DETERMINATION OF NUTRIENT ADEQUACY OF THE FOOD CATERED IN THE CHILD CARE HOMES (CCHs) OF SUNSARI DISTRICT

by

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A dissertation submitted to the Department of Nutrition and Dietetics Central Campus of Technology, Tribhuvan University, in the partial fulfillment of the requirements for the degree of B.Sc. Nutrition & Dietetics.

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Approval letter

This *dissertation* entitled *Determination of Nutrient Adequacy of the Food catered in the Child Care Homes (CCHs) of Sunsari District* presented by Om Prakash Sah has been accepted as the partial fulfillment of the requirements for the Bachelor degree in Nutrition and Dietetics.

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Abstract

Malnutrition continues to be a primary cause of ill health and mortality among school age orphan and vulnerable children in developing countries. Objective**:** Determination of nutrient adequacy of the food catered in the child care homes of Sunsari district. Methods**:** Weighing method was used for determining the amount of food eaten and food composition table was used to determine the nutrient content of food eaten. Anthropometric measurements were used to determine the nutritional status of the children and adolescent. Statistical analysis was performed by using the Statistical Package for Social Sciences for Windows SPSS (version 20.0). T-test and bivariate spearman correlation coefficients were used to compare the nutrient intake with respective RDA and to determine the association between nutrient intake and malnutrition respectively.

Results: The study revealed, 33.82% and 17.39% of study population were stunted and underweight respectively. Equal percentages (7.81%) of study population were overweight and thin. Probability of calorie and protein adequacy was found in 52.94% and 89.71% of study population in CCHs. Calcium intake of all children and adolescent were found to be below their RDA. Cereals contributed the highest amount by weight (355.3g) and proportion (39%) to the total diet for the study population in CCHs. Fruits 1% (12.9g) and additional oil 2% (20.9g) made a small contribution to the study population dietary intake. Fish and eggs were completely lacking in their diet. Probability of iron inadequacy was found in 80.9% of study population in CCHs. The proportion of stunting and underweight were inversely and significantly ($p<0.05$) correlated with population energy and iron intake respectively. The proportion of thin and stunting were positively and significantly correlated with study population's visible fat and calcium intake.

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List of Abbreviations

Abbreviation	Full form
AI	Adequate Intake
AIDS	Acquired Immune Deficiency Syndrome
ALA	Alpha-Linolenic Acid
ANR	Average Nutrient Requirement
CCH	Child Care Homes
CCWB	Central Child Welfare Board
CRC	Convention on the Right of the Child
DFSNs	District Food Security Networks
DRIs	Dietary Reference Intakes
EAR	Estimated Average Requirement
GFATM	Global Fund to Fight AIDS, Tuberculosis and Malaria
GoN	Government of Nepal
GDP	Gross Domestic Product
GHI	Global Hunger Index
HIV	Human Immune Deficiency Virus
ILO	International Labour Organisation
MoWCSW	Ministry of Women, Children and Social Welfare
MoAD	Ministry of Agricultural Development
NCHS	National Centre for Health Statistics
NGO	Non-Governmental Organizations
NHRC	Nepal Health Research Council
NFC	Nepal Food Corporation
NPA	Nepal Plan of Action
NIV	Nutrient Intake Value

NLSS	Nepal Living Standards Survey
NGO	Nepal Govermental Organization
NG	Nepal Government
RDA	Recommended Dietary Allowance
RNI	Recommended Nutrient Intake
SPSS	Statistical Package for Social Science
UI	Upper Intake
UNICEF	United Nations Children's Emergency Found
USAIDs	United Nations on HIV/AIDs
UNU	United Nations University
UNHCHR	United Office of the High Commissioner
WFP	World Food Program

Part I

Introduction

1.1 Background Information

Good nutrition is a fundamental component of survival, health and development for current and future generations. Good nutrition is vital for the cognitive and physical development and has both short and long term impacts on the quality of life experienced by individuals. Health and nutrition during early childhood is a strong reflection of countries' level of development as these conditions are directly linked to existing policies, programs and national plans which focus on early childhood well-being and children's rights (Sherif, 2016).

Good nutrition contributes to productivity, economic development, and poverty reduction by improving physical work capacity, cognitive development, school performance, and health by reducing disease and mortality. It is estimated that good infant and child nutrition leads to 2–3% growth annually in the economic wealth of developing countries. Additionally addressing malnutrition in early life can increase lifetime earnings by 20%. Alternatively, poor nutrition perpetuates the cycle of poverty and malnutrition through three main routes: direct losses in productivity from poor physical status and losses caused by disease linked with malnutrition; indirect losses from poor cognitive development and losses in schooling; and losses caused by increased health care costs (Sherif, 2016).

Nutritional status is the condition of the body resulting from the intake absorption and utilization of food (FAO, 1984). Nutrition related disorders can be caused by an insufficient intake of food or of certain nutrients, by an inability of the body to absorb and use nutrients, or by overconsumption of certain foods (WHO., 2016).

Orphanhood is a vast problem in the world with specific impacts on the social and public health sectors. According to the United Nations Children's Fund, children who have lost one or both parents are defined as orphan children. It is estimated that 153 million children worldwide have lost one or both parents. Although different sources provide different counts on orphan children, Asia is home to the largest number of orphans worldwide, where 60-80 million children are orphans (; UNICEF, 2010). In 2003, 87.6

million orphans were identified in Asia, while sub-Sahara Africa had a total record of 43.4 million orphans (UNAIDS *et al.*, 2004).

The political situation has left over 5000 children homeless, according to UNICEF study, and of those children 50% may be HIV positive and many more ill. Child mortality rates are the highest in Asia, and 50% of children are malnourished and this includes those with homes), for the homeless the situation is even worse. 2.6 million Children are working in Nepal, and nearly 5% of those working are in the cruelest forms of work (according to the International Labor Organization) (Bishokarma, 2013).

According to the survey for Regional Disparities in the Magnitude of Orphanhood in Nepal found that Western Mountain and Eastern Terai had higher and Central Hill had lower proportions of orphan. The possible factors related to Orphanhood were poverty and famine, conflict and displacement, a high adult mortality related to HIV/AIDS and maternal causes. The distribution of orphan children in households was varied by sub regions. Therefore, orphan welfare programs should be focused on those regions with higher proportions of orphans (Guragain *et al.*, 2015)

Souza *et al.* (2010) defined nutritional requirement as the amount of nutrients and energy available in foods that a healthy individual should ingest to meet his or her normal physiological requirements and prevent deficiency symptoms (means for similar population groups). Adequate nutrition is a fundamental right for every human being. If people fail to consume sufficient quality and quantity of nutrients, they will suffer from hunger or malnutrition. The main types of malnutrition seen in Nepal are protein-energy malnutrition, iodine deficiency disorders, iron deficiency anemia and vitamin A deficiency (Nutrition Section *et al.*, 2004).

1.2 Statement of the Problem

Nepal is now facing a concentrated epidemic of HIV/AIDS, high adult mortality including high maternal mortality and severe forms of poverty and famine. These factors may have resulted in many orphans in Nepal. According to the United Nations Office of the High Commissioner for Human Rights (UNHCHR) and Nepal conflict report (2012), more than 13,000 people were killed during the civil war and many people disappeared. Thousands of children became orphans and were internally displaced. (Guragain *et al.*, 2015).

Agriculture, manufacturing and the trade sectors are still lagging behind. According to the Nepal Living Standards Survey, the national average kilocalorie (Kcal) intake is 2,536Kcal per capita per day; a rate that is higher than the minimum average adequate requirement of 2,220Kcal set by the Government of Nepal. However, poor diet diversity is a serious problem across much of the country; more than 84 per cent of households in rural areas have a High Staple Diet(more than 60 per cent of their total calories are from staples) and more than half (52 per cent) have a very high staple diet i.e more than 75 per cent of their total calories are from staples (NPC., 2012).

Nepal confronts various forms of nutritional problems ranging from deficits in energy intake and imbalances in consumption of specific macro and micronutrients. In the past, only inadequacy of dietary intake or losses was considered to be a problem. Nepal is among ten countries in the world with the highest stunting prevalence, a measure of chronic under-nutrition, and one of top twenty countries with the largest number of stunted children. This problem affects 41 percent of its preschool children (Arimond and Ruel, 2011).

There are a very few studies done that provide data on nutritional status of children above 5-19 years in the South East Asian Region (Haider and Bhatia, 2006). Very few studies are available in Nepalese context on adolescent nutrition. A study done on adolescent girls of age 9-16 years in Kavrepalanchowk district has shown that prevalence of underweight, stunting and thinness was 31.98%, 21.08% and 14.94% respectively (Mansur *et al.*, 2015). The proportion of underweight children decreased from 48% in 2001 to 45% in 2006. This means that almost half of the children are suffering from malnutrition, which results in health problems as well as impaired cognitive development (GON, 2006).

No study has been conducted for determination of nutrient adequacy of food catered to children in Child Care Homes (CCHs) on Sunsari district till date. This study has been planned to assess the nutrient adequacy and nutritional status of the children in CCHs of Sunsari district. It can be beneficial for the policy makers at both local and national level.

1.3 Significance of Study

The findings of the study will be helpful to.

a) Provide information about the nutrient adequacy of food catered in to the CCHs.
b) Improve the nutritional quality of food provided in the CCHs if necessary.

1.4 Research Questions

a) Are the children in CCHs getting adequate nutrient?
b) What is the existing nutritional status of the children residing in CCHs?

1.5 Objectives

1.5.1 General objectives

Determination of nutrient adequacy of the food catered in the CCHs of Sunsari district.

1.5.2 Specific objectives

1. To assess the food intake and nutrient intake of children and adolescent in CCHs.
2. To compare the nutrient intake by the children and adolescent with Recommended Dietary Allowance (RDA).
3. To determine the association between nutrient intake and malnutrition.

1.6 Conceptual Framework

The conceptual framework for this study envisaged the main underlying preconditions that determine adequate nutrition as insufficient access to food, poor personal hygiene, inadequate sanitation facilities and lack of vaccination: the immediate preconditions as inadequate diet and disease. The degree of an individual's or a household's access to these preconditions affect how well they are nourished (Mwaniki and Makokha, 2013).

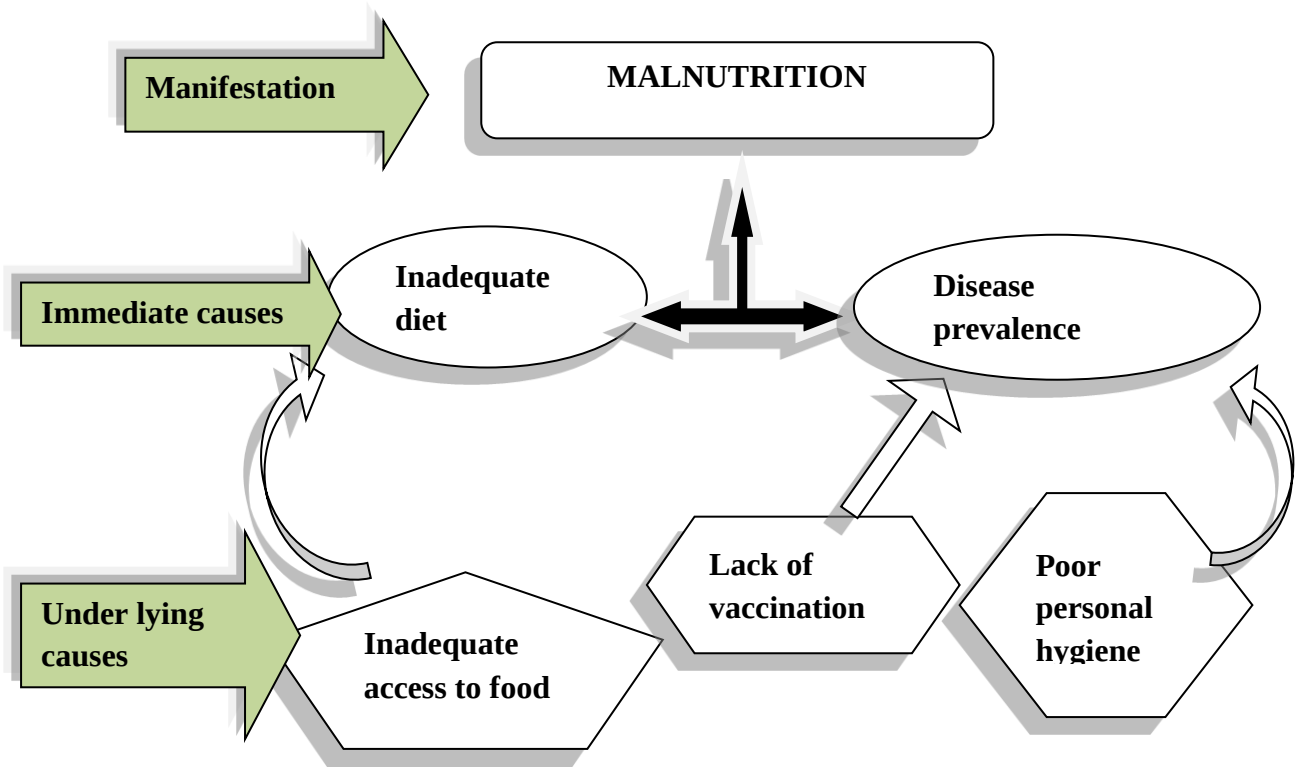

Fig. 1.1 Conceptual frame work for this study (Mwaniki and Makokha, 2013).

1.7 Limitation of the study

While conducting the survey following limitation might be seen and this is:

a) In sunsari district among six CCHs only five were selected for this study, which may not be representative of whole population of sunsari's CCHs.
b) The adequacy of all nutrients was not seen.

