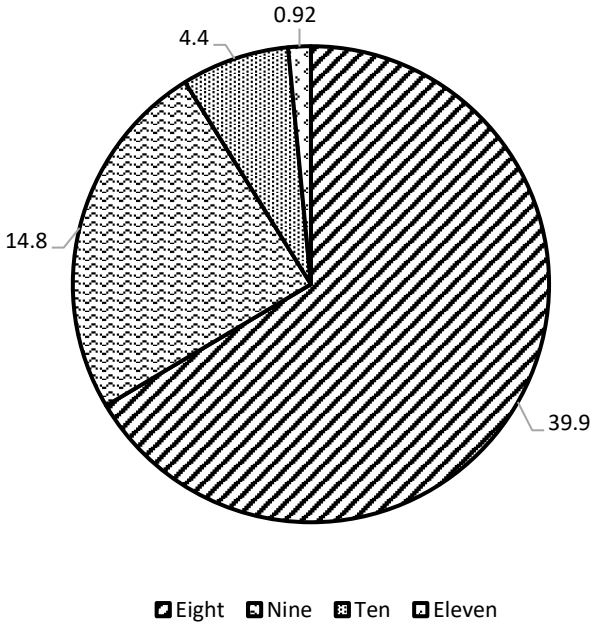
Food group	**Daily (%)**	**Regularly (%)**	**Rarely (%)**	**Never (%)**
Cereals	100	0	0	0.
Pulses	100	0	0	0
Green leafy vegetables	100	0	0	0
Other vegetables	100	0	0	0
Fruits	0	16	83	0
Chicken	0	0	47	52
Red meat	0	0	45	54
Fish	0	0	0	100
Eggs	0	0	45	54
Dairy products	33	29	37	0
Ghee	0	16	83	0
Oil	100	0	0	0
Nuts	0	0	0	100
Tea or coffee	100	0	0	0
Sugar	96	0	0	3
Soft drinks	0	0	100	0
Processed foods	0	0	85	14

4.3.3 Distribution of Dietary Diversity Score

The Dietary Diversity Score of the participants ranged from 8 to 11, with a mean score of 9.06 ± 0.94. Most participants (44.4%) had a DDS of 10, followed by 39.8% with a score of

8, 14.8% with a score of 9, and only 0.9% with the highest score of 11. This indicates that the majority had moderately high dietary diversity. The distribution of the diet diversity score of the study population is given in Figure 4.5.

Figure 4.5: Distribution of Dietary Diversity Score of the Study Population (n=108)



4.4 Factors associated with the nutritional status of the Geriatric Population

4.4.1 Demographic factors and Nutritional Status of the participants

The association of malnutrition risk with sociodemographic factors was analyzed. Age-wise distribution showed that the risk of malnutrition was higher among individuals aged more than 80 years (91.3%), compared to those aged 70–80 years (82.1%) and 60–70 years (75.4%). However, the association between age and nutritional status was not statistically significant ($p = 0.260$). In the study done in Okharpauwa, Nuwakot district, no association was shown between age and nutritional status (Ghimire *et al.*, 2017). Similarly, gender-wise comparison revealed that 85.2% of males and 79% of females were at risk of malnutrition, with no significant association observed ($p = 0.483$). This aligns with findings from a study by Man Kumar Tamang, which reported a higher prevalence of malnutrition among females (29%) compared to males (18%), though the difference was not statistically significant (Tamang *et al.*, 2019)

Ethnicity-wise comparison showed that 80.7% of Brahmin/Chhetri, 80% of Janajati, and 81.8% of Madhesi respondents were at risk of malnutrition, again with no significant association (p = 0.990). Similar findings were reported in Siraha District, where 19.8% of elderly were malnourished and 45.7% were at risk, indicating that malnutrition among elderly is widespread issue cutting across sociodemographic variable (Sharma *et al.*, 2021)

