COMPARATIVE STUDY ON NUTRITIONAL STATUS OF PRIMARY LEVEL SCHOOL CHILDREN STUDYING IN PRIVATE AND PUBLIC SCHOOLS OF BABIYA VDC, SUNSARI

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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 and Dietetics.

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Approval Letter

This *dissertation* entitled *Comparative Study on Nutritional Status of School Children Studying in Private and Public Schools of Babiya VDC, Sunsari* presented by Sukriti Koirala has been accepted as the partial fulfillment of the requirements for the degree of Bachelor of Science in Nutrition and Dietetics.

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(Sukriti Koirala)

Abstract

The nutritional status of school children influences their health, intellect, and subsequently their educational achievement. Yet, school children are not usually included in health and nutrition surveys. A descriptive cross-sectional study was conducted among 274 students; 137 students from each private and public schools in Babiya VDC, Sunsari to assess and compare the nutritional status of primary level school children and to determine the associated factors. Weight and height of students were measured using standard instruments and semi-structured questionnaires were administered to parents or care takers to assess the factors affecting nutritional status of children. Information about food consumption was collected by 24 hour dietary recall method. Prevalence of malnutrition was determined based on WHO classification and food composition table was used to calculate the nutrients contents. The survey data were analyzed using WHO Anthro Plus version 1.0.4 and SPSS 20.0. Chi-square test was used to identify the associated factors of malnutrition.

In private schools, 10.2% children were stunted (2.2% severely stunted and 8.0% moderately stunted) and 28.4% were thinned (5.1% severely thinned and 23.3% moderately thinned). In public schools, 27% children were stunted (2.9% severely stunted and 24.1% moderately stunted) and 26.3% were thinned (6.6% severely thinned and 19.7% moderately thinned). The prevalence of stunting was higher in female students in both private and public schools. Thinness was more prevalent in male students of private schools whereas its prevalence was equal in both genders in public schools. Gender ($p=0.013$), adequacy of protein ($p=0.000$), adequacy of calorie ($p=0.037$) and age of mother ($p=0.007$) of private school children were significantly associated with stunting. While in public schools, birth weight of children ($p=0.013$) and knowledge of mother about malnutrition ($p=0.014$) were significantly associated with stunting. Knowledge about malnutrition of mothers ($p=0.012$) was found to be significantly associated with thinness in private school children whereas caste ($p=0.01$) was found to be significantly associated with thinness in public school children.

Contents

List of Tables

List of Figures

List of Abbreviations

Abbreviation	Full form
BAZ	BMI-for-age Z-score
BFA	BMI-for-age
BMI	Body Mass Index
BNF	British Nutrition Foundation
BW	Birth Weight
CBS	Central Bureau of Statistics
DFTQC	Department of Food Technology and Quality Control
DGSM	David Geffen School of Medicine
DWO	Dalit Welfare Organization
FANTA	Food and Nutrition Technical Assistance
FAO	Food and Agriculture Organization
HAZ	Height-for-age Z-score
HDI	Human Development Index
HFA	Height-for-age
ICMR	Indian Council for Medical Research
MoHP	Ministry of Health and Population
NDHS	Nepal Demographic Health Survey
NMICS	Nepal Multiple Indicator Cluster Survey
PEM	Protein Energy Malnutrition
RDA	Recommended Daily Allowance

SLC	School Leaving Certificate
SPSS	Statistical Package for Social Science
SD	Standard Deviation
UNDP	United Nations Development Programme
UNICEF	United Nations Children Fund
VDC	Village Development Committee
WFA	Weight-for-age
WFH	Weight-for-height
WFP	World Food Program
WHO	World Health Organization

Part I

Introduction

1.1 Background

Malnutrition is a state of retarded physical development or specific clinical disorder caused by consistent lack of one or more nutrients. It is the diminishing health outcome due to deficiency, excess or imbalance of nutrients. Infants, pre-school children, adolescents, pregnant women and elderly people are the persons likely to be malnourished (Joshi, 2016). Protein energy malnutrition, deficiency of vitamin A, iodine deficiency disorder, and iron deficiency anemia are the common types of malnutrition in Nepal (Joshi, 2012). Lack of access to education and health facilities, dietary and hygiene practices, susceptibility to natural disasters, distribution and quality of land, level of infrastructure development and employment opportunities are responsible for under nutrition, morbidity, poverty and food insecurity in Nepal (UNICEF, 2014).

About half of the 10.7 million child deaths among children less than 5 years occurring each year are related to malnutrition in developing countries as estimated by WHO (Singh *et al.*, 2009). Primary school age (6-12 years) is a vibrant period of bodily growth and intellectual development of the child (Andrew *et al.*, 2014). Balanced nutrition is vital for school children. However, the nutritional status of school children is quiet lacking for the reason that the nutritional needs of infants, toddlers and pregnant women are only focused (Hamdani, 2015). The nutritional status of children reflects the socioeconomic position of the family, social wellbeing and proficiency of the health care system of the community as well as the effect of the surroundings (Andrew *et al.*, 2014).

Poverty and ignorance are underlying factors of malnutrition and malnutrition is the most common cause of diseases and mortality among children in developing countries (Andrew *et al.*, 2014). Apart from being caused by biomedical reasons, malnourishment is deep-rooted in poverty and disadvantaged public settings (Singh *et al.*, 2009). Protein energy malnutrition is responsible for more than half of all child deaths in Nepal as it possess a severe risk to the existence of young children (Manandhar *et al.*, 2008).

The health, cognition, and educational achievement of school children are influenced by their nutritional status. Malnutrition throughout the school years can obstruct the physical

and mental development of a child. Stunting (low height-for-age) can lead to long-term consequences, such as reduced intellectual achievement and school performance. It is also associated with the reduction in adult body size and reduced work capability and obstetric difficulties. Hindered maturation, deficiencies in muscular strength and work capacity, and reduced bone density later in life are the consequences of thinness (low BMI-for-age) in school children (Best *et al.*, 2010).

School children are usually not included in nutrition surveys though malnutrition is a serious health concern in school children in developing countries (Best *et al.*, 2010). The objective of the study was to assess the nutritional status of primary level school children of private and public schools of Babiya VDC. In view of the factors like poverty or income and knowledge on nutrition education, a comparative study on nutritional status of the school children studying in the government and private schools was done. Therefore this work of survey purposes to work out the nutritional status of school children of both categories of schools to discover the factors affecting the nutritional status and to figure out situation of nutrition in primary level school children.

Babiya is a village development committee in Sunsari District in the Koshi Zone of south-eastern Nepal. It has its border with Inaruwa metropolitan city towards north. This VDC consists of people of different ethnic group and different economic status. Mostly *Tharu*, Muslim, Yadav, Thakur, *Dalits* live here (District Development Committee, Sunsari). People are involved in various occupations like agriculture, trading, foreign employment, etc. Large numbers of people also work as labors in farms and in construction works. Major staple food is rice and along with rice people cultivate different crops like maize, wheat, sugarcane, potato, etc. The soil is fertile but still people depend on traditional methods for cultivating crops (CBS, 2011). The basic statistics of Babiya VDC is given in Appendix A.