Part II

Literature Review

2.1 Children's vulnerability and orphan hood in the world

. UNICEF (2016) reports as of 2015, an estimated 13.4 million children worldwide had lost one or both parents to AIDS. More than 80 per cent of these children (10.9 million) live in Sub-Saharan Africa. Many millions more were orphaned for other reasons. Orphans and children considered vulnerable for other reasons, including HIV and AIDS, are at higher risk of missing out on schooling, living in households with less food security, and suffering from anxiety and depression. They are also in greater danger of exposure to HIV. Their experiences differ across families, communities and countries, and are influenced by a complex mix of variables, including children's relationships to their caregivers, the wealth of their household and community, HIV prevalence in the area and many other factors. To care properly for orphans and vulnerable children, a minimum package of support is needed and includes access to services such as education, health care, social welfare and protection. However, without laws, policies and services that assist families and communities in caring for children at risk, such support tends to remain low (. UNICEF, 2016).

A majority of HIV positive children (64%) enrolled in cash transfer were orphaned by HIV & AIDS, of which nearly 20 percent had both their parents deceased. Around half of all children enrolled in cash are aged between 6 to 12 years. The main objective of the cash transfer program is to increase the quality of life of children living with HIV and to reduce HIV related morbidity and mortality in Nepal, which is started by Save the Children with the support of GFATM(The Global Fund to Fight AIDS, Tuberculosis and Malaria) (NCASC, 2015).

UNICEF. (2015) reports that over 132 million orphans in sub-Saharan Africa, Asia, Latin America and the Caribbean in 2005, only 13 million have lost both parents. Evidence clearly shows that the vast majority of orphans are living with a surviving parent grandparent, or other family member. Ninety five percent of all orphans are over the age of five.

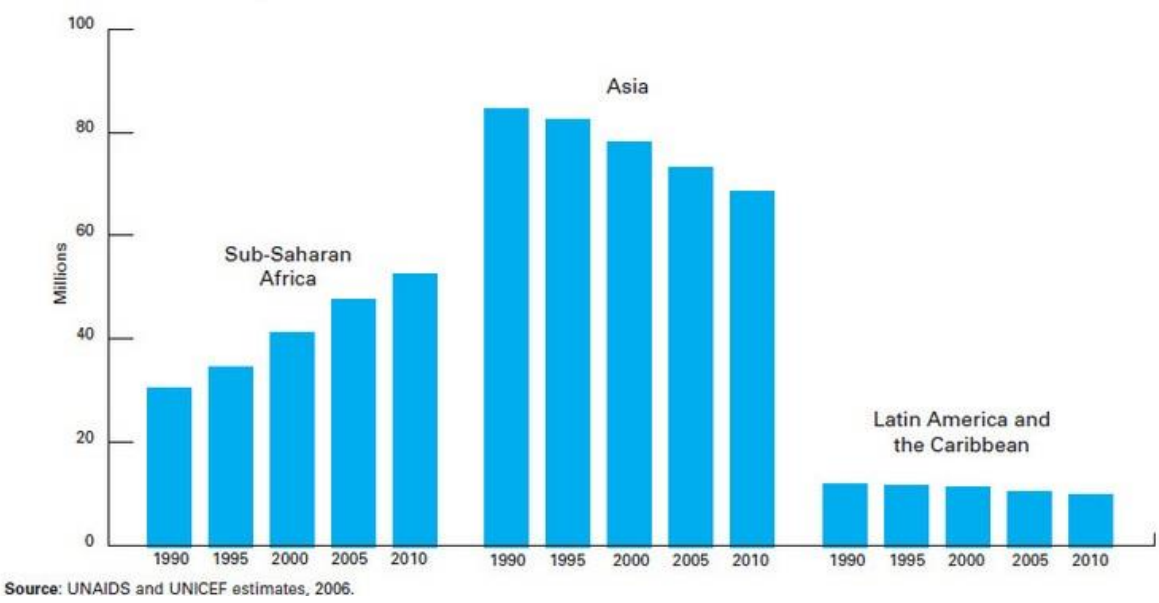

Fig. 2.1 Number of orphans ages 0 – 17, by region, 1990 - 2010

As the bar graph shows, while the number of orphans in Asia has declined during the period from 1990 to 2010 (the latter based on projections), and has remained fairly stable in Latin America and the Caribbean, there has been a steady increase in the number of orphans in Sub-Saharan Africa. Data is not given for the number of children in Asia who have been orphaned by HIV and other causes, but that figure is likely significant (UNICEF., 2015).

Figures for Africa show that in the benchmark years of 1990, 1995, 2000, and 2005, the percentage of children orphaned in sub-Saharan African countries as a result of AIDS rose sharply from 1% to 7% to 17% to 25%, and is projected to reach 30% of all orphans by 2010. Among them are over 10 million children who have lost both parents. AIDS is the leading cause of death among adults ages 15-59, and it has produced 12 million orphans in the region. The rates of HIV deaths are not uniform across Sub-Saharan Africa, but are much higher in southern Africa, where as many as 15% of all children are orphans. Behind these figures is a tremendous toll of human suffering. Older children may act as caregivers for their parents or siblings who are ill, or grandparents may have to raise their grandchildren. Poor nutrition, inability to attend school, inability to concentrate, emotional trauma and depression are among the most serious effects, and children whose families have been touched by AIDS may also be stigmatized by others, further worsening these effects.(UNICEF, 2010)

2.2 The state of orphans and vulnerable children

UNICEF (2002) estimated that 13000 children have been orphaned by AIDS, 1.5% of Nepal's 835,000 orphans. The annual number of deaths from the disease will escalate from 3000 in 2000AD to 6000 in 2005AD according to epidemic projections made before the extent of infection among labour migrants was realized. If the epidemic accelerates more rapidly through the infection of migrant labourers moving regularly between India and within Nepal itself, the proportion of children orphaned could grow exponentially (UNICEF, 2002).

Recent research has shown that as many as 200 million children worldwide fail to reach their cognitive and socio-emotional potential because of malnutrition, micronutrient deficiency, and lack of stimulation during early childhood (Gregor *et al.*, 2007).

Sherif (2016) reports that most orphans are placed either in extended families or in fostering households. Yet this communal arrangement, laudable as it is, may come at the cost of consumption shock to households who have taken in orphans. If the households that have absorbed orphans are already poor may translate itself into deeper poverty. Deprivation during these early years results in lifelong deficiencies and disadvantages. By contrast, adequate care, stimulation, and nutrition in early childhood can lead to positive physical, socio-emotional, and cognitive outcomes measurable well into adulthood (Vaida and Dr. Naheed, 2013).

Most common problems faced by orphans include loss of home, high dropout rate from school, lack of health care and problems with immunization, social downfall, child labours and drug abuse. It has been seen worldwide that every person, every family, every institution recognizes the need for looking after its children. Particularly orphans, destitute or abandoned children who are looked after primarily through child care institution run by government and non-government organization and in some cases through fosters families (Vaida and Dr. Naheed, 2013).

Although most children live with a caretaker, they face a number of challenges, including finding money for school fees, food, and clothing. Experts contend that effective responses must strengthen the capacity of families and communities to continue providing care, protect the children, and to assist them in meeting their needs. There are thousands of localized efforts, many of them initiated by faith-based groups, to address the needs of

children made vulnerable by AIDS. Proponents argue that supporting these "grassroots" efforts can be a highly cost-effective response, although additional mechanisms are needed to channel such resources. They further assert that additional resources are needed to expand the limited programs and to support the children who are on the street or in institutional care. But it is not only these children who will suffer. Countries struggle to develop when their citizens grow up malnourished, poorly educated or ravaged by disease. These factors perpetuate poverty and low productivity and may lead to instability or even spill over into violence and armed conflict. The healthy development of children not only safeguards their own well-being, it is also the best guarantee of the future peace, prosperity and security that are central ambitions of the millennium agenda (Mwaniki and Makokha, 2013).

Study in Budgam, J&K in India indicated that dietary intake was deficient for all nutrients when compared to RDA for all age groups which may be linked to poor planning of menus in orphanages (Vaida and Dr. Naheed, 2013). Choudhary *et al.* (2010) reported that average intakes of macro and micronutrients (except vitamin A) by adolescent girls of Varanasi district in India were >70% of the RDA. Average intakes of both macro and micronutrient (except vitamin A) were least in 10-12 years age group. Ignorance about micronutrients and protective foods prevailed in adolescent girls.

2.3 Status of Children in Nepal

UNICEF (2002) study about Regional Disparities in the Magnitude of Orphanhood in Nepal found that Western Mountain and Eastern Terai had higher and Central Hill had lower proportions of orphan children.

No better is the situation of a large majority of children in this Himalayan country. As per the latest National Census of Nepal, total population of children below the age of 18 years is 11.5 million of which over 2.6 million are estimated to be child laborers. It means that 22.61% of total Nepali children are involved in labour of one sort or the other. On top of that, about 306,115 children are forced to get involved in the worst forms of labour, as described by the International Labour Organization. The children in the worst forms of labour are meted out with the most hazardous work conditions and inhumane treatment. The child workers are not only deprived of food and other basic needs, but also of education needs (UNICEF, 2002).

The situation has worsened during the 10 years of armed Maoist insurgency. Despite the calls of human rights activists, international community and civil society, both of the warring parties were reportedly involved in violating child rights in various forms and at varying magnitudes. These years of politico economic crisis. Many schools and educational institutions have been destructed in bomb and grenade blasts, or used as the government army or rebel camp. In other incidents of atrocities, many students have been abducted and forcefully recruited by rebels, while government forces have apprehended and harassed them and teachers on the pretentious charge of terrorist. The war has left thousands of children homeless and orphans. The nation's socioeconomic crisis has also failed Nepal in investing and spending in social sectors like child education, health and welfare. All these developments have increased the need for providing various types of assistance and support to the children at risk (ORCHID-Nepal, 2011).

Though the family is the best place for healthy growth of children, the extended family could be the next best option for those children who have no parents. In Nepal, many parentless children are kept in the Child Care Homes. The Government of Nepal has policies and standards for operation and management of residential Child Care Homes, 2012 to monitor and regulate the CCHs. These initiatives are aimed at ensuring rights of the child and uphold best interest of the child living in such institutions. In this respect, the government holds accountability to monitor the CCHs to ensure their operation as per the law, regulations and the guidelines.(GoN., 2015).

The Central Child Welfare Board as a statutory body formed by the Children's Act 2048 BS is responsible to provide child related policy advice to the Government of Nepal as well as to ensure the rights of children in the nation by collaborating with civil society, national and international development partners as standard set by the CRC for the protection and promotion of the rights of children. The (CCWB) also coordinates and cooperates with the government and non-governmental organizations in the implementation of the provisions of the CRC. Further, the CCWB facilitates, monitors and evaluates child related interventions in the country (GoN., 2015).

2.4 Child Care Homes in Nepal

2.4.1 Description and Trend of the CCHs

The CCHs are formed to provide care, support, education, health services and security to the needy children; especially ones who are not in parental care and vulnerable. Though CCH is the last option to keep orphan and vulnerable children, it has become a common practice to send such children in the CCHs. The CCHs are found operating either with the support of international organization and/or sponsorship of individual or religious groups and/or individual charity. Therefore, the numbers of the CCHs fluctuate from time to time. In 2008 a total of 454 CCHs were recorded, whereas the number reached to 797 in 2013. But, the numbers of the CCHs decreased to 594 in 2014 altogether in 46 districts. The recent data collected by the CCWB shows that the numbers of CCHs again slightly decreased to 585as of January 2015 in altogether 45 districts instead of 46 districts (GoN., 2015).

2.4.2 Nature of the CCHs

This section explains the nature of CCHs. The nature of CCHs can be categorized broadly into three types:

a) The Government run child welfare homes, in which there are four child welfare homes;

b) Juvenile correction homes, in which there are three correction homes.

c) The non-governmental organizations (NGO) or by private sector run CCHs.

The CCHs run by the non-governmental organizations or by private sector can be categorized as per their objective. These are as follows;

a) CCHs for protection of children affected by armed conflict and disaster.

b) CCHs for protection of street children.

c) CCHs for protection of dependent children whose parent(s) are in prison.

d) CCHs for protection of children with disability.

e) CCHs for protection of children living with HIV/AIDS.

f) CCHs for protection of children abused/exploited sexually.

g) CCHs for protection of orphaned and helpless children.

h) CCHs for protection of trafficked children and child labour.

i) CCHs for protection of children of specific religion.

j) Residential transit homes and shelters for rescued children.

However some CCHs are in operation to provide services to more than one category of children (GoN., 2015).

2.4.3 District-Wise CCHs in Nepal

It was found that there are 585 CCHs, in which a total of 15811 children (7973 boys and 7838 girls) live there for fulfilling their basic needs. Only 45 districts out of 75 in Nepal have CCHs in operation varying number of CCHs from one to 205. There are 17 districts, where only one CCH is in operation per district, where as Kathmandu district alone has 205 CCHs. In terms of number of children staying in the CCHs, the CCHs in Dailekh has only four children followed by six each in Ilam and Dhanusha districts. By number of children living in the CCHs, 84 CCHs have children less than ten followed by 40 CCHs having only ten children and 28 CCHs having only 11 children as of information received till the end of December 2014. This shows that about 26 percent of the total CCHs in operation are having only 11 and less than 11 children. Further, there are noticeable number of CCHs which have children between 12 and 13.(GoN., 2015)

2.4.4 CCHs in Sunsari district

There are total six registered CCHs in Sunsari district. There are total 225 children, among them 126 ware boys and 99 were girls.

Table.2.1 Detail of Child Care Homes and number of children and adolescents

S.N	Name	Address	Protected Children		
			Boy	**Girl**	**Total**
1.	Nishaya BalBalika Sewa Aashram	Itahari-4	11	14	25
2.	Nisahya BalBalika Sewa Aashram	Dohabi-7	8	5	13
3.	S.O.S Balgram	Itahari-6	81	55	136
4.	Upakar Bal Aashram	Singiya-3	5	11	16
5.	Shree Saraswati Bal Aashram	Dharan-3	15	8	23
6.	Balsyahar Kendra	Dharan-11	6	6	12
	Total		**126**	**99**	**225**

Source:(GoN., 2015)

2.4.5 Problems and challenges of the CCHs

The problems and challenges seen in the CCHs against the "Standards for Operation and Management of Residential Child Care Homes" and faced by the CCHs are briefly presented as follows:

a) There is insufficient coordination among government and the CCHs regarding managing CCHs and mobilizing available resources to protect the rights of children.
b) Some children in the CCHs have been found admitted with insufficient documents and some with false identification. As a consequence obtaining birth registration certificate for those children has been difficult.
c) Many CCHs were found to have no proper documentation on rescue, admission process, and rehabilitation and reintegration process.
d) Many CCHs operators have insufficient knowledge on child rights, Children's Act, Child Protection Policy and Standards for Operation and Management of Residential Child Care Homes-2012. Consequently, some CCHs have not met the minimum standard.

e) Many CCHs have been found lacking financial transparency and sustainable fund raising plan for operation of the CCHs.