Marital status showed some variation, with 80.4% of married, 85.7% of unmarried, and 60% of widowed respondents being at risk of malnutrition. Although widows/widowers had a comparatively higher risk, the association was not statistically significant (p = 0.182). Similar to our findings, also reported a high prevalence of malnutrition and its risk among elderly individuals in Nepal, suggesting that age-related vulnerabilities may outweigh marital status in influencing nutritional outcomes (Sharma *et al.*, 2021). The demographic factors associated with nutritional status among the participants is shown in table no.4.7

Table 4.7: Demographic Factors associated with nutritional status among the participants

	Normal n(%)	**Risk of Malnutrition n(%)**	**Total**	**P-value**
Age				
60-70 years	14(24.6)	43(75.4)	57	0.260
70-80 years	5(17.9)	23(82.1)	28	
More than 80 years	2(8.7)	21(91.3)	23	
Gender				
Male	4(14.8)	23(85.2)	27	0.483
Female	17(21)	64(79)	81	
Religion				
Hindu	15(19)	64(81)	79	
Pranami	5(22.7)	17(77.3)	22	0.869
Muslim	1(14.3)	6(85.7)	7	
Ethnicity				
Brahmin/Chhetri	11(19.3)	46(80.7)	57	
Janajati	8(20)	32(80)	40	0.990
Madhesi	2(18.2)	9(81.8)	11	
Marital Status				
Married	11(19.6)	45(80.4)	56	
Unmarried	6(14.3)	36(85.7)	42	0.182
Widow/Widower	4(40)	6(60)	10	

4.4.2 Past occupation and nutritional status of participants

Occupation in the past also did not show a significant association (p = 0.766), with homemakers (77.8%), agricultural workers (80.6%), and service holders (88.9%) all showing high prevalence of malnutrition risk. This finding is consistent with evidence from Nepal, reported that 19.8% of elderly people were malnourished and 45.7% were at risk of malnutrition in Lahan, Siraha District, regardless of their occupational background. These results suggest that advanced age and associated physiological and social factors may have a stronger influence on malnutrition risk than past occupation (Sharma *et al.*, 2021)

Duration of stay in the old age home indicated that individuals staying more than 6 years had a higher prevalence of malnutrition risk (72.1%) compared to those staying 5 years or less (86.7%). Although this difference approached significance, it was not statistically significant (p = 0.073). Similar findings were reported in a study from Kathmandu Valley, where the duration of stay in old age homes was also not significantly associated with nutritional status (Singh and Shrestha, 2016). Finally, reasons for staying in the old age home showed that 82.2% of homeless elderly and 72.2% of those staying for religious purposes were at risk of malnutrition, with no significant association (p = 0.338).

There was a significant association between education and nutritional status (p = 0.006). Among the illiterate group, 31.3% were malnourished, 50% were at risk, and 18.8% were normal. In those with primary education, 6.3% were malnourished, 71.4% were at risk, and 22.2% were normal. None of the elderly with secondary education and above were malnourished, though 84.6% were at risk and 15.4% were normal. A statistically significant association was observed between educational status and the nutritional status of the respondents in the study by Jiwan Kumar Poudyal (Poudyal *et al.*, 2024). The socio-economic factor associate with nutritional status of the participants is shown in table no. 4.8.

Table 4.8: Socio-economic factor associated with nutritional status of the participants(n=108)

	Normal n(%)	Risk of Malnutrition n(%)	Total	P-value
Past occupation				
Homemaker	6(22.2)	21(77.8)	27	
Agriculture	14(19.4)	58(80.6)	72	0.766
Service	1(11.1)	8(88.9)	9	
Duration of stay				
5 years or less	8(13.3)	52(86.7)	60	0.073
More than 6 years	13(27.1)	35(72.1)	48	
Reason of Stay				
Homeless	16(17.8)	74(82.2)	90	0.338
Religion	5(27.8)	13(72.2)	18	
Education				
Illiterate	6(18.8)	16(50)	10(31.3)	
Primary level	14(22.2)	45(71.4)	4(6.3)	0.006
Secondary level	2(15.4)	11(84.6)	0	