1.2 Statement of problem

Malnutrition is impairment to the health of individuals because of deficiency, excess or imbalance of nutrients (Joshi, 2016). Insufficient food intake due to deficiency of food or lack of access to available food is the primal factor for poor nutritional status. A major proportion of Nepalese children are shorter or lighter than children of same age in well-nourished populations (Adhikari and Krantz, 2013). Nepal is among ten countries in the

world with the highest number of stunted children according to a report of UNICEF (Aryal, 2016).

Physical and mental developments are impaired during childhood as a result of malnutrition at premature age. Undernourishment affects school performance and often leads to a poorer earnings as a grown-up (WFP, 2017). The school children gain education either from private or public schools. Higher income families are likely to admit their children to private schools whereas disadvantaged people tend to admit their children in public schools. However, in both categories of schools, nutrition education seems to be lacking. Although the families have enough funds for balanced and nutritious food, they lack knowledge about nutrition and the balanced diet, causing malnourishment in the kids.

The prevalence of under nutrition was quiet high in Eastern Terai i.e. 36.7% stunting, 11.8% wasting and 24.4% underweight (MoHP, 2016). Babiya VDC is still underdeveloped and there is shortfall of study regarding nutritional status of children in this area. Therefore, this study is designed to assess the prevalence of malnutrition and associated factors among primary level school children which can be used as a reference in priority setting and designing effective nutritional programs at Babiya VDC.

1.3 Objectives

1.3.1 General objective

The general objective of this study was to assess and compare the nutritional status of primary level school children studying in private and public schools of Babiya VDC, Sunsari.

1.3.2 Specific objectives

a) To carry out the anthropometric survey of particular age group using standard instruments and guidelines.

b) To collect information regarding variables which are significantly associated with childhood malnutrition.

c) To compare the nutritional status between the school children between private and public schools of Babiya VDC.

1.4 Research questions

a) What is the nutritional status of school children aged 6-12 years studying in private and public schools of Babiya VDC?

b) What are the associated factors that cause malnutrition among those children?

1.5 Significance of the study

The outcomes of the study will be supportive to:

a) Act as tool to reflect sanitary condition, socio-economic variables, degree and types of malnutrition and condition of primary school children.

b) Help to plan suitable nutritional and health programs for this community based on the realities revealed from this study.

c) Reassure local people to improve the nutritional status by improving feeding practice of children, pregnant and lactating women.

d) Encourage government and other stake holders for the development of programs and policies related to nutrition.

e) Determine the issues related to nutrition, care practices and feeding behavior of this community.

1.6 Limitations

a) As the study was conducted with limited resources, biochemical and clinical assessments were not included.

b) As it was cross-sectional study, the prevalence of malnutrition might be affected by seasonal variation which was not taken into consideration.

1.7 Assumptions

It is assumed that the majority of school children of 6 to 12 years of age in Babiya VDC suffer from malnutrition caused by poor intake of nutrients, poor child caring practice and unhygienic environment.

Part II

Literature review

2.1 Nutrition

Nutrition is the discipline related to food and its interaction with an organism for the maintenance and promotion of health and well-being. The combination of all processes by which all parts of body obtain and utilize the materials or nutrients necessary for their functioning and for the growth and renewal of all components is referred to as nutrition (Joshi, 2016). Nutrition is vital for preservation of health and prevention of diseases, particularly the food-related deficiency diseases (Bansal, 2014).

2.2 Malnutrition

Malnutrition denotes the consequences resulting from insufficiency, excess or disproportion in the intake of calories and/or nutrients. The term malnutrition refers two major types of disorders. The first one includes under nutrition that comprises stunting (low height-for-age), wasting (low weight-for-height), underweight (low weight-for-age) and micronutrient deficiencies. The other includes overweight and obesity (WHO, 2016). Inability to eat or absorb sufficient nutrients as per the individual's energy requirements, for growth or to maintain a healthy immune system causes under nutrition. Micronutrient deficiencies result when the body does not obtain one or more essential micronutrients (Burgess and Danga, 2008).

2.3 Forms of malnutrition

a) Under nutrition: It results after the insufficiency of food consumed over prolonged time. It is called starvation in extreme cases (Jellife, 1996).

b) Over nutrition: This pathological condition is brought about by the intake of too much amount of food over an extended period of time. Over nutrition attributes to obesity, atheroma and diabetes in people (Jellife, 1996).

c) Imbalance: It is the condition resulting from the difference between intake and requirements of essential nutrients with or without complete lack of any nutrients (Jellife, 1996).

d) Specific deficiency: It is the pathological state due to comparative or complete deprivation of particular nutrients (Jellife, 1996).

The type of malnutrition depends on the duration of the deficiency of specific nutrients in the diet and age of the individual (WFP, 2016). Malnutrition is generally regarded as underweight, wasting or stunting in the child in developing countries. If the malnutrition continues for a long time, the height of the child may be affected which results stunting or short stature in the child. The short period of under nutrition causes the child to be under-weight or wasted (Gharti, 2005). The common type of malnutrition is protein energy malnutrition that manifests due to lack of energy and protein in the diet (WFP, 2016). Protein energy malnutrition is related to a group of disorders including marasmus, kwashiorkor, and intermediate states of marasmus-kwashiorkor (Scheinfeld and Khardori, 2015).

Marasmus is taken from the Greek term 'marasmos', that means wasting. Inadequate consumption of protein and calories causes marasmus which is characterized by excessive thinness. Kwashiorkor is derived from Ga language of Ghana meaning 'the sickness of the weaning' It indicates an inadequate intake of protein and calories. Edema is present in kwashiorkor but is absent in marasmus. The intermediate form of both marasmus and kwashiorkor is termed as marasmic-kwashiorkor. Both wasting and bilateral pitting edema can be observed in marasmic-kwashiorkor (Scheinfeld and Khardori, 2015).

2.4 Causes of malnutrition

There are many factors that result malnutrition in individuals. Most of the factors are related to inadequate diet or repeated infections, predominantly in disadvantaged populations. Insufficient diet and illness are consecutively associated with the standard of living and surroundings. Therefore, malnutrition is a health consequence, a risk factor for disease as well and it can alleviate the possibility of morbidity and mortality (Blossner and Onis, 2005).

The UNICEF conceptual framework was developed in 1990 which summarizes the causes of malnutrition. Figure 2.1 gives a clear picture of the UNICEF's conceptual framework.