It has also been reported that some children are sexually abused in CCHs or residential/institutional care. In 2014, two cases were registered against CCHs accusing sexual exploitation of girls (four were victimized) and as decided by the district court, perpetrators were sent to prison. Two complaints of pedophilia in the CCHs were also filed against international volunteers (GoN., 2015).

2.5 Household and Food Consumption

The findings of the Nepal Food Security Monitoring System, a household survey on the adequacy of food consumption (as measured by the food consumption score) by round of data collection, show in March–July 2014, 14.6 % of surveyed households consumed inadequate food, which is an improvement compared to November 2013–March 2014, when 19.6 % of households had inadequate food consumption. Further analysis by ecological belt shows a much larger proportion of households in the Mountains (25.7 %) had inadequate food consumption compared to the national average (14.6 %), Hills (15.6%) and Terai (11.8 %). In March-July 2014, the mean number of food groups consumed by households over the past 7 days was 5.2 compared to 4.9 in November 2013-March 2014. During this reporting period dietary diversity did not vary greatly by ecological belt, although the Terai had the highest score 5.3, compared to the Hills 5.1, and Mountains 5.0 (NeKSAP, 2014).

2.6 Food Availability and Access

According to the Ministry of Agricultural Development, the estimated total cereal production (summer and winter) for 2013/14 is 9.56 million mt, of which net cereal availability is 6.08 million mt. With the national cereal requirement of 5.2 million mt, the country has a national cereal surplus of 0.88 million mt (NeKSAP, 2014).

NFC and development partners provide food assistance (subsidized or in-kind) in different parts of the country, primarily in the remote districts. DFSNs reported that NFC supplied 769 mt for the far-western hills and mountains, 2,508 mt for Karnali, 864 mt for the eastern hills and mountains, and 783 mt for the western hills and mountains in this reporting period (NeKSAP, 2014).

In many hill and mountain areas winter crops play a limited role in household food stocks. According to the NeKSAP household survey, average household cereal stock was 239.47 kg, which provides 3.7 months of household staple food sufficiency on average (NeKSAP, 2014).

2.7 Measurement of Food Consumption

The concept of food consumption to be measured varies with the objectives of the survey. For each objective, various types of surveys exist and the approaches are at different levels:

a) National accounts of annual food availability per head of population; or
b) Food balance sheets;
c) Family budget and household consumption surveys;
d) Individual food intake or dietary surveys (Hartog *et al.*, 2006).

2.7.1 Individual Dietary Survey

Several methods with various characteristics have been developed to assess food consumption. The methods are often grouped into four main categories which are partly based on thesis characteristics:

a) Recall of past intake.
b) Recording of present intake.
c) Shortcut methods(e.g. some food frequency questionnaires)
d) Combination of methods (Hartog *et al.*, 2006).

2.7.2 Recording of Present Intake

Recording methods estimate the current food intake during one or more days. The amounts of food eaten can be weighted or estimated in terms of household measures.

The weighing method assesses the cooked weights of the total portions of the meal served, the portion for each individual, and leftovers. Often the ingredients and amounts used in the preparation of dishes are also measured. According to the cooperation and capacity of the participants, this method requires varying degrees of supervision. Educated people can weigh items for themselves with a spring balance provided for this purpose. With less educated people, the actual weighing should be done by the field-workers, meaning that the nutritionist has to spend several hours each day with the responded (Hartog *et al.*, 2006).

An estimated record is a list of all foods eaten by an individual during a specified period, given in terms of household measures or compared in size to food models. For educated people, this method is less demanding than weighing; they can record food intake themselves. There is less precision in this process but closer cooperation between fieldworker and respondent. Supervision by a dietician at the beginning and end of a period is necessary. A detailed interview is desirable at the end of the survey to allow for the checking of amounts. Details overlooked or omitted reduce the accuracy with which measurements can be converted to mass. For less educated people, this method is not appropriate because they cannot record and describe their portions. If a nutritionist has to do the work and spend significant time inbhe house with the mother, she could better weigh the foods. (Hartog *et al.*, 2006).

Present study was done by using the principle of the three-day food record, the propose of this record is to provide a quantitative assessment of food intake over three days. Two weekdays and one weekend day should be included to take in to account potential differences in food consumption patterns on weekdays versus weekend days. To assess portion sizes, household measures or weighing scales should be used. Accuracy and precision are of course greater for the weighed record compared to the estimated record method, because the portion sizes are weighed. Misreading the weighing scale and/or errors in recording, however, may still occur (Cameron *et al.*, 1988)

Respondents must be numerate and literate when a food record is used. They must also be highly motivated because the method is more time consuming than a twenty-four-hour recall, and the respondent burden is higher. Respondents may change their usual eating pattern to simplify the measuring or weighing process, or, alternatively, to impress the investigator (M. C. Burk and Pao, 1976)

2.8 Dietary Reference Intakes

The former RDAs and Recommended Nutrient Intake (RNIs) differ from Dietary Reference Intake (DRI) conceptually. These differences are: (1) where specific data on safety and efficacy exist, reduction in the risk of chronic degenerative disease is included in the formulation of the recommendation rather than just the absence of signs of deficiency; (2) upper levels of intake are established where data exist regarding risk of adverse health effects; and (3) components of food that may not meet the traditional

concept of a nutrient but are of possible benefit to health will be reviewed, and if sufficient data exist, reference intakes will be established (FNB and IOM.;, 2000).

Where adequate information is available, each nutrient has a set of DRIs. A nutrient has either Estimated Average Requirement (EAR) and an RDA, or Adequate Intake (AI). When an EAR for the nutrient cannot be determined (and therefore, neither can the RDA), then an AI is set for the nutrient. In addition, many nutrients have a Tolerable Upper Intake Level (UL). A brief definition of each of the DRIs is presented below:

Estimated Average Requirement (EAR): The average daily nutrient intake level estimated to meet the requirement of half the healthy individuals in a particular life stage and gender group (FNB and IOM.;, 2000).

Recommended Dietary Allowance (RDA): The average daily nutrient intake level sufficient to meet the nutrient requirement of nearly all (97 to 98 percent) healthy individuals in a particular life stage and gender group (FNB and IOM.;, 2000).

Adequate Intake (AI): A recommended average daily nutrient intake level based on observed or experimentally determined approximations or estimates of nutrient intake by a group (or groups) of apparently healthy people that are assumed to be adequate—used when an RDA cannot be determined (FNB and IOM.;, 2000).

Tolerable Upper Intake Level (UL): The highest average daily nutrient intake level likely to pose no risk of adverse health effects to almost all individuals in the general population. As intake increases above the UL, the potential risk of adverse effects increases (FNB and IOM.;, 2000).

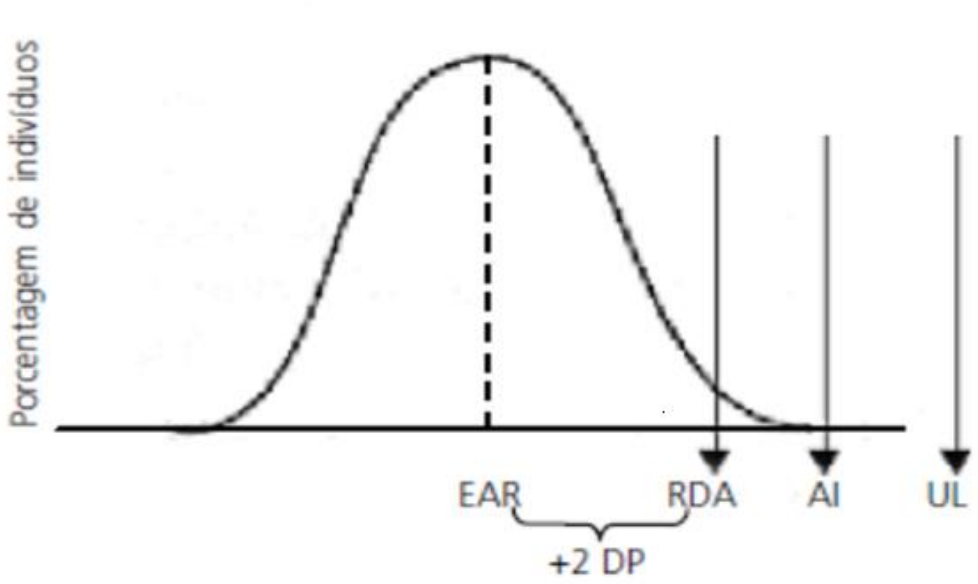

Fig.2.2 Dietary reference intakes (Souza *et al.*, 2010)

Like the former RDAs and RNIs, each DRI refers to the average daily nutrient intake of apparently healthy individuals over time. The amount of intake may vary substantially from day to day without ill effect in most cases. The chosen criterion of nutritional adequacy or adverse effect on which the DRI is based is different for each nutrient and is identified in the DRI nutrient reports. In some cases the criterion for a nutrient may differ for individuals at different life stages. In developing recommendations, emphasis is placed on the reasons underlying the particular criterion of adequacy used to establish the requirement for each nutrient. This requirement is typically presented as a single number for various life stage and gender groups rather than as multiple endpoints even if the criterion of adequacy for the end-point differs (FNB and IOM.;, 2000).

Dietary standards, regardless of the name they go by – Recommended Dietary Allowances, Recommended Nutrient Intakes, Recommended Daily Amounts of Nutrients, or Safe Intakes of Nutrients – are the average daily amounts of essential nutrients estimated, on the basis of available scientific knowledge, to be sufficiently high to meet the physiological needs of practically all healthy persons in a group with specified characteristics (ICMR, 2010).

Some internationally used terminologies can be mentioned. In 2007 UNU in collaboration with WHO, FAO and others convened a group to harmonies nutrient-based dietary standards. They decided that the term NIV should include, ANR and Upper Nutrient Limit. ANR + 2SD which would cover 98% of the population refers to terms like RDI, RDA and RNI; ANR refers to values that cover 50% of the population and in Korean this value is EAR when it is derived on the basis of available scientific knowledge. For nutrients where such evidence is not there, the term AI is used (ICMR, 2010)

2.9 Recommended Dietary Allowance (RDA)

Humans need a wide range of nutrients to lead a healthy and active life. The required nutrients for different physiological groups can only be derived from a well-balanced diet. Components of the diet must be chosen judiciously to provide all the nutrients to meet the human requirements in proper proportions for the different physiological activities. The amount of each nutrient needed for an individual depends upon his/her age, body weight and physiological status. Adults need nutrients for maintenance of constant body weight and for ensuring proper body function. Infants and young children grow rapidly and require nutrients not only for maintenance but also for growth. They require relatively more nutrients (2-3 times) per kg body weight than adults. In physiological conditions like pregnancy and lactation, adult woman needs additional nutrients to meet the demand for foetal growth and maternal tissue expansion in pregnancy and milk secretion during lactation. These extra intakes of nutrients are essential for normal growth of infants in utero and during early post-natal life (ICMR, 2010).

There are certain general guidelines in arriving at Nutrient Requirement and Dietary Allowances for various groups. The nutrient requirement of an individual and the dietary allowances for a group or a population are distinctly different. The former depends upon the age, body weight and physiological and metabolic status of the individual. The latter must also take into consideration individual variation within the group, quality of the diet, effect of cooking and processing and bio-availability of the nutrient from the diet (ICMR, 2010).

The RDA is derived from (i) the individual variability, and (ii) the nutrient bio-availability from the habitual diet.

Individual variability: Definition of RDA takes into account the variability that exists in the requirement of a given nutrient between individuals in a given population group. The distribution of nutrient requirement in a population group is considered normal and the RDA corresponds to a requirement, which covers most of the individuals (97.5%) in a given population. This corresponds to Mean + 2 SD. This is termed as a safe level of intake of a nutrient, that is, the chances of individuals having requirements above the RDA is only 2.5%. This principle is used in case of all nutrients except energy, since in the case of energy, intakes either the excess or below the actual requirement of energy are not safe. In case of other nutrients the RDA is 25% (+ 2SD) higher than the mean requirement, 12.5% being considered as the extent of individual variability in the requirements of all those nutrients (ICMR, 2010).

Bio-availability: Bio-availability of a given nutrient from a diet, that is, the release of the nutrient from the food, its absorption in the intestine and bioresponse have to be taken into account. It is the level of the nutrient that should be present in the diet to meet the requirement. This bio-availability factor is quite important in case of calcium and protein and trace elements like iron and zinc. In case of iron, the amount to be present in the diet is 20-30 times higher than the actual iron requirement to account for the low bio-availability of iron from a given diet, particularly a cereal-based diet (ICMR, 2010).

RDA represents the level of the nutrient to be consumed daily to meet all the requirements of most of the individuals in a given population. However, it must be recognized that RDA is not meant to be used as standard to determine whether or not a given individual requirement has been met, since it is a level above the requirement of most individuals in a given population. RDA value of a nutrient is valid only when all other dietary nutrient intakes are satisfactory (ICMR, 2010).

Nutrient adequacy: To assess the nutrient adequacy of food intake by an individual, it is first necessary to establish his or her habitual nutrient intake and confront it with his or her requirements. This would require one to know the food intake during a long period of time, taking into account the great intra-individual intake variation. This makes it impossible to assess an individual's actual intake. Therefore, in practice, the apparent intake is assessed using food questionnaires on three non-consecutive days. However, these data do not allow one to correctly assess the intrapersonal intake variation, so the use of pre-established variability values of a reference population is recommended. Hence, in order to calculate

the intake adequacy of a given nutrient, one needs to take into account the estimated requirement given by the RDA of the nutrient (Souza *et al.*, 2010).