4.5 Physical activity, lifestyle, and Nutritional Status

Risk of malnutrition was higher among participants performing only 1 hour of physical activity per day (94.6%) compared to those performing 2 hours per day (73.2%), and this difference was statistically significant (p = 0.008). These findings align with a study by Man Kumar Tamang, which reported that elderly individuals with low physical activity levels were significantly more likely to be malnourished (Tamang *et al.*, 2019). Sitting hours (1–5 hours vs. 6–10 hours) showed no significant association with nutritional status, with risk of malnutrition reported at 80% and 81.8% respectively (p = 0.826). The physical activity and lifestyle, associated with nutritional status among the study population is shown in table no.4.9.

Table 4.9: Physical Activity and Lifestyle, associated with Nutritional status among the Study Population. (n=108)

	Normal n(%)	Risk of Malnutrition n(%)	Total	P value
Physical Activity				
1 Hour	2(5.4)	35(94.6)	37	0.008
2 Hour	19(26.8)	52(73.2)	71	
Sitting Hour				
1-5 Hour	15(20)	60(80)	75	0.826
6-10 Hour	6(18.2)	27(81.8)	33	

4.6 Health and Medical History and Nutritional Status of the participants

The prevalence of malnutrition risk was high among participants with and without diseases, at 79.4% and 81.1%, respectively (p = 0.839). This aligns with findings from a study by Karki *et al*. (2024), which reported that 52.43% of elderly individuals with comorbidities and 47.56% without comorbidities were at risk of malnutrition, indicating no significant association between the presence of diseases and malnutrition risk (Karki *et al.*, 2024).

Participants who regularly used medication had a slightly lower risk (71.8%) compared to those who did not (81.3%), but this difference was not significant (p = 0.758). This is consistent with findings from Xiao-Lu Zheng, who identified polypharmacy as a prevalent factor among older patients (Zheng *et al.*, 2025).

Risk of malnutrition was 66.7% among participants admitted to the hospital in the past 6 months and 81.8% among those not admitted (p = 0.373), however this association was not statistically significant using Fisher's Exact Test. Among participants who experienced weight loss in the past 6 months, risk was 92.9% compared to 78.7% in those without weight loss, though this association was not statistically significant using Fisher's Exact Test (p = 0.296). The factors associated with health, medical history and nutritional status of the participants is shown in table no. 4.10.

Table 4.10: Factors Associated with Health, Medical History and Nutritional Status of the Participants (n=108)

	Normal n(%)	Risk of Malnutrition n(%)	Total	P value
Presence of diseases				
No	14(18.9)	60(81.1)	74	0.839
Yes	**7**(20.6)	27(79.4)	34	
Regular use of medication				
No	14(18.7)	61(81.3)	75	0.758
Yes	7(21.2)	26(71.8)	33	
Hospital admission in past 6 months				
No	18(18.2)	81(81.8)	99	0.373
Yes	3(33.3)	6(66.7)	9	
Weight loss in the past 6 months				
No	20(21.3)	74(78.7)	94	0.296
Yes	1(7.1)	13(92.9)	14	

4.7 Dietary Pattern and Intake and Nutritional Status of the participants

The high prevalence of malnutrition risk among both vegetarians (75.4%) and non-vegetarians (86.3%) observed in this study aligns with findings from Dijson Dhakal's journal, who reported that approximately 50% of elderly residents in old age homes were at risk of malnutrition. This suggests that factors beyond dietary preferences, such as overall diet quality and lifestyle, may play a more significant role in influencing nutritional status in the elderly population (Dhakal *et al.*, 2023).

Participants with moderate or poor appetite had higher malnutrition risk compared to those with good appetite, with 83.3% and 100% at risk, respectively, though this difference was not statistically significant ($p = 0.218$). This is consistent with the study by Kubra Cingar Alpay, which investigates the clinical implications of appetite loss in older adults (Cıngar Alpay *et al.*, 2025).