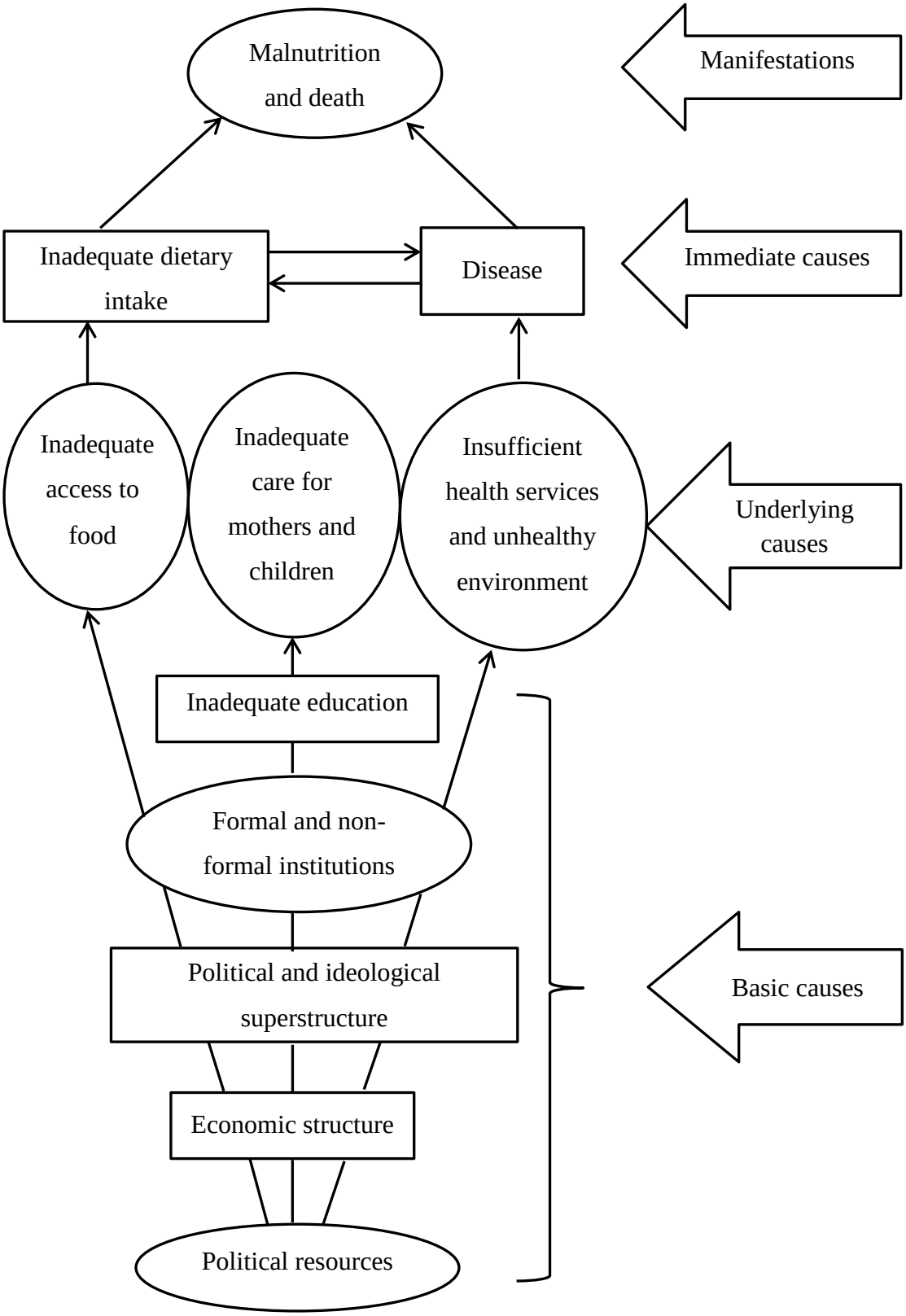

Fig 2.1 UNICEF conceptual framework (UNICEF, 2015a)

Malnutrition is initiated by insufficient diet and by infection at the most immediate level. Food access and availability, healthcare, water and sanitation, care practices of a child (for example, whether the infant is breastfed and whether basic hygiene practices are used, such as hand washing) are the influencing factors for the primary causes of malnutrition. Underlying these primary and intermediate factors are poverty, lack of resources (e.g., financial and human resources), and social, economic and political factors (e.g., women's status) (Joshi, 2012).

2.5 Malnutrition and infection cycle

Malnutrition, which is a key health problem in developing countries, is the important risk factor for illness and death worldwide. Hundreds of millions of pregnant women and young children are predominantly affected by malnutrition. In developing countries, marasmus, kwashiorkor, deficiencies in iron, iodine, vitamin A and zinc are the major consequences of malnutrition. A greater incidence of inadequate diet and infectious disease repeatedly unites into a vicious cycle in these communities (Müller and Krawinkel, 2005).

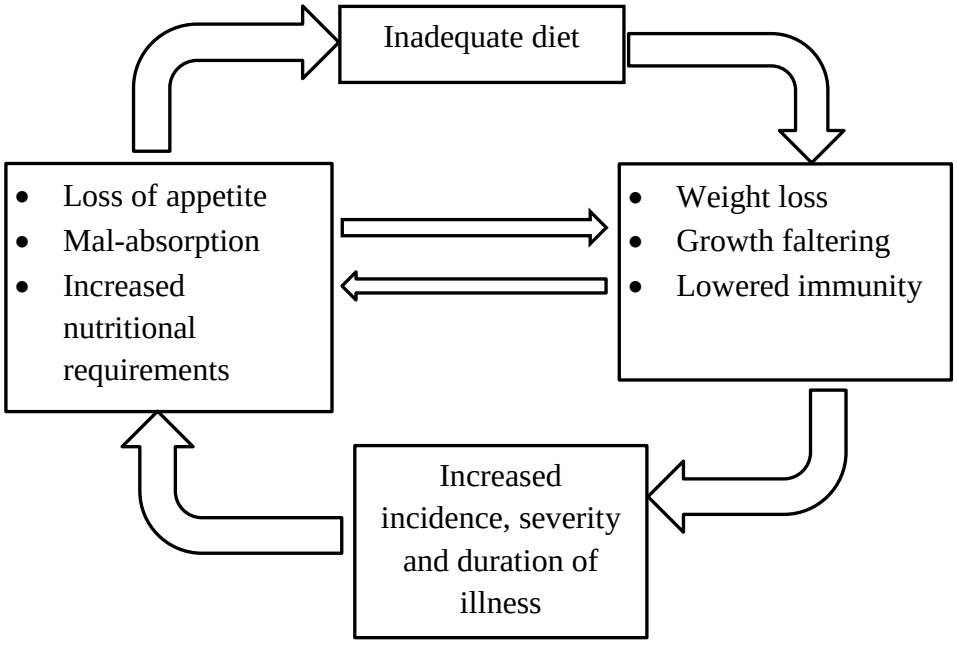

Fig 2.2 Malnutrition and infection cycle (UNICEF, 2015b)

Malnutrition mostly affects infants, children, adolescents, and the elderly; which is the major reason of immunodeficiency. There is a solid association between malnourishment, infection and infant mortality. Deprived growth and development, impaired mental

capability, enlarged mortality and vulnerability to infection are the effects of micronutrient deficiencies. Malnourished individuals become more vulnerable to infection and infection also aids to malnutrition, which causes a vicious cycle. A limited dietary consumption causes weight loss, lowered immunity, mucosal damage, attack by pathogens, and diminished growth and development in children. A sick person is further affected by diarrhea, mal-absorption, loss of appetite, diversion of nutrients for the immune response, and urinary nitrogen loss. All of these result in nutrient losses and further damage to immune system. These, consecutively, cause reduced dietary consumption (Katona, 2008).