Considering that the percentage of adequacy in relation to the RDA was an assessment approach used until the 1990's and still used by some professionals in their practice, for comparison the individual intake (mean of three days) was expressed in percentile of the RDA.

PA = (Mi / RDA) * 100

Where: PA = Percentage of adequacy

Mi = Mean intake of the nutrient during "n" days by the individual

RDA = Recommended Dietary Allowances (Souza *et al.*, 2010)

If PA is more or equal to 100% than it says that probability of nutrient adequacy is high or low probability of nutrient inadequacy and similarly if PA is less than 100% than it says that probability of nutrient inadequacy in high or low probability of nutrient adequacy.

2.10 Growth and Development

2.10.1 Growth

Growth is defined as physical maturation which is indicated by an increase in the size of the body i.e. an increase in the weight, height, head and chest measurement and mid-arm circumference and dentition (Adhikari and Krantz, 2013).

2.10.2 Development

Development is defined as functional maturation. It is indicated by the maturation of organs and systems, acquisition of skills, ability to adapt more readily to stress and the ability to assume responsibilities (Adhikari and Krantz, 2013).

2.10.3 Factor Influencing the Growth

i. Nutritional care: Early initiations of breast feeding, timely and adequate complementary feeding are important for normal growth both by supplying essential nutrients and by protecting from infections. But after the age of 6 months, breast

feeding alone is not sufficient and adequate complementary feeding is essential (Adhikari and Krantz, 2013).

ii. Protection from infectious illnesses: Repeated diarrhea, cough and colds and other infections adversely affect the growth process. Availability of health services particularly of immunization and simple remedies like oral rehydration solution for prevention of dehydration in diarrhea help in promotion of growth in infants and children (Adhikari and Krantz, 2013).

iii. Play opportunities, games and other stimulation: Games which require running, jumping, climbing etc, help the child to develop motor skills. Similarly, play in group, playing with mud or play dough and drawing on floor with sticks etc. help the child to develop social skills and in the use of hands. Talking with the child and answering his/her questions help in developing language skills and also allows the child to grow normally. In the absence of such emotional support, growth and development suffer despite adequate feeding (Adhikari and Krantz, 2013).

2.11 Nutrient Requirement

The nutritional recommendations are the intake values of essential nutrients that, based on scientific knowledge, are considered adequate to meet the specific nutrient requirements i.e. mean + safety margin, of nearly all healthy individuals (Burk, 1984).

Nutritional requirements refers to the amount of food, energy and nutrient needed on an average per day by specific group and sex categories to meet the needs of healthy individuals for normal functioning of the body for work and growth (Burk, 1984).The energy supplies seem to occur important in those developing countries where the staple commodities are either very low in protein content or the protein is of very low quality. Most of the people of developing countries depend upon starchy food and derived their 80% of total calories from them. The people of those country are able to obtain about 87% of calorie intake and 79% of gross protein intake and they receive only 6.4% of their calories and 8.9% of their protein from the consumption of meat, egg, milk and milk fats combined (Yadav, 1994).

2.12 Nutritional Status of Children

Nutrition has been defined as the food at work in the body. Nutrition includes everything that happens to food from the time it is eaten until it is used for various functions in the

body (Srilakshmi, 2014).Nutrition is a core pillar of human development and concrete large scale programming which not only reduces the burden of under nutrition and deprivation but also advances the progress of nations (Anonymous, 2012) Nutritional status is the state of our body as a result of the foods consumed and their use by the body. Nutritional status can be good, fair or poor (Mudambi, 2012).

Under nutrition places children at an increased risk of morbidity and mortality and is also associated with impaired mental development. Anthropometry provides one of the most important indicators of children's nutritional status. The height and weight data are used to compute three summary indices of nutritional status: height-for-age; weight-for-height; and weight-for-age. These three indices are expressed as standard deviation units from the median for the international reference population recommended by the World Health Organization. Children who fall more than two standard deviations (-2 SD) below the reference median are regarded as undernourished, while those who fall more than three standard deviations (-3 SD) below the reference median are considered severely undernourished. Children whose height-for-age is below minus two standard deviations from the median of the reference population are considered stunted or short for their age. Stunting is the outcome of failure to receive adequate nutrition over an extended period and is also affected by recurrent or chronic illness. 41 percent of children under five are short for their age, and 16 percent are severely stunted. Children whose weight-for-height is below minus two standard deviations from the median of the reference population are considered wasted or thin. Wasting represents the failure to receive adequate nutrition in the period immediately before the survey, and typically is the result of recent illness episodes, especially diarrhea, or of a rapid deterioration in food supplies. In Nepal, 11 percent of children are wasted and 3 percent are severely wasted. Children whose weight-for-age is below minus two standard deviations from the median of the reference population are considered underweight. The measure reflects the effects of both acute and chronic under nutrition. Nearly three in ten children (29 percent) are underweight and 8 percent are severely underweight. In general, the nutritional status of children in Nepal has improved over the last decade. 57 % of children were stunted in 2001 compared with 41% in 2011 and 43% of children were underweight in 2001 compared with 29% in 2011. However, the proportion of children who are wasted declined only slightly from 13% in 2006 to 11% in 2011 (NDHS, 2012).

Mwaniki and Makokha (2013) in Kenya found that the children in orphanages had a significantly higher rate of stunting and underweight ($p< 0.05$). This was an indication that chronic malnutrition was more prevalent among the children in orphanages.

2.13 Factor Affecting Nutritional Status

The factors affecting nutritional status are mother's food security, breast feeding practices, types of food given to young children, feeding frequency, status of women and child nutrition and last but not the least who feeds the child and how the child eats (NMICS, 2010).

There are many other factors that influence the nutritional status some of which are food availability and its distribution system, consumption of food, income source and purchasing power, family size, illiteracy, sociocultural and religious belief, environmental sanitation and health facility (Dhakal, 2015).

2.14 Indices Reflect about the Nutritional Status of Infants and Children

The advantages and disadvantages of the three indices and the information they can provide is summarized below:

i. Weight-for-age

Low weight-for-age index identifies the condition of being underweight**,** for a specific age. The advantages of this index are that it may reflect both past (chronic) and/or present (acute) under nutrition (although it is unable to distinguish between the two) (Cogill, 2003).

ii. Height-for-age

This index is an indicator of past under nutrition or chronic malnutrition. It cannot measure short term changes in malnutrition. For children below 2 years of age, the term is length-for-age; above 2 years of age, the index is referred to as height-for-age. Deficits in length-for-age or height-forage are signs of stunting (Cogill, 2003)**.**

iii. Weight-for-height

This index helps to identify children suffering from current or acute under nutrition or wasting and is useful when exact ages are difficult to determine. Weight-for-length (in

children under 2 years of age) or weight for- height (in children over 2 years of age) is appropriate for examining short-term effects such as seasonal changes in food supply or short-term nutritional stress brought about by illness(Cogill, 2003).

iv. BMI-for-age

The body mass index, a measure of body mass relative to height, has emerged as the most practical, universally applicable, inexpensive and non-invasive anthropometric indicator for classifying overweight and obesity. Although there is some reluctance to describe children as obese on the basis of BMI alone, i.e. without taking into account a more direct measure of body fat, recognition of the difficulties inherent in obtaining more proximate measures of body fat and lack of references to interpret them has resulted in BMI-for-age alone being used to define overweight and obesity. In its favour, increased BMI-for-age in childhood and adolescence is associated with higher percentages of body fat (49-51) and known risk factors for cardiovascular disease (WHO, 2006).

Table 2.2 WHO Classification of nutrition conditions in children (below 60 months) based on Anthropometry.

Classification	Condition	Age: Birth to 60 months Indicator and cut-off
Based on body mass index (BMI)	Possible risk of overweight	BMI-for-age (or weight-for-height) >1SD to 2SD
	Overweight	BMI-for-age (or weight-for-height) >2SD to 3SD
	Obese	BMI-for-age (or weight-for-height) >3SD
Based on weight and height	Stunted	Height-for-age <-2SD to -3SD
	Severely stunted	Height-for-age <-3SD
	Underweight	Weight- for - age <-2SD to -3SD
	Severely underweight	Weight- for - age < -3SD
	Wasted	Weight- for - height <-2SD to -3SD
	Severely wasted	Weight- for - height <-3SD

Source: (WHO, 2006)

Table 2.3 WHO Classification of nutrition conditions in children (61 months to 19yrs.) based on Anthropometry.

Classification	Condition	Age: 61 months to 19 years Indicator and cut-off
Based on body mass index (BMI)	Possible risk of overweight	
	Overweight	BMI-for-age >1SD (equivalent to BMI 25 kg/m^2 at 19y)
	Obese	BMI-for-age >2SD (equivalent to BMI 30 kg/m^2 at 19y)
	Thin	BMI-for-age <-2SD to -3SD
	Severely thin	BMI-for-age < -3SD
Based on weight and height	Stunted	Height-for-age <-2SD to -3SD
	Severely stunted	Height-for-age <-3SD
	Underweight	Weight- for - age (up to 10y) <-2SD to -3SD
	Severely underweight	Weight- for - age (up to 10y) <-3SD

Source: (WHO, 2006)

The three indices are used to identify three nutritional conditions: underweight, stunting and wasting.

i. Underweight

Underweight, based on weight-for-age, is a composite measure of stunting and wasting and is recommended as the indicator to assess changes in the magnitude of malnutrition over time (Cogill, 2003).

ii. Stunting

Low length-for-age, stemming from a slowing in the growth of the fetus and the child and resulting in a failure to achieve expected length as compared to a healthy, well-nourished child of the same age, is a sign of stunting. Stunting is an indicator of past

growth failure**.** It is associated with a number of long-term factors including chronic insufficient protein and energy intake, frequent infection, sustained inappropriate feeding practices and poverty. In children over 2 years of age, the effects of these long-term factors may not be reversible. For evaluation purposes, it is preferable to use children under 2 years of age because the prevalence of stunting in children of this age is likely to be more responsive to the impact of interventions than in older children. Data on prevalence of stunting in a community may be used in problem analysis in designing interventions. Information on stunting for individual children is useful clinically as an aid to diagnosis. Stunting, based on height-for-age can be used for evaluation purposes but is not recommended for monitoring as it does not change in the short term such as 6 - 12 months (Cogill, 2003).

iii. Wasting

says that wasting is the result of a weight falling significantly below the weight expected of a child of the same length or height. Wasting indicates current or acute malnutrition resulting from failure to gain weight or actual weight loss. Causes include inadequate food intake, incorrect feeding practices, disease, and infection or, more frequently, a combination of these factors. Wasting in individual children and population group can change rapidly and shows marked seasonal patterns associated with changes in food availability or disease prevalence to which it is very sensitive. Because of its response to short-term influences, wasting is not used to evaluate Title II programs but may be used for screening or targeting purposes in emergency settings and is sometimes used for annual reporting. Weight-for-height is not advised for evaluation of change in a population since it is highly susceptible to seasonality.

iv. Overweight

It is defined using the WHO BMI-for-age cut-offs identify children with higher metabolic and vascular risk, while emphasizing the importance of preventing overweight and obesity in childhood to reduce cardiovascular risk (WHO, 2006).

v. Edema

Edema is the presence of excessive amounts of fluid in the intracellular tissue. Edema can be diagnosed by applying moderate thumb pressure to the back of the foot or ankle. The impression of the thumb will remain for some time when edema is present. Edema

is diagnosed only if both feet show the impression for some time. As a clinical sign of severe malnutrition, the presence of edema should be recognized when using short term indicators such as wasting. The presence of edema in individuals should be recorded when using weight-for-height for surveillance or screening purposes. When a child has edema, it is automatically included with children counted as severely malnourished, independently of its wasting, stunting, or underweight status. This is due to the strong association between edema and mortality. Edema is a rare event and its diagnosis is used only for screening and surveillance and not for evaluation purposes (Cogill, 2003).

vi. Mid— Upper Arm Circumference (MUAC)

MUAC is relatively easy to measure and a good predictor of immediate risk of death. It is used for rapid screening of acute malnutrition from the 6-59 month age range (MUAC overestimates rates of malnutrition in the 6-12 month age group).MUAC can be used for screening in emergency situations but is not typically used for evaluation purposes. (MSF, 1995)MUAC is recommended for assessing acute adult under nutrition and for estimating prevalence of under nutrition at the population level (Cogill, 2003).

Part III

Methods and Methodology

3.1 Research Design

This was a descriptive study that compared nutrient intake of children and adolescent with their respective RDA. It also sought to determine how the nutrient intake and other factors influencing the nutritional status of children and adolescent sheltered in CCHs of Sunsari district.

3.2 Study Area

The study was conducted in CCHs of Sunsari district. This district lies in Eastern terai of Nepal with Morang in east, Dhankuta in north, Saptari and Udayapur in west, and Bihar state of India in south.

CCHs of the district are located in Dharan, Itahari, Duhabi, and Singiya.