All participants who reported using alcohol or tobacco were at risk of malnutrition (100%), compared to 78.8% among those who did not use these substances, though the difference was not statistically significant ($p = 0.201$). This finding is consistent with a study by Tamang *et al.*, 2019, which reported that 17.3% of elderly participants used alcohol, and 12.4% used tobacco, but did not find a statistically significant association between substance use and malnutrition risk (Tamang *et al.*, 2019). The factor associate with dietary pattern with nutritional status of the study population is shown in table no. 4.11.

Table 4.11: Factor associate with Dietary Pattern with Nutritional Status of the Study Population (n=108)

	Normal n (%)	Risk of Malnutrition n (%)	Total	P value
Food Habit				
Vegetarian	14()	43(75.4)	57	0.155
Non-vegetarian	7(13.7)	44(86.3)	51	
Appetite				
good	7(31.8)	15(70)	22	
Moderate	14(16.7)	70(83.3)	84	0.218
Poor	0(0)	2(100)	2	
Use of Alcohol and Tobacco				
No	21(21.2)	78(78.8)	99	0.201
Yes	0(0)	9(100)	9	

4.8 Predictors of Nutritional Status Based on Binary Logistic Regression

Binary logistic regression showed that only physical activity duration was a significant predictor of nutritional status. Participants performing only 1 hour/day of physical activity had 5.65 times higher odds of being at risk of malnutrition compared to those performing 2 hours/day ($p = 0.029$, OR = 5.654, 95% CI: 1.189–26.879). Marital status, duration of stay in the old age home, and food habits were not statistically significant predictors ($p > 0.05$). Similar associations have been reported in studies by Bhatta and Tamang, highlighting the critical role of physical activity in the nutritional health of older adults in Nepal (Tamang *et al.*, 2019; Bhatta *et al.*, 2023). The binary logistic regression analysis of factors associated with nutritional status among elderly residents of old age homes is shown in table no. 4.12.

Table 4.12: Binary Logistic Regression Analysis of Factors Associated with Nutritional Status among Elderly Residents of Old Age Homes

Predictor	**Odd Ratio**	**P-value**	**95% CI for OR**
Marital Status		>0.05	0.646 – 14.743
Duration of stay in Old Age Home		>0.05	0.668 – 5.502
Physical Activity	5.654	0.029	1.189 – 26.879
Food Habit		>0.05	0.167 – 1.425

Part-V

Conclusion

- The study among 108 elderly residents (27 males, 81 females) in Itahari old age homes showed that, based on MNA, 13% were malnourished, 66.7% were at risk of malnutrition, and only 20.4% had a normal nutritional status.

- BMI assessment (Asian cut-off) revealed 16.7% underweight, 34.3% normal, 15.7% overweight, and 33.3% obese. Body fat analysis showed 70.4% of males and 72.8% of females had low body fat, with very few having high levels. Visceral fat levels averaged 9.03 ± 4.83 in males and 8.33 ± 5.11 in females.

- Dietary assessment highlighted poor nutrient intake, 100% inadequate calorie and protein intake. Mean daily intake was 31.34 ± 7.78 g protein, 39.07 ± 4.72 g fat, 154.03 ± 37.56 g carbohydrate, and 1081.48 ± 190.46 kcal energy. Fruits were rarely consumed (83.3% rare), while dairy consumption was limited (33.3% daily).

- The overall prevalence of malnutrition or risk of malnutrition was therefore 79.7% (n = 86), indicating a very high nutritional vulnerability in this population.

- Physical activity was a significant predictor: the elderly performing only 1 hour/day of activity had 5.65 times higher odds of malnutrition risk compared to those doing 2 hours/day ($p = 0.029$, OR = 5.654, 95% CI: 1.189–26.879). Education also showed a significant association ($p = 0.006$), with illiterate participants more likely to be malnourished.

- Other factors, including marital status, duration of stay, and food habits, did not show a statistically significant association with nutritional status.