2.6 Nutritional status

Nutritional status is the condition of the body that results from the stability between food intake and energy expenditure (Adhikari and Krantz, 2013). It is the state of the body influenced by the diet; the levels of nutrients in the body and the capability of those levels to sustain the normal metabolic integrity (Bender, 2005). Physical examination, appropriate laboratory investigation and a careful medical and dietary history can be used to determine the nutritional status of an individual (Robinson, 1972). When the body is attaining sufficient nutrients and they are used efficiently, permitting the physical and mental development, and general health at the highest possible level, nutritional status can be regarded as good or optimal (Hamdani, 2015).

2.6.1 Factors affecting nutritional status

There are several factors that impact the acceptability and consumption of food such as availability, cultural practices, economic condition, familiarity, taste and knowledge about health (Bhatta *et al.*, 1998). Mother's food security, types of food given to the young children, feeding frequency, poverty, illiteracy, ignorance to the child for care and feeding, who feeds the child and how the child eats, status of woman and child nutrition are the factors that affect nutritional status (NMICS, 2010).

There are various other factors that affect the nutritional status like food availability and its distribution, food intake, source of income and purchasing power, family size, illiteracy, sociocultural and religious faith, birth order, environmental hygiene and health facility. The main reasons of nutritional insufficiency in developing country like Nepal are poverty, lack of food security and nutrition education (Devkota *et al.*, 2015). Malnutrition in children results from combination of insufficient or unsuitable food intake as well as

recurrent child infections, lack of knowledge of mothers regarding child nutrition, feeding practices, hygiene and sanitation (Baral *et al.*, 2017).

Shortage of food in amount and quality due to the lack of food supply, lack of good distribution of food, poverty, unawareness and incorrect eating habits are the main factors that affect the nutritional status of a person. Secondly, all the factors that hinder the nutrients to reach the cells of the body after the intake of food also lead to deprived nutritional status (Hamdani, 2015). Some of the factors that affect the nutritional status of school children are discussed below:

a) Inadequate dietary intake: Insufficient intake of both macro nutrients (fat, protein, carbohydrate) and micro nutrients (vitamins and minerals) are deleterious to nutritional status. Inadequate macro nutrient intake can result stunting in children along with loss of weight. Micro nutrients such as vitamin A, zinc and other vitamins and minerals are crucial for immunity system and their deficiency can cause reduced immunity. (Bhatta *et al.*, 1998).

b) Immune function and infectious diseases: Poor dietary intake can deteriorate immune response through alterations in mucus membranes of the body. Suppressed immunity thus raises the risk of getting infection. As soon as immune function is depressed, it may result to infectious disease. Along with the occurrences infectious diseases, malnutrition can furthermore increase the severity and duration of illness (Bhatta *et al.*, 1998). Malnutrition is associated with suffering from childhood diseases such as diarrhea or other severe illness. Children who suffer from repeated episodes of diarrhea or Acute Respiratory Infections (ARI) are more likely to suffer from malnutrition. This is partly because of reduced appetite, less quantity of fluids and foods offered during diarrhea and other sickness (Sah, 2004).

c) Socio-economic and demographic factors

i) Poverty: At the primary level, child malnutrition is related to poverty. One of the significant factors related to malnutrition is the intra-household utilization of resources such as the management of time and knowledge of the caretaker, who is generally the mother (Somogy *et al.*, 2000). Household wealth can diminish child malnutrition by as much as 20%. (Bishwakarma, 2011). In Nepal, income is found to be significantly correlated with decline in the possibility of stunting. (Thapa *et al.*, 2014).

ii) Type and size of family: Living in the joint family is protective factor for both stunting and underweight in children. Although mothers are engaged in field whole day, grandparents take care of the children as well as the children are reared well (Sapkota, 2008). Children from larger family suffer more from malnutrition compared to small family (Rijal *et al.*, 2011).

iii) Ethnic groups: Muslim and Terai caste children suffer more from malnutrition than hilly caste people (Sah, 2004). Seventy percentage of *Dalits* in Nepal are undernourished and more than seventy percentage of *Dalit* children become victim of malnutrition (Darnal, 2005). *Dalit* and Muslim children (like women from the same groups) suffer most from malnutrition (Dhakal *et al.*, 2013).

iv) Parent's education: Parent's education is positively associated with the better nutritional status of children. Mother's level of education in general has reverse correlation with stunting, underweight and wasting level (MoHP, 2016).

d) Child's characteristics

i) Gender: Gender discrimination in children is reason of hunger and malnutrition. Higher levels of gender inequality are related with higher levels of malnutrition; both acute as well as chronic malnutrition (FAO, 2012).

ii) Birth weight: Children with low birth weight were less likely to be stunted compared with those with normal birth weight. (Esfarjani *et al.*, 2013).

iii) Birth order: Higher proportion of children with birth order more than 2 suffer from wasting as compared to children having first birth order (Panigrahi and Das, 2014). Third order, fourth order, and fifth or upper birth order children are more prone to be stunted (Rahman, 2016).

iv) Age group: Malnourishment is predominant in 10-12 years of age (Hamdani, 2015). The risk of stunting was significantly higher among age group 10-12 years and the thinness was more prevalent in age group 6-9 years as revealed by the comparative study in Egypt (Ali *et al.*, 2013).

e) Maternal characteristics

Literacy and social status of mothers are also key factors contributing to malnutrition in children. NDHS shows decrease of stunting with increasing level of mother's education. Practices of mothers related to preparation of food, cooking, sanitation during cooking and feeding children are also crucial factors that affect the child's nutritional status. (Sah, 2004). Maternal age is related with lower birth weight, gestational age, child nutritional status, and schooling. Young maternal age at childbearing (≤19 years) is found to be linked with a greater risk of preterm birth and intrauterine growth constraint, infant mortality, and child malnutrition. (Sinha *et al.*, 2015).

2.6.2 Nutritional requirements

The dietary requirement of school children aged 6 to 12 years is given in Table 2.1 (Shrilaxmi, 2014).