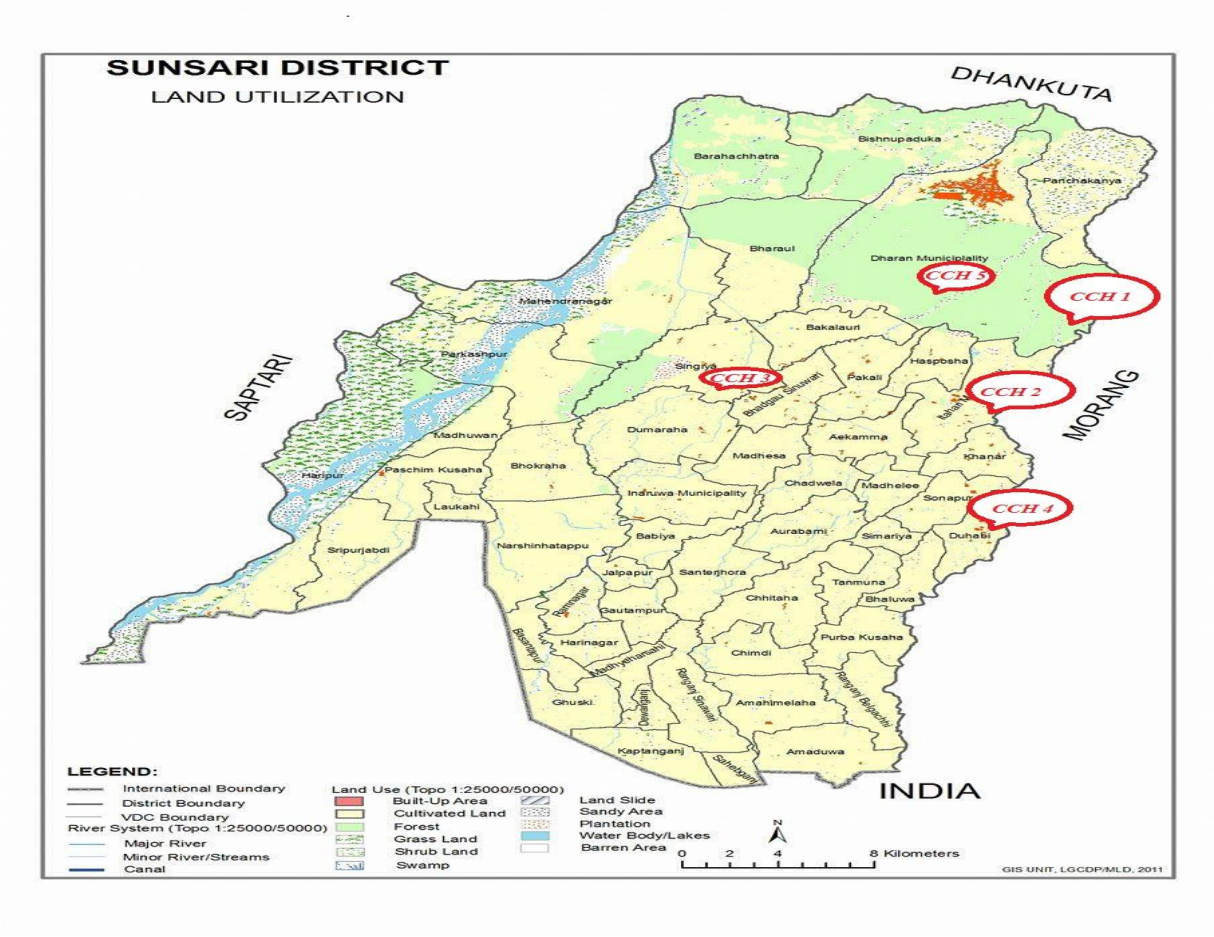

Fig. 3.1 Map of study area

3.3 Target Population

For the purpose of the study, full time resident children and adolescent in CCHs belonging to age group 1-17 years were taken. Sunsari district has a total six registered CCHs within the Ministry of Women, Children and Social Welfare, Central Child Welfare Board. Five CCHs were selected for the study. These were Dharan, Itahari, Singiya and Duhabi in Sunsari district. These CCHs were the only ones that allowed research activities.

Table 3.1 List of CCHs in sunsari district.

S.N	Name	Address
1.	Nishaya BalBalika Sewa Aashram	Itahari-4
2.	Nishaya BalBalika Sewa Aashram	Duhabi-7
3.	Upakar Bal Aashram	Singiya-3
4.	Shree Saraswati Bal Aashram	Dharan-3
5.	Balsyahar Kendra	Dharan-11

3.4 Inclusion Criteria

1. Children and adolescent who were full time residents of CCHs of Sunsari district.

3.5 Exclusion Criteria

1. Children and adolescent in CCHs who had not resided at least three months.
2. Children and adolescent who were absent during the study period.
3. Children and adolescent with chronic illness.

3.6 Sample Size

The sample size was determined using the census technique. Total sample was 68, among which 31 were boys and 37 were girls.

3.7 Sampling Techniques

Study was carried out by using the census technique. Total five CCHs were selected for the study.

3.8 Data Collection

Data collection was done using structured questionnaire. Demographic data was collected which included age, sex and educational level of the caretakers of the children and adolescent in CCHs. Data on period of stay in the CCHs, health seeking behavior and

hygienic practice was also collected from caretakers of children and adolescent in CCHs with the help of structured questioners (Appendix 1).

Information on the history of the CCHs: when and why it was started, the proprietors, sources of support, source of food, type of support offered to children and adolescent in CCHs and challenges encountered was obtained from the CCHs' management.

The amounts of foods consumed in different meals by children and adolescent were assessed. The weighing method was used to obtain the amount of foods consumed for breakfast, lunch and supper by staying whole day in CCHs. This process was done by using pre-structured steps (Appendix B) for three consecutive days. Following are the measure steps done for estimating raw amount of ingredient consumed by each child:

1) Firstly the raw ingredients used for cooking food and utensil used for cooking were weighted before cooking.

2) After food was cooked, weight of cooked food was measured by subtracting weight of container from total weight of cooked food with container. The loss in weight should be considered as water loss and all ingredients should be considered as uniformly mixed.

3) To estimate the amount of portion of each food the utensil used to serve the child was displayed and amount of food it can hold was recorded. Fraction of food was obtained by dividing weight of food in each portion by total weight of cooked food, (Fraction= amt. of potion / wt. of cooked food). This was used to obtain the amount of each raw ingredient present in each portion of food (amount of used raw ingredient for cooking × fraction).

In this way total amount of each ingredient consumed by children and adolescent in one meal was measured. The ingredients of the foods consumed and their volumes or quantities were used to generate carbohydrate, protein, visible fat, calcium and iron by using the food composition table of Nepal. The averages were compared with corresponding RDAs recommended by ICMR (2010).

Anthropometric measurements of children and adolescent were taken by weighing and measuring their height as well as verifying their ages by filling in date of birth from the CCHs' records.

a) Weight: A bathroom weighing Salter scale was used to take the weight of the children and adolescent. Weight was taken as the average of two measurements in kilograms.
b) Height: A stadiometre was used to take the height of the children and adolescent. The children and adolescent were taken the measurements with no shoes, standing straight and with no heavy clothing. Height was taken as the average of two consecutive measurements for accuracy in centimeters.

3.9 Pre-testing

Pre-testing of electric weighing balance, local weighing food utensils and prepared sets of questionnaire were done. Pre-testing should be conducted in order to maintain accuracy and clarity of questionnaire and instruments, to check the consistency in interpretation of questions by respondents and to identify ambiguous item. Pre-testing was performed in Saraswati Bal Aashram of Dharan. After pre- testing all the ambiguous, misleading and wrongly interpreted questions were omitted and questionnaire was revised in accordance with the findings of pre-testing and suggestions.

3.10 Data Analysis

The data were input in Microsoft Excel 2010 and processed for the statistical analysis. Statistical analysis of the data was performed using the SPSS version 20.0. Nutrients were compared with RDA and percentage of RDA was calculated. Student t-test was used to determine significant difference between nutrient intake and respective RDA. Bivariate correlation, Spearman correlation coefficients were used to determine the association. Anthropometry was used to determine the nutritional status of the children and adolescent. Z-scores were generated and used to assess the nutritional status of children and adolescent. The children and adolescent were classified into categories of nutritional status using the NCHS/WHO as a reference data (WHO, 2006).

3.11 Ethical Consideration

Permission to conduct the research was obtained from Central Campus of Technology and Department of Nutrition and Dietetics. Ethical approval was obtained from NHRC (Appendix-C) and permission from Sunsari district as well as from each CCHs was obtained. Verbal and written consent from care taker and children and adolescent of study

was obtained and the objective of the study was explained lucidly to them. Privacy and confidentiality of collected information was ensured at all level.

Part IV

Result and discussion

The study was carried out in five CCHs of Sunsari district. Out of them two were (CCH 1,5) were from Dharan, three (CCH 2,3,4) were from Ithari, Singiya and Duhabi respectively. The participants in the study were children and adolescent from 1- 17 years of age. The results of the survey are presented in the following heading:

4.1 Demographic characteristics of children and adolescent

Table 4.1 shows that the percentage of study children and adolescent was 25%, 36.8%, 14.7%, 19.2% and 4.4% from CCH 1, CCH2, CCH 3, CCH 4 and CCH 5, respectively. Out of total 68 participants, 45.6% (31) were boys and 54.4% (37) were girls.

Table 4.1 Distribution of children and adolescent according to CCHs and gender (N = 68)

		Frequency		
	Location	**Boys**	**Girls**	**Percentage**
CCH 1(N=17)	Dharan	11	6	25%
CCH 2(N=25)	Itahari	10	15	36.8%
CCH 3(N=10)	Singiya	3	7	14.7%
CCH 4(N=13)	Duhabi	5	8	19.2%
CCH 5(N=3)	Dharan	2	1	4.4%
Total(N=68)		**31(45.6%)**	**37(54.4%)**	**100%**

Majority of children and adolescent (32.4%) were of 13-15 years age and one fourth of total study subjects were in age group 7-9 years. (Table 4.2)

Table 4.2 Distribution of study sample by age (N = 68)

Age group	Frequency	Percentage
1-3yrs	2	3%
4-6yrs	4	5.9%
7-9yrs	17	25%
10-12yrs	13	19.2%
13-15yrs	22	32.3%
16-17yrs	10	14.7%

The study shows that most of the children and adolescent were staying in CCHs since more than 3 years. Of total children and adolescent, 89.7% were non- vegetarian, 10.3% were vegetarian (Table 4.3)

Table 4.3 Distribution of children and adolescent by duration of stay in orphanage and their food habit (N = 68)

Variable	Frequency	Percentage
Stay in CCH		
Less than 1 yr.	1	1.5%
1 to 2 yrs.	9	13.2%
2 to 3 yrs.	3	4.4%
More than 3 yrs.	55	80.9%
Food habit		
Vegetarian	7	10.3%
Non-Vegetarian	61	89.7%

4.2 Demographic characteristics of caretakers in the orphanages.

Among 16 caretakers, table 4.4 shows that 75% of them were females and 25% were males. Higher proportions (37.5%) of caretakers were of age 25 - 35 years and 36 – 45 years. Half of the total caretakers had attained campus, 31.3% had attended basic and 6.3% had attended secondary level. And 12.5% of them were illiterate.

Table 4.4 Distribution of the caretakers by age, sex and education (N = 16)

Variable	Frequency	Percentage
Age		
25-35	6	37.5%
36-45	6	37.5%
46-55	2	12.5%
>55	2	12.5%
Sex		
Male	4	25%
Female	12	75%
Education		
Basic	5	31.3%
Secondary	1	6.3%
Campus	8	50%
Illiterate	2	12.5%

4.3 History of the CCHs

Five CCHs, CCH 1,2,3,4 and 5 had started 24, 34, 15, 30 and 3 years previously to rescue the orphaned and vulnerable children and adolescent who were not able to take them in to their families. Among these, three CCHs were started by individuals and two by private sectors.

4.4 Resources for the orphanages

One home had neither a permanent donor nor an official sponsor but relied on individual's contribution on adhoc basis. They used to perform some cultural activities in special occasion to collect fund. Two homes were run by foreign donors with co-operation to local community and also rely on individual's contribution on adhoc basis. These homes received support in form of clothes and food from different groups and well-wishers. However, these donations were also erratic and therefore not dependable. They find schools for support to meet their children and adolescent fees. Two homes were self-sponsored and also used to accept support from well-wishers.

4.5 Challenges in the CCHs

The main challenges faced by the CCHs were:

a) Lack of permanent income base.

b) An inadequate amount of land to accommodate large number of children and adolescent.

c) Lack of funds to offset school fees, textbooks, clothing, salaries, medical and utilities expenses.

d) There was lack of transportation facilities to perform various administrative activities of the home.

The solution to these problems would be the involvement of the communities, various governmental and non-governmental sectors by supporting and further improvement of orphanages.

4.6 Personal hygiene

Personal hygiene was assessed by using structured questionnaire. Mwaniki and Makokha (2013) states that children who reported taking a bath daily were rated as having good bathing hygiene while those who took a bath four to six times a week and less than four times a week were rated as having adequate and poor bathing hygiene respectively. Similarly children and adolescent who reported brushing their teeth daily were rated as having good oral hygiene while those who brushed their teeth four to six times a week and less than four times a week were rated as having adequate and poor oral hygiene respectively.

1. Bathing

Majority (47.8%, n=33) of the children and adolescent reported poor bathing hygiene while (23.2%, n=16) reported adequate bathing hygiene and (29%, n=20) of the children and adolescent reported good bathing hygiene.(Table 4.5) Study in Kenya found that 32.2% of the children and adolescent in orphanages reported poor bathing hygiene. Among the study population in orphanages 59% reported adequate bathing hygiene and only 8.7% reported good bathing hygiene. (Mwaniki and Makokha, 2013). This study shows that prevalence of poor

bathing hygiene was higher and also prevalence of good bathing hygiene was better compared to the children in orphanages of Kenya.

2. Brushing

Higher (85.5%, n=59) proportion of children and adolescent used to brush once a day whereas (8.7%, n=6) children and adolescent used to brush twice a day and four children and adolescent (5.8%) did not used to brush because they were too small and unknown about brushing. It has been found that about 94% of children and adolescent in CCHs had a good oral hygiene whereas in Kenya only 33.3% children in orphanages reported good hygiene in brushing of teeth (Mwaniki and Makokha, 2013).

Table 4.5 Frequency of bathing, brushing teeth and washing hands at critical times among children and adolescent in CCHs.

Variable	Frequency	Percentage
Bathing		
Daily	20	29%
4-6 times a week	16	23.2%
<4times	33	47.8%
Brushing		
Once	59	85.5%
Twice	6	8.7%
Use to wash hand after visiting toilet		
water only	Nil	Nil
water and soap	67	97.1%
Use to wash hand before eating		
water only	8	11.6%
Water and soap	59	85.5%

3. Washing hands

Almost all children and adolescent (97.1%, n= 67)) reported washing hands with soap and water after visiting toilet. Study showed (85.5%, n=59) of children and adolescent wash their hands with water and soap before eating and (11.6%, n=8) wash hands with water

only, 2.9% children and adolescent did not wash hand before and after eating because they were too small, that they cannot eat by their own hands.