Recommendations

The results of this study suggest the following recommendations:

- Introduce structured at least 150 minutes of moderate intensity aerobic activity per week (WHO,2011) alongside providing nutritionally adequate meals with sufficient protein and carbohydrate intake to improve the nutritional and functional status of elderly residents.

- Develop community support programs, provide funding for nutrient-rich foods, and organize training for caregivers to improve the nutrition and well-being of elderly residents in old age homes.

- This study can provide a background for a population-based intervention in attempts to prevent rising problems of malnutrition in the country.

- The campus should promote community-based nutrition projects and research that directly support the dietary and health needs of the elderly population.

Summary

Ageing is a growing global concern. Due to decreased fertility and increased life expectancy, the elderly population is increasing rapidly in many countries, including Nepal. With the rise in the geriatric population, their health and nutritional problems are also increasing. Malnutrition is a major cause of morbidity and mortality among elderly people.

An analytical cross-sectional study was conducted among 108 elderly residents (27 males and 81 females) living in old age homes of Itahari, Nepal. Data were collected using a pre-tested questionnaire that included socio-demographic information, dietary intake, and behavioral factors such as physical activity, alcohol, and tobacco use. Anthropometric measurements, including BMI, waist-hip ratio, visceral fat, and body composition, were taken to assess nutritional status. Dietary assessment and lifestyle factors were analyzed to identify associations with malnutrition. Data analysis was performed using SPSS version 22 and Microsoft Excel 2016. Descriptive statistics identified prevalence, and logistic regression determined predictors of malnutrition.

Findings revealed that 16.7% were malnourished, 34.3% had normal BMI, 15.7% were overweight, and 33.3% were obese. The participants that had inadequate protein intake and insufficient carbohydrate intake were 100%. Physical activity was a significant predictor, with 94.6% at risk among those performing 1 hour/day, versus 73.2% among those performing 2 hours/day ($p = 0.008$). Education showed a significant association with nutritional status ($p= 0.006$), with illiterate participants having the highest malnutrition prevalence. Age, gender, ethnicity, marital status, past occupation, duration of stay, and reason for staying in the old age home showed high malnutrition risk but were mostly not statistically significant.

The study concluded that the geriatric people who are malnourished and at risk of malnutrition required regular monitoring, support and education to sustain, revive and to achieve better health and nutritional outcomes in the future.

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Appendices

Appendix-A Survey Questionnaire

Nutritional Assessment form Department of Nutrition and Dietetics Central Campus of Technology Tribhuvan University
Dharan, Nepal

Nutritional Status and Associated Risk Factors with Elderly People Living in Old Age Homes of Itahari Municipality

Participants' Code: Date: _____/_____/

SECTION A: Socio-Demographic Information

Name _____

Age _____yrs

Gender _____

Religion
- Buddhist
- Hindu
- Muslim
- Christian
- Others _____

Ethnicity
- Bhramhin
- Janajati
- Madhesi
- Kshettri
- Others ___

Marital Status	Married
	Unmarried
	Divorced
	Widow/Widower
Past Occupation	Homemaker
	Service
	Business
Education	Illiterate
	Primary Level
	Secondary Level
	Graduate

9. Duration of stay in the old age home

10. Reason for staying in an old age home

11. Type of family before admission i. Nuclear ii. Joint iii. Extended

12. Support system (Do you have children/relatives who visit you?

SECTION B: Anthropometric Measurement

Indicators	Reading	Remarks
Weight in kg		BMI (kg/m^2)=
Height in cm		
Waist circumference		WHR=
Hip circumference		

SECTION C: Physical Activity and Lifestyle

1. Do you engage in any physical activity?

i. Yes ii. No

If yes, specify the type and duration _____ and _____ Hours

_____Minutes per day.

ii. How many hours do you spend sitting per day?