Table 2.1 Recommended dietary intake of nutrient for school children

Nutrients	**6-9 years**	**10-12 years**	
		Boys	**Girls**
Calories (Kcal/day)	1690	2190	2010
Protein (g/day)	29.5	39.9	40.4
Fat(g/day)	30	35	35
Calcium(mg/day)	600	800	800
Iron(mg/day/day)	16	21	27
Vitamin A(µg/day)	600	600	600
Thiamine(mg/day)	0.8	1.1	1
Riboflavin(mg/day)	1	1.3	1.2
Nicotinic acid(mg/day)	13	15	13
Pyridoxine(mg/day)	1.6	1.6	1.6
Ascorbic acid(mg/day)	40	40	40
Folic acid(µg/day)	40	60	60
Vitamin B12(µg/day)	0.2-1	0.2-1	0.2-1

(ICMR, 2011)

Nutritional requirement implies to the amount of calories and nutrient from food required on an average by particular age and gender categories per day to meet the requirement of individuals for normal functioning and growth of the body as well as for performing daily activities. The nutritional necessity differs with gender, age, physical activity, physiological condition (pregnancy, lactation and old age) and environmental circumstance. The requirements are usually stated on an average, considering such variation into accounts (Burk, 1984).

2.6.3 Methods of assessment of nutritional status

Nutritional status assessment provides the data necessary to study the effects of nutrition on health and disease, to identify critical nutrients in a specific population and the groups that are at risk of deficiency, and to develop effective public health policies to prevent and cure nutrition-related diseases (Elmadfa and Meyer, 2014). The principle aim of such an assessment is to determine the type, magnitude and distribution of malnutrition in different geographic areas to identify the risk groups and to determine the contributory factors. In addition, it is also essential for administrators to obtain allocation of materials and human resources and to plan appropriately (Shrilaxmi, 2002).

The nutritional status can be assessed in various ways: clinical examination (by looking physical signs in a person), anthropometry (by taking measurements of body weight, height, etc.) and biochemical examination (by examining the blood for concentration of nutrients (Adhikari and Krantz, 2013). There are basically two methods of assessing the nutritional status. The methods are categorized as, direct and indirect methods (WHO, 1996).

2.6.3.1 Direct methods of nutritional survey

They are summarized as ABCD; Anthropometric, biochemical, clinical and dietary evaluation methods (Joshi, 2016).

a) Anthropometric method: It is concerned with the measurement of the physical dimensions and the gross composition of the human body at different age levels and degrees of nutrition (Joshi, 2016). The measurements are of two types; single measurements that have to be interpreted in relation to age (e.g.; weight, height, head circumference) and a ratio of two measurements (e.g.; weight for height ratio) (Adhikari

and Krantz, 2013).The physical dimensions of the body are influenced by nutrition, especially during rapid growth period of childhood (Joshi, 2016).

b) Biochemical or laboratory method: Blood and urine are the two easily available fluids, which are used in biochemical assessment of nutritional status. A wide range of tests can be used and an appropriate one should be selected depending on the type of survey being carried out (Joshi, 2016).

c) Clinical methods: External evaluation for changes in superficial epithelial tissues especially skin, eyes, hair and buccal mucosa may be carried out. Similarly, organs close to the surface of body may be examined, e.g. the parotid and thyroid glands. It is based on observation of physical signs and does not require any elaborate field equipment (Joshi, 2016).

d) Dietary evaluation methods: A dietary assessment is a comprehensive evaluation of a person's food intake. It is the blanket term for any method used in diet surveys. Diet history, 24 hour dietary recall, food frequency questionnaire, record methods etc. are the techniques used for dietary evaluation (Joshi, 2016).

Twenty four hour dietary recall method is an informal, quantitative method in which the subjects are asked to recall all of the foods and beverages that were consumed in the last 24 hours (DGSM, 2003). It involves a systematic repetition of open-ended questions, asking subjects to describe amounts in household measures (Nunn, 2008).

2.6.3.2 Indirect methods of nutritional survey

a) Ecological variables including agricultural crop production, food balance sheet, health and educational services (WHO, 1996).

b) Socio-economic factors e.g.; family size, occupation, per capita income, population density, education, customs and social habits (WHO, 1996).

c) Vital health statistics particularly infant and under five mortality rate: morbidity related to PEM, anemia, goiter, diarrhea, measles and parasitic infections (WHO, 1996).

2.6.4 Nutritional status indicators

Growth standards and/or growth references are used for the anthropometric assessment for children and adolescents for assessing their growth, nutritional status and well-being. A growth standard reflects optimal growth, indicating that all children have the potential to achieve that level, while a growth reference is simply the distribution used for comparison (Wang and Chen, 2012). Nutritional status indicators are used to identify the nutritional imbalance that causes under nutrition (underweight, wasting and stunting) and overweight. Child growth is globally known as a significant indicator of nutritional status and health in people. The percentage of children with a low height for age (stunting) imitates the collective effects of under nutrition and infections since and even before birth. The proportion of children with low weight for age (underweight) can reflect wasting (i.e. low weight for height), stunting, or both (WHO, 1997).

The WHO global database on child growth and malnutrition practices a z-score cut-off point lesser than minus two SD to classify low weight-for-age, low height-for-age and low weight-for-height as moderate and severe malnutrition, and less than minus three SD to define severe under nutrition. The cut-off point further than plus two SD categorizes high weight-for-height as overweight in children. A main benefit of the z-score system is that a group of z-scores can be exposed to summary statistics like mean and standard deviation. The mean z-score, however less commonly used, has the benefit of describing the nutritional status of the entire population directly without resorting to a subset of those below a set cut-off. A mean z-score suggestively lower than zero-the expected value for the reference distribution usually indicates that the whole distribution has shifted downward, signifying that most of the individuals have been affected. Using the mean z-score as an index of severity for health and nutrition issues leads to the increase in awareness that, if a situation is severe, an intervention is essential for the whole community, not only those who are categorized as "malnourished" using the cut-off criteria (WHO, 1997).

Following are the nutritional status indicators;

a) Underweight: It denotes weight for age less than minus two standard deviations (SD) of the WHO child growth standards median. Evidence has made known that the mortality risk

of children who are even mildly underweight is increased, and severely underweight children are at even greater risk (WHO, 2010).

b) Stunting: It refers to height for age less than minus two SD of the WHO child growth standards median. Children who suffer from growth retardation as an end result of poor diets or frequent infections tend to be at greater risk for illness and death. Stunting is the consequence of long-term nutritional deficiency that might result delayed mental development, poor school performance and reduced intellectual capacity. This consecutively affects economic productivity at national level (WHO, 2010).

c) Wasting: It refers weight for height less than minus two SD of the WHO child growth standards median. Wasting in children is a symptom of acute under nutrition, as a result of inadequate food intake or a high incidence of infectious diseases, especially diarrhea. Wasting as a result impairs the functioning of the immune system and can lead to increased severity and duration of illness and susceptibility to infectious diseases (WHO, 2010).

d) Overweight: It refers weight for height more than plus two SD of the WHO child growth standards median. Childhood obesity is related with a higher probability of obesity in adulthood that can result to a variety of disabilities and diseases, such as diabetes and cardiovascular diseases. The risks for most non-communicable diseases as a consequence of obesity depend partially on the age at onset and the duration of obesity (WHO, 2010).

e) Thinness: It refers BMI for age less than minus two SD of the WHO child growth standards median. Thinness indicates a recent and severe process of weight loss, which is often connected with acute starvation and/or severe disease (WHO, 2010).