4.7 Nutritional status of the children and adolescent

Anthropometric data which included, height, weight, and age were collected of children and adolescent in CCHs. These three variables were developed into indices of nutritional status. The indices obtained were weight-for-age (underweight), height-for-age (stunting), weight-for-height (wasting), BMI-for-age (thin and overweight) were used to obtain the prevalence of nutritional status of children and adolescent in CCHs.

From the study, prevalence of underweight among children below 10 years of CCHs was found to be 17.39%. Sherif (2016) in Ethiopia found that prevalence of underweight (16.3%) which is slightly lower than present study. Similarly 13% underweight was found in orphan of Intervida Children home of Dhaka(Muhammad and Md, 2010). Finding indicates that prevalence of underweight was higher than children of Ethiopia and Dhaka.

The prevalence of chronic malnutrition or stunting was found to be 33.82%, which is higher than the prevalence of primary school children in eastern Nepal i.e. 21.5% (Shakya *et al.*, 2004). The discrepancies could result from differences in socio-economic differences between CCHs and also existing nutritional or other care and support programs. Stunting is usually associated with long term chronic malnutrition and long term factors such as frequent infection and poor feeding practices during early months of life.

Prevalence of thin and overweight ware found to be same 7.81%, which is very lower than prevalence of thinness found in orphans and vulnerable children of Ethiopia i.e. 18.2% (Sherif, 2016) and overweight found in orphans of Bangladesh i.e. 21.74% (Muhammad and Md, 2010).

Table 4.6 Prevalence of overall malnutrition (N=68)

Nutritional status	Frequency	Percentage
Stunted	23	33.82%
Underweight	4	17.39%
Thin	5	7.81%
Overweight	5	7.81%

Girls had a higher prevalence of stunting (35.24%) in comparison to boys (32.26%). On the other hand boys had a higher rate of underweight (18.18%) than girls (16.67%). Wasting rate was higher among girls (10.1%) than boys (8.7%). From this study it was found that stunting was higher and underweight was lower in girls. The reason might be due to higher physical activity of boys than girls.

The prevalence rate of overweight was 3.33% in boys and 11.76% in girls. Figure 4.2 indicates that if prevalence of stunting is higher than the prevalence of underweight is lower. The similar inverse relationship was found in preschool children of Latin America and Caribbean (Duran *et al.*, 2006).

A study done in Adolescent School Girls of West Bengal, India showed that overall prevalence rates of underweight, stunting and thinness were 27.9%, 32.5% and 20.2% respectively (Maiti *et al.*, 2011). It was found that prevalence of underweight and thinness of Indian girls was higher than Nepalese girls of CCHs. Similar study was done in Kavre district showed that overall prevalence of underweight, stunting and thinness was 31.98%, 21.08% and 14.94% respectively, in adolescent girls (Mansur *et al.*, 2015). The overall prevalence of stunting and thinness were found to be 46.6% and 42.4% respectively among rural adolescent of Darjeeling (Mondal and Sen, 2010).

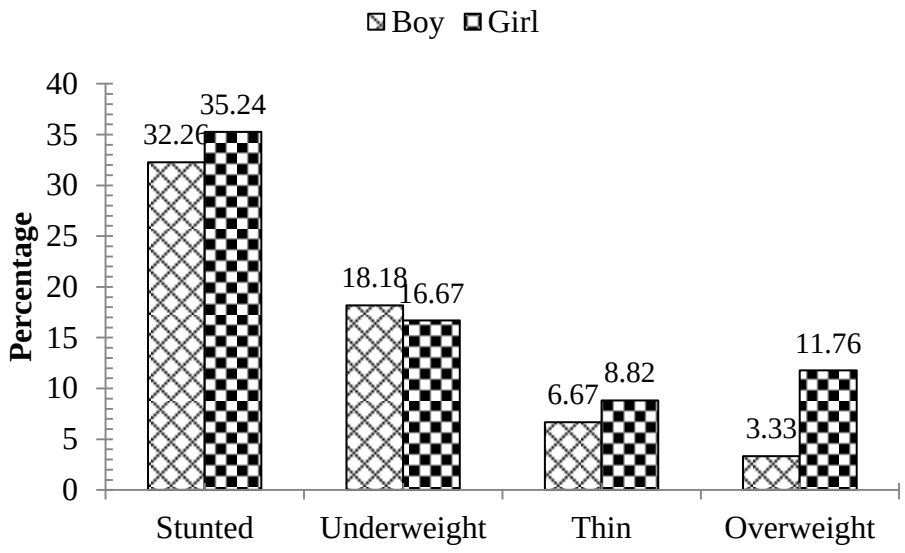

Figure 4.1 Overall bar diagram of malnutrition by sex.

4.8 Prevalence of Severity of malnutrition

Prevalence of severe and moderate stunting was 6 (8.82%) and 17 (25%) respectively. In Kenya contrast result were found in children of orphans where Prevalence of severe and moderate stunting was (33.4%) and (2.4%) respectively (Mwaniki and Makokha, 2013). Among 37 girls, (5.41%) and (29.73%) were severely and moderately stunted, respectively. Moderately underweight, severely and moderately thin were found to be (16.67%), (5.88%) and (2.94%) respectively. Among 31 boys, 19.35% and 12.9% were moderately and severely stunted, same percentage (9.09%) was severely and moderately underweight among 11 boys, similarly same percentage (3.33%) was severely and moderately thin among 30 boys. Prevalence of overweight was (3.33%) and (11.76%) found among 30 boys and 34 girls respectively.

Thapa *et al.* (2013) found that 22.4% and 29.4% of children in Humla and Mugu district, respectively were thin whereas present study found 7.78% of children and adolescent in CCHs of Sunsari district were thin, which is very low than western district of Nepal. Study in orphan of Bangladesh found that 12% and 14.3% were severely underweight and stunted respectively (Obidul Huq *et al.*, 2013).

Table 4.7 Prevalence of Severity of Malnutrition

	Characteristics	**Boy%**	**Girl%**	**All%**
HAZ	Severely Stunted	12.9	5.41	8.82
	Moderately Stunted	19.35	29.73	25
	Normal	67.74	64.86	66.15
WAZ	Severely Underweight	9.09	0	4.35
	Moderately Underweight	9.09	16.67	13.04
	Normal	81.82	83.33	82.61
BAZ	Severely thin	3.33	5.88	4.69
	Moderately thin	3.33	2.94	3.13
	Normal	90	79.41	84.38
	Overweight	3.33	11.76	7.81

4.9 Food intake by the children and adolescent in CCHs

The children in CCHs who attended school away from the CCHs had three meals (lunch, mid-day meal and dinner) in a day during school days and four meals (morning meal, Lunch, mid-day meal and dinner) during the holiday.

To determine the contribution made by each food consumed by the study population, study population's total food intake by weight was calculated. The foods were classified into 12 different food groups (Swindale and Bilinsky, 2006). The food groups found in the study population's diet and their contribution by weight to the total diet intake are as shown in Table 4.8. The cereals food group contributed the highest amount by weight (355.3g) and proportion (39%) to the total diet for the children and adolescent in orphanages. Fruits 1% (12.9g) and additional oil 2% (20.9g) made a small contribution to the study population in CCHs dietary intake. Fish and eggs were completely lacking in the CCHs' diet. The children and adolescent included in the study had monotonous diets, with few animal products, fats, fruits and vegetables other than green leaves. Same diet was provided to the preschool age children of Nigeria (Tarini *et al.*, 1999). Similar finding was also found in Kenya, children in orphanages have cereal food group contributed the highest amount and eggs were completely lacking in orphanages diet (Mwaniki and Makokha, 2013).

Table 4.8 Food intake by the children and adolescent in CCHs

Food Groups	**Amount consumed from each food group (g)**	**Percentage contribution to the total diet**
Cereal	355.3	39%
Root and tuber	125.1	14%
Vegetable	139.0	15%
Fruit	12.9	1%
Meat	65.7	7%
Egg	3.7	0
Fish	0.0	0
Pulses	58.0	6%
Milk	53.3	6%
Oil	20.9	2%
Sugar	9.7	1%
miscellaneous	71.7	8%
Total	**915.3**	**100**%

Source: Swindale and Bilinsky (2006)

4.9 Dietary intake result

Present study has found that average calorie intake was 1035±347.6 kcal/day of children 1-3 years which was 97.67% of RDA. Similarly average protein (31.6±13.89 gm/day), visible fat (5.94±4.023gm/day), calcium (195.26±47.67gm/day) and Iron (8.96±5.71gm/day) intake were 189.22%, 22%, 32.54% and 99.56% of RDA respectively of children 1-3 years. Difference between mean calorie, protein, visible fat, calcium, and iron intake with their respective RDA were statistically not significant ($p > 0.05$), this result may show that intake of nutrient by children (1-3 years) have high probability of nutrient adequacy.

Table 4.9 Nutrient intake by 1-3 years children

	Intake	**RDA**	**% of RDA**	**t**	**p**
Calorie(kcal/day)	1035.29±347.6	1060	97.67%	-0.101	0.936
Protein(gm/day)	31.6±13.89	16.7	189.22%	1.517	0.371
Vis. Fat(gm/day)	5.94±4.023	27	22%	-7.404	0.085
Calcium(mg/day)	195.26±47.67	600	32.54%	-12	0.053
Iron(mg/day)	8.96±5.71	9	99.56%	0.01	0.994

Average calorie intake per day (1621.46±234.12 kcal) of 4-6 years children was 120.11% of estimated RDA; corresponding values for protein and visible fat intake were 234.68% and 39% respectively. Study in Durban, South Africa also found that intake of average calorie and protein by children (4-8 years) in residential care facilities was 141.81% and 346.34% of the recommended intake respectively (Grobbelaar *et al.*, 2013). Average daily calcium and iron intake were 48.59% and 133.77% of RDA respectively. Average daily visible fat and calcium intake of study subject in age 4-6 years were significantly ($p< 0.05$) less than estimated RDA. Grobbelaar *et al.* (2013) also found that calcium intake by children in Durban were significantly ($p < 0.05$) less than estimated intake. Similarly average daily protein and iron intake were significantly higher than estimated corresponding RDA at $p <0.05$. Similar significant was seen in research done in South Africa, Durban (Grobbelaar *et al.*, 2013).

Table 4.10 Nutrient intake by 4-6 years children

	Intake	RDA	% of RDA	t	p
Calorie(kcal)	1621.46±234.12	1350	120.11%	2.319	0.103
Protein(gm)	48.98±5.36	20.1	243.68%	10.781	0.002*
Vis. Fat(gm)	9.87±1.515	25	39.48%	-19.979	0.000*
Calcium(mg)	291.56±89.77	600	48.59%	-6.872	0.006*
Iron(mg)	17.39±2.68	13	133.77%	3.278	0.046*

Average calorie intake per day (1918.97±282.65 kcal) of 7-9 years children was 113.55% of estimated RDA; corresponding values for protein and visible fat intake were 182.78% and 72.7%, respectively. Average daily calcium and iron intake were 47.94% and 101.81% of RDA, respectively. Average daily visible fat and calcium intake of study subject in age 7-9 years were significantly ($p < 0.05$) less than estimated RDA, similarly average daily protein intake was significantly higher than estimated corresponding RDA, at ($p < 0.01$). Study in Durban had also found similar significance of protein intake by children at ($p < 0.05$) (Grobbelaar *et al.*, 2013). Muhammad and Md (2010) indicate that orphan children of age groups 7-9 years had calorie, protein, fat, calcium and Iron intake 2270kcal, 65gm, 73gm, 826mg and 31mg respectively in Dhaka city of Bangladesh which was comparatively higher than present study.

Table 4.11 Nutrient intake by 7-9 years children

	Intake	RDA	% of RDA	t	p
Calorie(kcal)	1918.97±282.65	1690	113.55%	3.34	0.004
Protein(gm)	53.92±9.92	29.50	182.78%	10.15	0.000*
Vis. Fat(gm)	21.81±12.27	30.00	72.70%	-2.751	0.014*
Calcium(mg)	287.61±117.27	600	47.94%	-10.98	0.000*
Iron(mg)	16.29±3.81	16	101.81%	0.316	0.756

Average calorie intake per day of boys and girls (10-12yrs) was (2440.79±514.1) and (2138.1±249.22) respectively which were 111.45% and 106.37% of the estimated RDA. Grobbelaar *et al.* (2013) had also reported 119.28% and 108.39% of estimated RDA of calorie intake by girls and boys in residential care facilities at Durban. Corresponding values for protein and visible fat daily intake by boys (10-12yrs) were 171.88% and 138.63%, respectively.

Table 4.12 Nutrient intake by 10-12 years children and adolescent

	Sex	Intake	RDA	% of RDA	t	p
Calorie(kcal)	Boy	2440.79±514.1	2190.00	111.45%	1.38	0.21
	Girl	2138.1±249.22	2010.00	106.37%	1.149	0.314
Protein(g)	Boy	68.58±20.3	39.90	171.88%	3.995	0.005*
	Girl	56.7±9.53	40.90	138.63%	3.823	0.019*
Vis. Fat(g)	Boy	17.23±6.82	35.00	49.23%	-7.375	0.000*
	Girl	15.48±7.95	35	44.23%	-5.492	0.005*
Calcium(mg)	Boy	253.28±45.17	800	31.66%	-34.235	0.000*
	Girl	207.14±16.95	800	25.89%	-66.457	0.000*
Iron(mg)	Boy	17.99±5.02	21	85.7%	1.697	0.134
	Girl	14.83±3.39	32	46.3%	-8.032	0.001*

Average calcium and iron consumption by boys (10-12yrs) were 31.66% and 8.7% of RDA respectively. Similarly for girls of 10-12 years mean daily consumption of protein, visible fat, calcium and iron were 138.63%, 44.23%, 25.89% and 46.3% of estimated RDA respectively. Average daily protein intake by boys and girls in age group 10- 12 years were significantly ($p < 0.05$) more than estimated RDA. In the context of girls (10-12 years) similar significant association was found in India (Choudhary *et al.*, 2010). Corresponding values for visible fat and calcium intakes by boys and girls were significantly ($p < 0.05$) less than estimated RDA. The mean iron daily intake by girls (10-12yrs) was significantly ($p <0.05$) less than estimated RDA.