_____Hours _____Minutes per day.

SECTION D: Health and Medical History

1. Do you suffer from any chronic disease? (Specify):_____
2. Do you take any medications regularly? Yes / No (If yes, specify): _____

Any recent hospital admissions (past 6 months)? Yes / No

3. Do you experience difficulty in chewing or swallowing food? Yes / No
4. Do you have dental problems (loss of teeth, denture use)? Yes / No
5. Do you have any vision or hearing problems? Yes / No
6. Any weight loss in the last 3 months? Yes / No (If yes, how much?): _____

SECTION E: Dietary Pattern and Intake

1. What is your food habit? Vegetarian/Non-Vegetarian
2. How many meals do you eat per day? 1 / 2 / 3 / More
3. Are you satisfied with the quantity and quality of food served here? Yes / No
4. Do you take snacks in between meals? Yes / No
5. Do you consume fruits and vegetables daily? Yes / No
6. Do you consume protein-rich foods regularly (milk, egg, pulses, meat)? Yes / No
7. How is your appetite? Good / Moderate / Poor
8. Do you avoid any foods due to medical reasons or preferences? Yes / No (If yes, specify):

Do you consume alcohol or tobacco? Yes / No / Occasionally (If yes, specify):

SECTION F: Psychological and Functional Assessment

1. Do you feel lonely or depressed? Often / Sometimes / Never

2. Are you satisfied with your current living environment? Yes / No

3. Do you have sleeping problems? Yes / No

4. Can you walk without assistance? Yes / No

5. Do you need help with daily activities (bathing, dressing, eating)? Yes / No

6. How physically active are you? Not active / Moderately active / Active

SECTION G: 24-Hour Dietary Recall

Timing	**Description of food**	**Amount**
Breakfast		
Lunch		
Mid-snacks		
Snacks		
Dinner		
Bed-time		

SECTION H: Food Frequency Questionnaire

S.N.	Type of food	Daily	Regular (3-4 times a week)	Rare (once a week or less)	Never
1.	Cereals				
2.	Pulses				
3.	Green Leafy Vegetables				
4.	Other Vegetables				
5.	Fruits				
6.	Chicken				
7.	Red meat				
8.	Fish				
9.	Eggs				
10.	Dairy				
11.	Ghee				
12.	Oil				
13.	Nuts				
14.	Tea and coffee				
15.	Sugar				
16.	Soft drinks				
17.	Processed Foods				

SECTION I: Dietary diversity

Q. N	Food Group	Examples	YES=1 NO=0
1	CEREALS	corn/maize, rice, wheat, sorghum, millet or any other grains or foods made from these (e.g. bread, noodles, porridge or other grain products) *+ insert local foods e.g. ugali, nshima, porridge or paste*	
2	WHITE ROOTS AND TUBERS	white potatoes, white yam, white cassava, or other foods made from roots	
3	VITAMIN A RICH VEGETABLES AND TUBERS	pumpkin, carrot, squash, or sweet potato that are orange inside + *other locally available vitamin A rich vegetables (e.g. red sweet pepper)*	
4	DARK GREEN LEAFY VEGETABLES	dark green leafy vegetables, including wild forms *+ locally available vitamin A rich leaves such as amaranth, cassava leaves, kale, spinach*	
5	OTHER VEGETABLES	other vegetables (e.g. tomato, onion, eggplant) + *other locally available vegetables*	
6	VITAMIN A RICH FRUITS	ripe mango, cantaloupe, apricot (fresh or dried), ripe papaya, dried peach, and 100% fruit juice made from these + *other locally available vitamin A rich fruits*	
7	OTHER FRUITS	other fruits, including wild fruits and 100% fruit juice made from these	
8	ORGAN MEAT	liver, kidney, heart or other organ meats or blood-based foods	
9	FLESH MEATS	beef, pork, lamb, goat, rabbit, game, chicken, duck, other birds, insects	
10	EGGS	eggs from chicken, duck, guinea fowl or any other egg	

11	FISH AND SEAFOOD	fresh or dried fish or shellfish	
12	LEGUMES, NUTS AND SEEDS	dried beans, dried peas, lentils, nuts, seeds or foods made from these (eg. hummus, peanut butter)	
13	MILK AND MILK PRODUCTS	milk, cheese, yogurt or other milk products	
14	OILS AND FATS	oil, fats or butter added to food or used for cooking	
15	SWEETS	sugar, honey, sweetened soda or sweetened juice drinks, sugary foods such as chocolates, candies, cookies and cakes	
16	SPICES, CONDIMENTS, BEVERAGES	spices (black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, alcoholic beverages	

Total: ……

Appendix B

Mini Nutritional Assessment Score Table

A. Has food intake declined over the past three months due to loss of appetite, digestive problems, or chewing or swallowing difficulties?