Table 2.2 explains the cut-off points for underweight, stunting, wasting and thinness.

Table 2.2 Interpretation of cut-off points.

	Moderate	Severe
Stunting	HFA < -2SD	HFA < -3SD
Wasting	WFH < -2SD	WFH < -3SD
Underweight	WFA < -2SD	WFA < -3SD
Thinness	BFA < -2SD	BFA < -3SD

(WHO, 2010)

2.7 Nutritional status of Nepal

There is limitation of available data on the nutritional status of school children in Nepal. The main source of nutrition related data is Nepal Demographic and Health Survey (NDHS) although the NDHS indeed gathers the data of mothers and under-5 children. The nutritional status of children in Nepal has improved over the last two decades. Although there has been a decline in malnutrition problems but still the data shows that the prevalence is much higher than that of developed countries. The percentage of prevalence of malnutrition below 5 years of age is illustrated in given diagram.

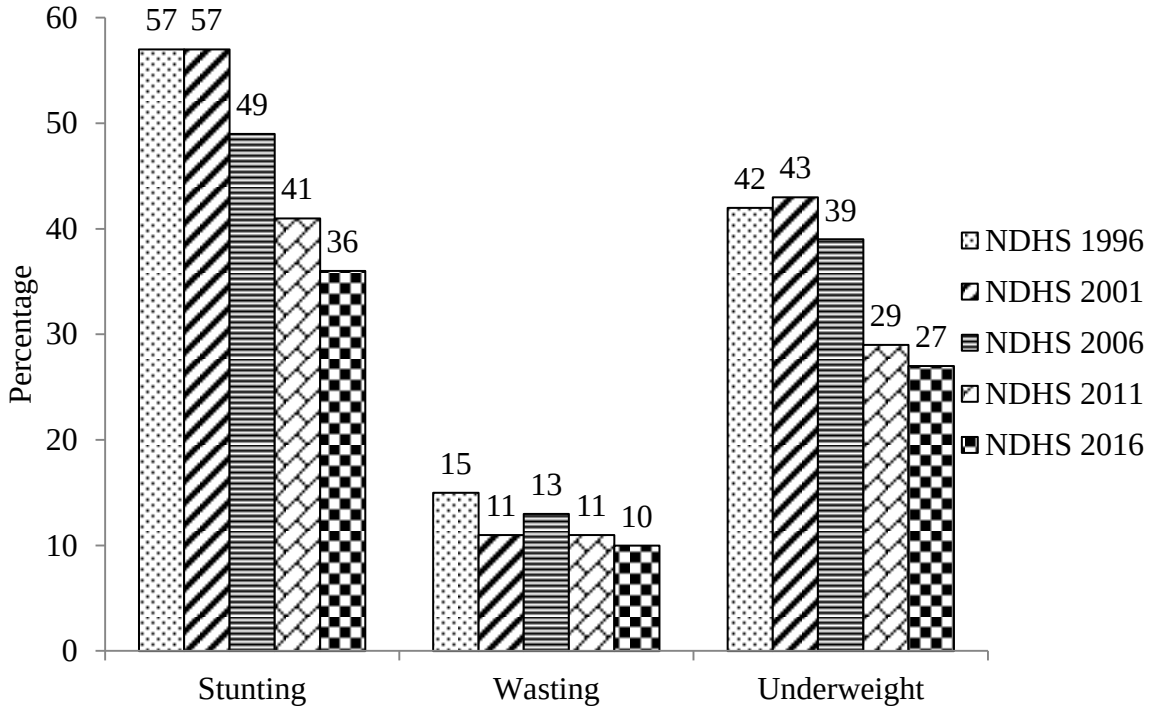

Fig 2.3 Prevalence of malnutrition in 6-59 months children in Nepal (MoHP, 2016).

In Eastern Development Region, the percent of the children below five years of age who were stunted, wasted and underweight were 32.6%, 13.1% and 26.5% respectively and the percentage of children in Terai region who were stunted, wasted and underweight were 36.7%, 12.2% and 32.5 % respectively (MoHP, 2016).

2.8 Causes of low nutritional status in school children in developing countries

Primary school age is a dynamic period of physical growth as well as of intellectual development of the child. (Srivastava *et al.*, 2012). Malnutrition among school children is

due to lacks in one or more of the three main preconditions for good nutrition: food, care and health. Children stunted at school age possibly have been exposed to poor nutrition since early childhood (Mwaniki and Makokha, 2013). In developing countries, 20-80% of primary school children are suffering from nutritional deficiency (Shivaprakash and Joseph, 2014).

There are several factors which directly or indirectly result malnutrition among school children. Child malnutrition results from a combination of insufficient or inappropriate food intake, gastrointestinal parasites and other childhood diseases, and inappropriate care during illness. Literacy and social status of mothers are also key factors that contribute to undernourishment in children. Place of residence has some relationship with malnourishment in children. Children from rural communities are more susceptible to malnutrition compared to the children from urban areas. Gender, caste differences and untouchability also influence the nutritional status of school children in Nepal. Moreover, Food and Agriculture Organization (FAO) recognizes the dimensions of good nutrition as sufficient food, proper health, and adequate care (Sah, 2004).

2.9 Literature review from previous studies

A descriptive cross sectional study was conducted in private and public schools of Itahari sub-metropolitan city, Sunsari to assess the nutritional status of school children to find the prevalence of malnutrition. From each type of school, 91 students were randomly selected and then anthropometric measurements (weight and height) were taken. Based on WHO classification, 18.68%, 13.19% and 5.50% of students in private schools were stunted, underweight and thinned respectively. While, 29.66%, 30.76% and 13.28% of students in public schools were stunted, underweight and thinned respectively. In whole students from both types of school, 24.17%, 20.93% and 9.39% of students were stunted, underweight and thinned. In private schools, there was significant association found between stunting and family occupation (P=0.027) as well as between underweight and father's education (P=0.048). Similarly, there was significant association between stunting and age group and type of tiffin snacks of public school children (P=0.049 and P=0.008 respectively) (Neupane, 2015).

A study was conducted among students of 6-12 years age group in private schools of Belbari, Morang. A total of 150 students were selected from six schools in which, 20.66%

were found to be normal and 79.33% were found to be undernourished on the basis of weight-for-age of different grades as 28% in first degree, 22.66% in second degree, 27.33% third degree and 8% in fourth or severe. According to height-for age, 54.66% were found to be normal and 45.34% malnourished of different grades as 36% in first degree, 6.66% in second degree, 2% third degree and 0.66% in fourth or severe. Also according to weight-for-height, 68% were found to be normal and 32% malnourished of different grades as 22% in first degree, 8% in second degree, 2% in fourth or severe (Subba, 2003).