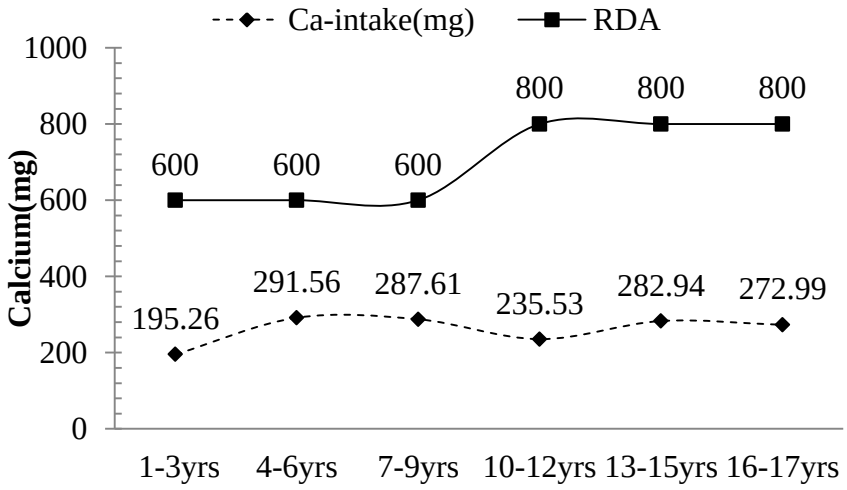

Fig. 4.2 Diagram of calcium intake

Study found that calcium intake by all studied samples were very low than essential RDA. In India one study indicated that calcium intake by boys in all the orphanages in

Udaipur was significantly low in all age groups, expect for calcium intake in 4-6 year old (Khan *et al.*, 1996). Similarly study in Kuala Lumpur on adolescent also reported that calcium intake was less than RNI (Chee *et al.*, 2008). Survey found that the intake of milk and milk product was very poor. This may be due to low budget of CCHs. They depend upon donation and cannot buy essential nutritive food. Choudhary *et al.* (2010) had reported that calcium intake by Indian's girls (10-12 years) were significantly ($p< 0.05$) less than estimated RDA. Similarly calcium intake do not met the requirement of children and adolescents in residential care facilities in Durban (Grobbelaar *et al.*, 2013).

Average daily calorie intake of boys and girls (13-15yrs) were (2273.8±414.96) and (2186.32±335.32) respectively which were 82.68% and 93.83% of the estimated RDA. Corresponding values for daily protein and visible fat intake by boys (13-15 years) were 122.8% and 121.83% respectively. Average calcium and iron consumption by boys (13-15 years) were 35.9% and 57.3% of RDA respectively. Similarly for girls (13-15 years) mean daily consumption of protein, visible fat, calcium and iron were 121.83%, 57.7%, 35.02% and 69.3% of estimated RDA respectively whereas study in adolescent girls of India was found that the intake of calorie, protein, fat, calcium, and iron were 78.98%, 80.16%, 77.26%, 71.54% and 86.66% respectively (Choudhary *et al.*, 2010).

Average daily protein intake by boys and girls in age group 13- 15 years were significantly ($p< 0.01$) more than estimated RDA. Corresponding values for visible fat, calcium and iron intakes by boys and girls were significantly ($p < 0.01$) less than estimated RDA.

Choudhary *et al.* (2010) reported that calorie, protein and calcium intake by Indian's girls (13-15 years) were significantly ($p< 0.05$) less than estimated RDA.

Table 4.13 Nutrient intake by 13-15yrs children and adolescent

	Sex	Intake	RDA	% of RDA	t	p
Calorie(kcal)	Boy	2273.8±414.96	2750.00	82.68%	-3.443	0.009*
	Girl	2186.32±335.32	2330.00	93.83%	-1.545	0.148
Protein(gm)	Boy	66.78±10.93	54.30	122.8%	3.424	0.009*
	Girl	63.23±9.94	51.90	121.83%	4.154	0.001*
Vis. Fat(gm)	Boy	25.88±12.1	45	57.51%	-5.086	0.001*
	Girl	23.08±11.99	40	57.7%	-5.089	0.000*
Calcium(mg)	Boy	286.91±92.45	800	35.9%	-16.65	0.000*
	Girl	280.19±81.87	800	35.02%	-22.891	0.000*
Iron(mg)	Boy	18.34±6.1	32	57.3%	-6.724	0.000*
	Girl	18.71±4.75	27.00	69.3%	-6.286	0.000*

Average daily calorie intake of boys and girls (16-17yrs) were (2763.34±747.56) and (2208.05±450.73) respectively which were 91.5% and 90.49% of the estimated RDA. Corresponding values for daily protein and visible fat intake by boys (16-17 years) were 131.11% and 59.1%, respectively. Average calcium and iron consumption by boys (16-17 years) were 38.81% and 574.68% of RDA respectively. Similarly for girls (16-17 years), mean daily consumption of protein, visible fat, calcium and iron were 115.39%, 46.63%, 32.12% and 65.38% of estimated RDA, respectively.

Hassan and Hossain (2006)in Bangladesh, found that energy, protein, calcium and iron intake by adolescent children were 86%, 96%, 61% and 77% of estimated requirement (Hassan and Hossain, 2006).

Table 4.14 Nutrient intake by 16-17yrs children and adolescent

	Sex	Intake	RDA	% of RDA	t	p
Calorie(kcal)	Boy	2763.34±747.56	3020	91.5%	-0.595	0.612
	Girl	2208.05±450.73	2440	90.49%	-1.361	0.222
Protein(gm)	Boy	80.63±18.87	61.5	131.11%	1.756	0.221
	Girl	64.04±21.94	55.5	115.39%	1.03	0.343
Vis. Fat(gm)	Boy	29.55±15.8	50	59.1%	-2.243	-0.154
	Girl	16.32±5	35	46.63%	-9.889	0.000*
Calcium(mg)	Boy	310.49±69.17	800	38.81%	-12.26	0.007*
	Girl	256.92±61.4	800	32.12%	-26.31	0.000*
Iron(mg)	Boy	20.91±5.43	28	74.68%	-2.26	0.152
	Girl	17±3.02	26	65.38%	-7.897	0.000*

Average daily visible fat intake by girls in age group 16-17 years were significantly ($p< 0.01$) less than estimated RDA. Corresponding values for calcium intakes by boys and girls were significantly ($p< 0.05$) less than estimated RDA. Mean daily intake of iron by girls (16-17 years) was significantly ($p<0.05$) less than estimated RDA. Similarly iron intake by girls(16-19 years) was found to be significantly ($p<0.05$) less than estimated RDA in India. Mean calcium intake by girls was significantly ($p< 0.01$) less than the RDA values in the age groups 10-12 years and 13-15 years; Same result was found in study in Varanasi district of India (Choudhary *et al.*, 2010).

Iron intake was found to be 14.83, 18.71 and 17 mg in girls of 10-12, 13-15 and 16-17 years respectively. Study on Indian adolescent girls was found to be 17.84, 24.20 and 24.15 mg of corresponding age groups (Choudhary *et al.*, 2010). Iron intake by study samples was found to be lower than RDA among children and adolescent (10 -17yrs). Though requirement of iron increases with age, intake by subjects were found to be roughly in same range. This may be due to lack of knowledge about nutrient requirement.

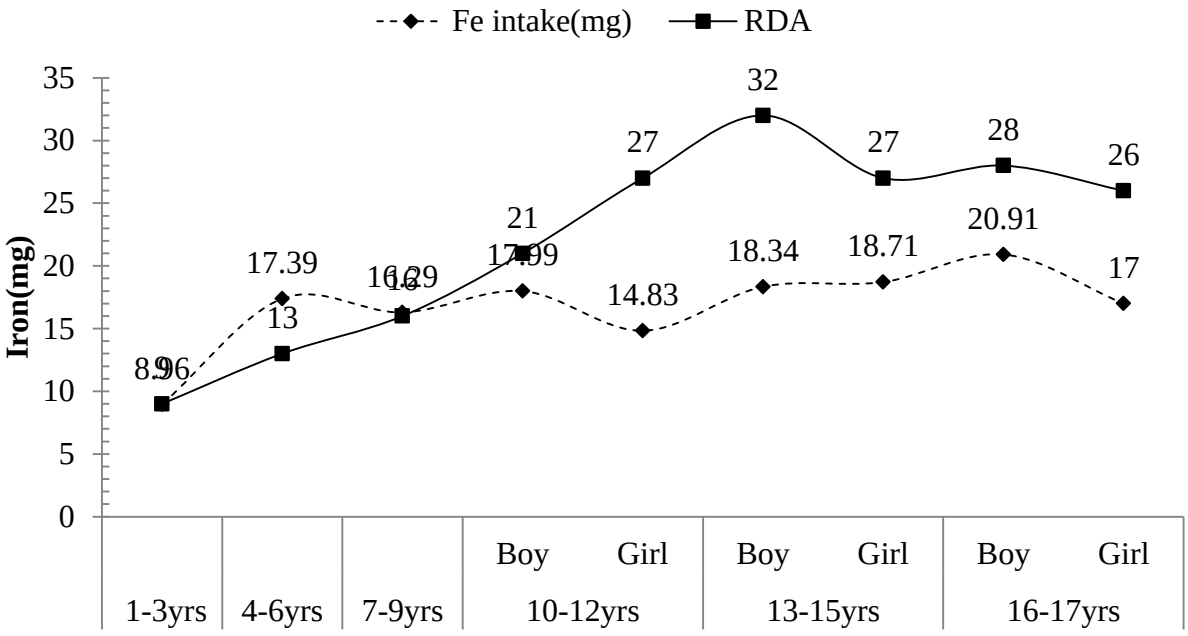

Fig. 4.3 Iron intake variation with age.

From above tables it was found that intake of calorie and protein are comparatively higher than the micronutrient like calcium and iron whereas the finding on orphan children's of Jammu and Kashmir indicated that nutrient intake was deficient for all nutrients when compared to RDA (Ahmad and Ganesan, 2016). Intake of calcium and additional fat is very poor. This may be due to lacking of milk and dairy product, fruit and green vegetables in diet. Protein and calorie intake was found to be higher, this may be due to excess use of cereal product in each meals.

Overall the study shows that out of 68 study subjects, 32 (47.06%) had low probability of calorie adequacy and 36 (52.94%) had high probability of calorie adequacy. Only 7 (10.29%) out of total study subject had low probability of protein adequacy and 61 (89.71%) had high probability of protein adequacy. In Durban, probability of protein adequacy was found to be high in 5- 18 years children and adolescent (Grobbelaar *et al.*, 2013). Adequacy of visible fat intake was high in 8 (11.8%) and low in 60 (88.24%) of total study subject.

All study subjects had low probability of calcium adequacy. Same result of low calcium adequacy was found in Indian's girls (Choudhary *et al.*, 2010). Out of total study subject 19.1% had high percentage of adequacy of iron intake and 80.9% of study subjects had low percentage of iron adequacy. (Table 4.16)

Table 4.15 Nutrients intake of study subjects as percentage of RDA

Nutrients	Percentage of intake of RDA	
	≥100	<100
Calorie	36(52.94%)	32(47.06%)
Protein	61(89.71%)	7(10.29%)
Visible fat	8(11.8%)	60(88.24%)
Calcium	Nil	68(100%)
Iron	13(19.1%)	55(80.9%)

This finding shows that higher protein intake by children and adolescent in CCHs was from cereal sources rather than major sources of protein like meat and pulses. That may cause the lack of essential amino acid. That may be reason of chronic malnutrition.

Figure 4.4 shows that the average calorie intake was slightly higher compared to their respective RDA intake up to age 4 to 12 years. The mean calorie intake by 13 to 17 years was found to be less than respective RDA. This may be due to their tight daily schedule and greater physical activity.

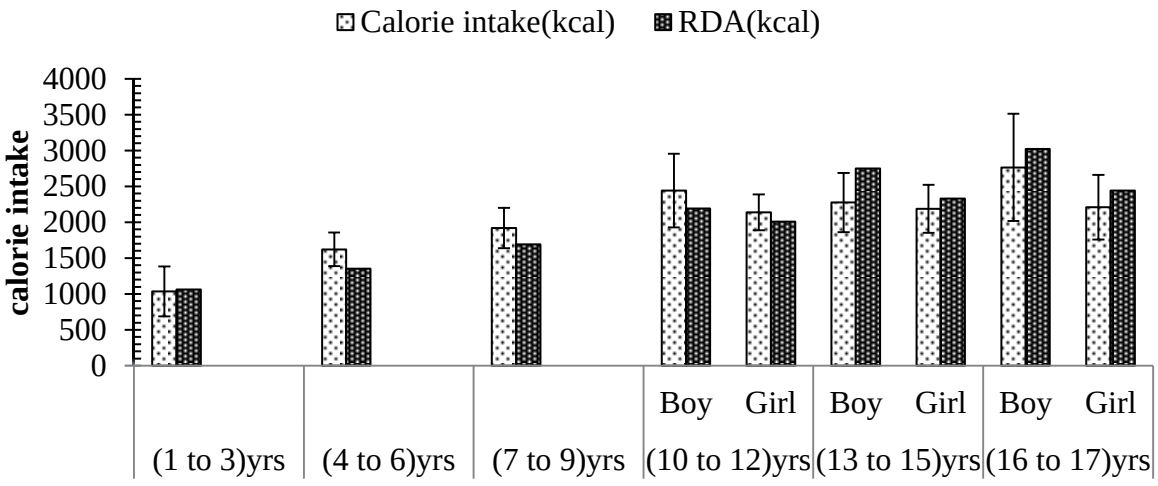

Fig. 4.4 Bar Diagram of energy intake

Figure 4.5 shows that mean intake of visible fat was lower than essential RDA, use of additional fat was found to be low. This may show the risk of fat soluble vitamins deficiency. It was found that the use of cooking oil was maximum same types, may result deficiency of essential fatty acids.