Score

0 = Severe decrease in food intake

1 = Moderate decrease in food intake

2 = No decrease in food intake

B. Involuntary weight loss during the last 3 months? Score

0 = Weight loss greater than 3 kg

1 = Does not know

2 = Weight loss between 1 and 3 kg

3 = No weight loss

C. Mobility? Score

0 = Bed or chair bound

1 = Able to get out of bed/chair, but does not go out

2 = Goes out

a. Has the patient suffered psychological stress or acute disease in the past three months? Score

0 = Yes 2 = No

b. Neuropsychological problems? Score

0 = Severe dementia or depression 1= Mild dementia

2= No psychological problems

D. Body mass index (BMI)? (Weight in kg/height in m2) Score

0 = BMI less than 19

1= BMI 19 to less than 21

2= BMI 21 to less than 23

3= BMI 23 or greater

E. Waist circumference (WC) in cm Score

0 = WC less than 31 1 = CC 31 or greater

Total Score:

a) 12 points or greater- Normal

b) 11 points or lesser- Risk of malnutrition

c) 7 points or lesser- Malnourished

Appendix C

Consent Form

नमस्कार! मेरो नाम रञ्जु राई हो। म केन्द्रीय क्याम्पस, धरानमा पोषण तथा आहार विज्ञान, आठौं

सेमेस्टरमा अध्ययनरत विद्यार्थी हुँ। यस सौंकायको आठ औं सेमेस्टरको पाठ्यक्रम अन्तगगत म एक अनुसन्धान कायग गरररहेकी छु। मेरो अनुसन्धानको विषय, ―Nutritional Status and Associated Risk Factors with Elderly People Living in Old Age Homes of Itahari Municipality‖ रहेको छ। यसैले म तपाईंलाई सो अनुसन्धानमा सहभागी हन अनुरोध गदगछु। अनुसन्धान अन्तगगत म तपाईंलाई तपाईंको

खानपान सम्बन्धी जानकारी सोध्नेछु, साथै तपाईंको त ल, उचाइ र छालाको अिस्था सम्बन्धी विरण सौंकलन गररनेछ। यो प्रवक्रया लगभग १५-२० वमनेट जवत लाग्नेछ। तपाईंले वदनुभएका उत्तरहरूमा कुनै सही ा गलत भन्ने छैन, र सबै उत्तरहरू अनुसन्धान प्रयोजनका लावग मात्र प्रयोग गररनेछ। तपाईंको सहभावगता पूणग रूपमा स्वेच्छिक हनेछ। तपाईंले जुनसुकै समयमा यो अनुसन्धानबाट पवछ हट्न सक्नुहन्छ।

यो अनुसन्धानले तपाईंलाई कुनै पवन हावन पुरयाउने छैन। तपाईंको नाम, ठेगाना र अन्य व्यच्छिगत जानकारी गोप्य रूपमा राच्छखनेछ।

कृपया तल वदइएको जानकारी ध्यानपूिगक पढ्नुहोस् र तपाईं सहभागी हन चाहनुहन्छ ा चाहनुहन्न भन्ने छनोट गनुगहोस्।

तपाईं यस अनुसन्धानमा सहभागी हन मञ्जुर हनुहन्छ?

१. छु

२. छैन

उत्तरदाताको नाम: अन्तिागताागकताागको नाम:

सही: _____ सही:

_____

Appendix D Photo Gallery