A cross-sectional study was administered in two schools located in Bolde phedeche and Mahure of Kavrepalanchowk to map out the nutritional status and morbidity pattern in school children. From the chosen schools, a total number of 160 students studying from Grade one to five were enumerated in the study by means of census survey method. Applying categorization of Indian Academy of Pediatrics, based on weight for age, 36 (55.3%) boys and 34 (35.8%) girls fell under first degree malnutrition and 15 (23.07%) boys and 44 (46.3%) girls fell under second degree malnutrition, 7 (7.2 %) girls fell under third degree malnutrition (Bhandari and Shrestha, 2012).

A cross sectional study was conducted throughout the period of August-September, 2006 to study the nutritional status of primary school children in Bharatpur, Chitwan, Nepal. The study population was the school children of Nursery to class five. One of the public schools was selected randomly in Bharatpur. 11.38% of school children were below 80% weight for age i.e. underweight. According to Waterlow classification, 89.85% were normal, 7.69% of school children were stunted and 3.38% of children were wasted. Skin diseases (21.45%) were usual in school children. Dental carries were seen in 16.0% of school children followed by history of worm infestation in 10.77% of children (Manandhar *et al.*, 2008).

A descriptive cross sectional study was carried out during November 2009 to February 2010 in Dagoretti, Nairobi, Kenya. From four public primary schools, 208 students aged 4–11 years of both gender were randomly selected. Amongst the surveyed children, 24.5% were stunted, 14.9% underweight and 9.7% were wasted. The number of boys who were stunted was more than girls. This study revealed that malnutrition levels were high among school children just as in children below five years of age (Mwaniki and Makokha, 2013).

A study was conducted to measure the nutritional status of rural school children (6-12 years) of Mandya district, Karnataka. A total of 484 children were selected. The total prevalence of underweight was 30.3% (147) and stunting was 27.9% (135). Pallor was prominent in 123 (25.4%). Hair changes were observed in 19 (3.9%). Eye changes was seen in the form of conjunctival xerosis in 100 (20.7%) and bitot's spots in 10 (2.1%). Teeth changes were distinguished in the form of dental caries in 137 (28.3%) and enamel mottling in 19 (3.9%). Skeletal changes were found in 7 (1.4%) children. Flat nails or koilonychia were seen in 57 (11.8%) (Shivaprakash and Joseph, 2014).

A study intended to determine the nutritional status of school children was conducted at Sirnagalih Bogor of grade 1-6 with overall 263 students aged 6-12 years old in November 2014. The nutritional status of students was assessed according to the z-score of the WHO. The average child with normal nutritional status was approximately 68.2%. Yet, it still revealed some nutritional problems (very underweight, underweight and overweight,) accounted in 31.8% of children. Under age-wise category, there was highest number malnourishment in 10-12 years age group i.e. 37.5%. By gender, the malnourishment in boys was more i.e. 34.9%. Based on parent education, undernourishment was seen in students with less educated fathers; which was about 41.6%. Based on the number of siblings in the family, malnourishment was greater among children with more than two sisters and brothers that amounted to 57.9% (Hamdani, 2015).

A descriptive study was carried out between January and June 2011 in Jordan to determine the nutritional status of primary school children from low income households. Two basic variables (height and weight) besides a single derived variable (body mass index) were used in the study. The children were of age 6-12 years old with an average age of 7.1±0.88 years. Children's BMI-for-age indicated that 71% of overall school children were found to be normal as 66% girls and 71% boys while 24% of children were overweight among which 17% were boys and 33% were girls (Mohammad *et al.*, 2013).

A descriptive cross-sectional study was conducted to examine the nutritional status and morbidity pattern in primary school children of government schools in north Kolkata. The study was carried out among 10 primary schools by means of interview techniques and anthropometric as well as clinical examinations. Out of 502 children, 40.2% children indicated poor hygiene. Anemia rate was 22.3% and dental caries were found among 29.9% of the children. Enlarged tonsils were found in 10.4% children and a major group of

children (39.4%) had the history of worm expulsion. Vitamin B-complex insufficiency was observed among 20.7% of children. There were one-third of the under-weight children. There was no significant difference in nutritional status among the students from the various classes. There was no case of severe under-nutrition and stunting and wasting was not found in this study population (Das *et al.*, 2012).

A cross sectional survey was done among 191 children aged 6-12 years who were selected from private and government school of Nigeria. The studied variables involved; age, gender, religion, dietary pattern of the children as well as socio-economic status and educational background of parents. The percentage of female students (51.7%) who were underweight was more than their male counterparts (48.3%). The percentage of male students (65%) who were overweight was greater than the females (35%). Stunting was more prevalent among males than their female counterparts. In overall students, the prevalence of stunting was 15.7% whereas prevalence of severe stunting was 5.23%. Wasting was more predominant among females 56.3% than males 47.4% (Andrew *et al.*, 2014).

A study was conducted to determine the nutritional status and dietary habits of school children of 6-12 years attending public and private primary schools in Zagazig city, Egypt. Based on the WHO standard, mean BMI, obesity and overweight was higher among students in the private school than in the public school whereas underweight was high among students in the public school (18.7%) compared to students in private school (7.5%). More than half of the public school students (52.7%) were of short stature compared to 27.4% of the private school students (Ali *et al.*, 2013).

Part III

Methods and materials

3.1 Research method

A descriptive cross-sectional study was conducted in Babiya VDC, Sunsari to assess the nutritional status and associated factors among school children studying in class 1-5 using semi-structured questionnaire. The survey included;

a) Anthropometric measurement of primary level school children.

b) General survey of the situation of household belonging to the children under study with the help of questionnaire.

3.2 Study variables

Study variables were categorized into two groups: dependent variables and independent variables. Dependent variable of this study was nutritional status of school children as indicated by stunting and thinness. Whereas, independent variables of the study were:

a) Socio-economic and demographic variables: head of household, ethnicity, family size, income, occupation, education.

b) Household characteristics: water supply, sanitation and housing condition.

c) Child characteristics: age, sex, birth order and number of siblings.

d) Maternal characteristics: age, education, occupation, age at marriage and age at first pregnancy, knowledge about malnutrition and number of children born.

3.3 Study area

This study was conducted in 3 private schools and 3 public schools of Babiya VDC, Sunsari District. According to village development committee, Babiya, there were 954 children studying in primary level at the time of study.

3.4 Target population

The target population for nutritional status assessment was 6-12 years children from

private and public schools and parents or caretakers were the targets for the assessment of factors associated with nutritional status of children. There is a lack of data on the nutritional status of children in this age group. Most of the researches focus on malnutrition in young children under 5 years of age, whereas school-aged children are often omitted from health and nutrition surveys. The study is aimed to investigate the nutritional status of school-aged children who may also be at risk of compromised growth and development.