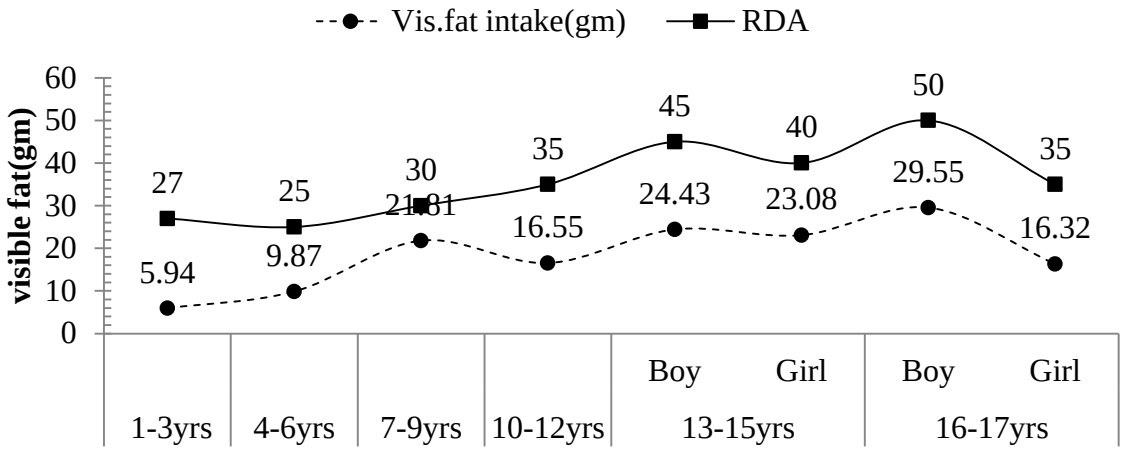

Fig. 4.5 Diagram of visible fat intake

4.10 Correlation

The table 4.18 shows that proportion of stunted children and adolescent was inversely and significantly ($p<0.05$) correlated with study population's energy intake. This shows that if energy intake was higher than the chance of stunting would be lower. Also in a study carried out in Kenya among children in orphanages similar correlation was found (Mwaniki and Makokha, 2013). The proportion of stunted children and adolescent was positively and significantly ($p<0.05$) correlated with children and adolescent's calcium intake. It represented that if calcium intake will increase than the prevalence of stunting may also be increase. Similarly thinness was positively and significantly correlated with visible fat intake.

Though calcium and visible fat intake seems to be positively correlated with stunting and thinness, as the calcium intake and visible fat were below the recommended RDA for the given population, the correlation cannot be regarded to be significant. That means if the nutrient intake is below requirement then there will always be chance of under nutrition.

Table 4.16 Correlation coefficient between nutrient intake and malnutrition among children and adolescent in CCHs

Nutrient	Stunting	Underweight	BMI for age	
			Thin	Overweight
	r	r	r	r
Energy	-0.208*	0.005	0.035	0.014
Protein	-0.145	0.181	0.021	0.000
Visible fat	0.038	-0.005	0.226*	-0.116
Calcium	0.232*	-0.108	0.031	-0.124
Iron	-0.154	-0.361*	0.203	0.103

KEY: p<0.05*

Iron intake was inversely and significantly (p<0.05) correlated to the prevalence of underweight. Study in Indonesia on pregnant woman found that consumption of one or more tablets (200 mg ferrous sulfate and 0.25 mg folic acid) per week by women during pregnancy was associated with increased neonatal weight (EL *et al.*, 1995).

Table 4.17 Correlation coefficient between malnutrition and various factors among children and adolescent in CCHs

Variable	Stunting	Underweight	Thin	Overweight
	r	r	r	r
Duration in CCHs	0.098	0.067	0.073	-0.015
Age of children	-0.163	-0.036	0.143	0.043
Bathing	0.036	-0.067	0.017	-0.177
Brushing	0.004	-0.032	0.195	0.306*
Washing hands	0.096	0.097	-0.082	-0.043

Study shows that malnutrition except overweight was not significantly correlated with different variable like stay of children in CCHs, age of children, hygiene behavior. This shows that hygiene behavior of all children was good. Study found that overweight was positively and significantly (p<0.05) correlated with brushing teeth by children and

adolescent. Good oral hygiene may be helpful to prevent infection and increase the appetite, which result the good nutrient absorption.

Part V

Conclusions and recommendations

5.1 Conclusions

Conclusively, this study has assessed the nutritional adequacy of food and nutritional status of children and adolescent in CCHs of Sunsari district of Nepal, which was not explored before and findings are important to understand nutritional quality of food and prevalence and determinants of malnutrition of children and adolescent in CCHs. Following points can be concluded from the study.

a) Probability of calorie adequacy was in 52.94% of children and adolescent.
b) Probability of protein adequacy was very high among all children and adolescent.
c) Whereas the percentage of visible fat and calcium intake was very low.
d) The probability of iron adequacy was higher among children below 10 years and was lower in adolescent above 10 years.
e) Prevalence of stunting was very high i.e. 33.82%. Underweight was found to be in 17.39% of children and adolescent. Equal percentage (7.81%) of children and adolescent were overweight and thin.
f) Energy and iron intake were inversely and significantly ($p<0.05$) correlate with stunting and underweight respectively. Calcium intake was positively and significantly ($p<0.05$) correlated with stunting of children and adolescent.
g) Ignorance about micronutrients and protective foods prevailed in CCHs.

5.2 Recommendations

Based on the results of this study following recommendations could be made:

a) Diet provided to children and adolescent in CCHs should include more fruits and milk and milk product to improve the nutritional status of the children and adolescent.
b) Diet should include seasonal green vegetables and other low-cost nutritious foods in the diet of children and adolescent in CCHs.
c) There is need for increasing frequency of meal per day specifically to adolescents by introduction of lunch programs to impact positively on the nutritional status of them.
d) There is the need for intervening nutritional and health education as educated caretaker is most likely to provide better care in terms of good nutrition and better hygiene which in turn improve the nutritional status.
e) Survey of this nature should be carried out at regular intervals so that it will assist the stakeholder to formulate plan and policies for the betterment of food's nutritional quality and nutritional status of CCHs
f) Appropriate intervention of fortified micronutrients food distribution programs should be implemented to improve the micronutrient adequacy and nutritional status.
g) Similar cross-sectional descriptive or longitudinal survey can be conducted to determine the magnitude and distribution of malnutrition and other probable causes of malnutrition.

Part VI

Summary

Orphanhood is a vast problem in the world with specific impacts on the social and public health sectors. Human beings need to have adequate nutrition to attain normal physical growth (in children) and for a healthy life. Good nutrition contributes to productivity, economic development, and poverty reduction by improving physical work capacity, cognitive development, school performance, and health by reducing disease and mortality. The study was conducted to determination of nutrient adequacy of the food catered in the child care home (CCH) of sunsari district.

The study included all children and adolescent (1-17 years) of five CCHs of Sunsari district. Weighing method and food composition table were used to determine the amount and nutrient content of food catered to the study population respectively. Anthropometry was used to determine the nutritional status of the children. Z-scores were generated and used to assess the nutritional status of children and adolescent. Statistical analysis of the data was performed using the statistical package for Social Sciences for Windows SPSS (version 20.0). T-test, bivariate spearman correlation coefficients were used to compare the nutrient intake with respective RDA and to determine the association between nutrient intake and malnutrition, respectively.

Out of 68 children and adolescent of age 1 to 17 years, 37 were girls and 31 were boys. Stunting was found in 33.82% of children and adolescent, 17.39% were underweight, equal percentages of children and adolescent (7.81%) were overweight and thin. Probability of calorie adequacy was found in 52.94% of children and adolescent in CCHs and probability of protein adequacy was found in higher proportion (89.71%) of children and adolescent in CCHs. Calcium intake of all children and adolescent were found to be below their RDA. Probability of Iron inadequacy was found in 80.9% of children and adolescent in CCHs. The proportion of stunting and underweight were inversely and significantly ($p<0.05$) correlated with children and adolescent's energy and iron intake respectively. The proportion of thin and stunting were positively and significantly correlated with children and adolescent's visible fat and calcium intake, respectively. The cereals food group contributed the highest amount by weight (355.3g) and proportion (39%) to the total diet for the children and adolescent in orphanages. Fruits 1% (12.9g) and additional oil 2%

(20.9g) made a small contribution to the children and adolescent in CCHs dietary intake. Fish and eggs were completely lacking in the CCHs' diet.

The results of this study indicate that under nutrition and nutrient inadequacy are still important problems among children and adolescent in CCHs of Sunsari district. These findings are of great importance to the stake holders as they identify potential actions that can be used to improve the existing nutritional status and adequacy of food catered to children and adolescent. Thus, to reduce the existing prevalence of malnutrition and inadequacy of nutrient in CCHs of Sunsari district appropriate interventional program should be implemented.

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Appendix

Appendix A

Questionnaire

Nutritional and Health seeking behavior of children in child care homes.

Interview with care takers

1. How many children live with you in your family?
   ……
2. How many times do the children feed per day?
   ……
3. Is there a fixed meal schedule for each day?

a) Yes b) No

4. Do you hold celebrations on special occasions for the children? ……
5. How many meals do the children take during school days?
   ……..
6. Has the child suffered any illness in last 7 days?

a) Yes b) No

7. Which symptom of the illness was observed?

a) Diarrhea b)flu/cough/cold c)vomiting d) fever/malaria e)others

8. Were certain foods increased during illness?

a) Yes b) No c) If yes which ones?

9. Has the child been vaccinated?
   ……
10. How many latrines are available for your families/children's use?
    Girls……
    Boys……
11. How do you use the water?

a) By filtration b) by boiling c) without any treatment.

12. Which schools do the children attend?

School	no. of children
……..	……
……..	……
……..	..……...
……...	……

13. How far are the schools from the orphanage/home?

a) <1km b) 1km c) 2-3 km d) >4km

Interview with in-charge of the CCHs

14. Biographical data
a) Age of respondent……
b) Marital status……
c) Gender ……
d) Educational level of respondent ……..
e) Occupation ……
15. Total number of children in the CCH
No. of males …….
No. of females ……
16. History of the CCH
a) When was the orphanage started?

b) Why was it started?

c) Who are the sponsors?

17. Sources of income and subsistence activities
a) What are the CCH's subsistence activities?

b) What are the main sources of income for running the orphanage?

c) Apart from the main source, are there other sources of income?

d) Do you receive any other type of non- financial support?

18. What are the challenges faced in providing for children?
a) Financial b) Discipline of the children c) Poor academic performance of the children d) other (specify…….)
b) What would you recommended to be solutions to the above problems?

Name of CCH: **date:**

Nutritional and Health seeking behavior of children in child care homes.

A. Child's background

19. Name-……
20. Code- ☐
21. Indicate whether male/female
22. Age - ☐
23. Which class are you in? Thick there appropriate

Class										1 0	1 1	1 2	… …

24. At what age did you come/were you brought t the Child Care Home?

a. Less than 1yr. b. 1-2 yr. c. 2-3yr. d. more than 3 yr.

B. Health and hygine (thick one)

25. How often do you take bath?

a. Daily b. 4-6 times a week c.<=4times a week d. others

26. How often do you brush your teeth?

a. Once b. twice

27. Did you wash your hands yesterday?

a. After visiting the toilet? (yes/no)

b. Before eating food? (yes/no)

28. What did you use to wash hands?

a. Water only b. Water and soap

C. Nutritional status

29. 1st height of child in cm =…… 2nd height of child in cm =……..
    Average height =……..
30. 1st weight of child in kg. =…… 2nd weight of child in kg. =……...
    Average weight in kg. =……
31. MUAC (child below 5 yrs.)
    1st MUAC=…… 2nd MUCAC=……
    Average MUCAC=……

Appendix B

Name of CCH: …….. Date:……
Food preparation by household……

Food	Name of ingredient	Net weight raw(g)	Weight of containers:
1.			
2.			
3.			
4.			
5.			
6.			

FOODS						
Wt. of pan and raw foods:						
Wt. of pan and cooked foods:						
Wt. of cooked foods:						

- Assume the weight loss during cooking is due to the evaporation of water.
- Assume that the components are uniformly divided

FOODS						
The standardized portion amount:						

Fraction= amt. of potion / wt. of cooked food

FOODS						
FRACTION						

Amt. of each ingredient in a portion:

Food	Ingredient	Amount(netwt.×factor)	Food	Ingredient	Amount(netwt.×factor)

2.3 Record of a individual's food intake in a day

Date : **Meal:** **Time:**

FOOD / **NAME**							LEFT OVER

Appendix C

Government of Nepal

Nepal Health Research Council (NHRC)

Ref. No.: 1376

12 February 2017

Mr. Om Prakash Sah
Principal Investigator
Tribhuwan University
Nepal

Ref: **Approval of Research Proposal** entitled **Determinants of nutrient adequacy of the food catered in the Child care home of Sunsari district**

Dear Mr. Sah

It is my pleasure to inform you that the above-mentioned proposal submitted on 24 January 2017 **(Reg. no. 17/2017)** please use this Reg. No. during further correspondence) has been approved by Nepal Health Research Council (NHRC) National Ethical Guidelines for Health Research in Nepal, Standard Operating Procedures Section 'C' point no. 6.3 through Expedited Review Procedures.

As per NHRC rules and regulations, the investigator has to strictly follow the protocol stipulated in the proposal. Any change in objective(s), problem statement, research question or hypothesis, methodology, implementation procedure, data management and budget that may be necessary in course of the implementation of the research proposal can only be made so and implemented after prior approval from this council. Thus, it is compulsory to submit the detail of such changes intended or desired with justification prior to actual change in the protocol.

If the researcher requires transfer of the bio samples to other countries, the investigator should apply to the NHRC for the permission.

Further, the researchers are directed to strictly abide by the National Ethical Guidelines published by NHRC during the implementation of their research proposal and submit progress report and full or summary report upon completion.

As per your research proposal, the total research amount is **NRs. 19,000.00** and accordingly the processing fee amounts to **NRs-1,000.00**. It is acknowledged that the above-mentioned processing fee has been received at NHRC.

If you have any questions, please contact the Ethical Review M & E Section at NHRC.

Thanking you,

Dr. Khem Bahadur Karki
Member- Secretary

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