3.5 Research materials

The materials used during survey were:

a) Weighing Machine: Weighing machine with the capacity of 100 kg and having the least count of 0.1 kg (Microlife pvt. ltd)

b) Height measuring scale: Stadiometer

c) Questionnaire: A well designed and pretested set of questionnaire to collect household information (Appendix - B)

3.6 Sampling techniques

A cross-sectional descriptive study was conducted in Babiya VDC. Three private and public schools were selected from the list of 3 private and 8 public schools using cluster sampling method. Again the numbers of students from both categories were selected on the basis of their respective proportions. Similarly, the students were selected from each class by using lottery method by drawing out the roll numbers of students present in the class.

a) Inclusion criteria: Students present at the day of survey, those studying in class 1-5 and within age group of 6-12 years.

b) Exclusion criteria: All those students absent at the day of survey and not including in age criteria 6-12 years.

In this survey, the parents or caretakers were requested to arrive at school for collecting information about household situation and maternal characteristics. Information was collected by sending questionnaires to parents through children and by personal contact when parents or care takers could not arrive at school.

3.7 Sample size

The calculation of the sample size was done by using the statistical formula,

Sample size (n_0) = $z^2 \times P(1-P)/m^2$ (Sthapit *et al.*, 2014)

Where, z = confidence interval at 95% (standard value of 1.96)
P= estimated prevalence of malnutrition
m= margin of error (7%)

Here, P was estimated on the basis of research conducted in private and public schools of Itahari sub-metropolitan city, Sunsari in 2015. The result of the study is included in literature review. The reason to select the data from the study is that, it is closely related to this research work and it is latest available research similar to this work. The result obtained from the study showed that 24.17% of students were stunted. Thus, this 24.17% is taken as the estimated prevalence of malnutrition (P) for the calculation of sample size for this study (Neupane, 2015).

Now,

$n_0 = 1.96^2 \times 0.2417 \times (1-0.2417)/ (0.07)^2$
$= 143.69 \approx 144$

In Babiya VDC, the total population of children studying in class 1-5 in both private and public schools was 954 at the time of study. Thus, by applying finite population sample formula new sample size was obtained to conduct survey in this particular VDC.

The sample size was adjusted for finite population.

New sample size (N) = $n_0 / [1+ \{(n_0 -1)/Pop\}]$ (Sthapit *et al.*, 2014)

where, n_0 = Sample size in infinite population
Pop = Total number of population (in this case total number of children studying in primary level in this village).

New sample size was obtained to be 125 from the calculation. The actual sample size was determined by adding 10% non-response rate on calculated sample size and was found to be 137. Thus, 274 students (137 from each type of school) were selected as sample.

3.8 Pre - testing the data collection tools

The pre-testing was conducted among school children and their mothers to identify the consistency of tools, establish accuracy of questions, clarify and check for consistency in the interpretation of questions and identify ambiguous items. The questionnaire was developed in English and translated into Nepali language and reviewed by the teachers in Central Campus of Technology. The prepared sets of questionnaire and anthropometric instruments were pretested among ten percent (n=28) of the school children who were under sampling plan. After pretesting, all the ambiguous, misleading and wrongly interpreted questions were omitted and questionnaire was reviewed in accordance with findings of pretesting.

3.9 Validity and reliability of the research

To ascertain the degree to which the data collection instruments measure what they purposed to measure, the instruments was validated by comparing with standard known weights (for weighing balance). Reliability refers to quality control measure of data collected. Questionnaire was checked for completeness, consistency and clarity.

Validity and reliability of the study was ensured by pre-testing of the tools, using standardized instruments. The instruments were checked and reset daily to validate the data before taking measurements. To check reliability, five different surveyors measured the same person's height and weight separately. Questionnaires were pretested and revised. For 24 hour dietary recall, different foods were standardized in utensils used for data collection. Close supervision was done in the field.

3.10 Data collection techniques

Primary data was collected using semi-structured questionnaire and by anthropometric measurement. Interview was conducted with parents/care takers of the children to fill the questionnaire. When parents or care takers were not available, information were collected by sending questionnaires to parents through children and by personal contact. Secondary data was obtained from Village Development Committee, Nepal Demographic Health Survey, Central Bureau of Statistics, and key informants like teachers and local leaders.

The structured questionnaires comprised mainly of details on household profiles like age, sex, education level and occupation of household members and household size. Data

on sources of income was also collected. The date of birth for each child was inquired from the caretaker/mother and school registers were also checked. Anthropometric measurements taken for the children included:

a) Height: The height of children was measured using stadiometer placed on hard flat surface with line of sight perpendicular to the horizontal surface. Children were made to stand bare foot on height board and with feet parallel and joined together and with heels and buttock touching the wall. It was made sure that that head was held erect and hands were hung closely at the sides. The child's height was measured to the nearest one decimal place.

b) Weight: Weight was measured by electronic digital weighing scale and read to the nearest 0.1 kg with minimal clothing and no shoes. Calibration was done before and after weighing every child by setting it to zero.

3.11 Data management

The collected data were coded by giving numbers starting from 001 to 274 and were stored safely.

3.12 Data analysis

The data was checked for completeness and consistency. The collected data was first edited, organized, coded and entered into Microsoft excel 2010. Anthropometric data were entered into WHO Anthro Plus version 1.0.4. Using food composition table for Nepal designed by DFTQC, nutrients contents of the food were calculated. The data were then entered into statistical package for social science (SPSS) version 20.0. The collected data were analyzed by using both descriptive and inferential statistics.

Descriptive analysis was used to describe the percentages and number distributions of the respondents by socio-demographic characteristics and other relevant variables in the study. The data were presented in different table. The nutritional status was measured by WHO Standards. Z-scores of height-for-age and BMI-for-age for each child were calculated based on the WHO criteria and curves were made. Food composition table developed by DFTQC in 2012 was used for the calculation of nutrients content in foods. The nutrients intakes of students were compared with RDA provided by ICMR in 2011 to calculate nutrients adequacy. The chi-square test was applied to test the association

between the nutrition status and its associated factors.

3.13 Logistic and ethical considerations

Permission to conduct survey in Babiya VDC was obtained from office of the Village Development Committee of Babiya VDC. Similarly, clearance was obtained from principals of respective schools selected for study. Verbal consent from parents/care taker of study subjects was obtained and the objective of the study was explained to them. Privacy and confidentiality of collected information was ensured at all level.

Part IV

Results and discussion

The cross-sectional descriptive study was conducted in order to assess the nutritional status of school children from private and public schools of Babiya VDC, Sunsari. From each type of school, 137 samples (274 samples in overall) were selected from cluster sampling and simple random sampling technique. Two approaches were administered i.e. anthropometry to obtain data regarding anthropometric measurements and household survey to collect information regarding various socioeconomic variables. Thus, collected data were analyzed using WHO anthro plus 1.0.4 and SPSS version 20.0. The results and findings of the study are expressed into several following headings. The cross tabulation between thinness and stunting and different factors affecting nutritional status of children is given in appendix - C.

4.1 Demographic and socio-economic characteristics

4.1.1 Ethnic groups

The ethnic groups of the survey students are categorized as *Madhesis*, *Dalits* and Muslims. Figure 4.1 shows distribution of different ethnic groups in private and public school students

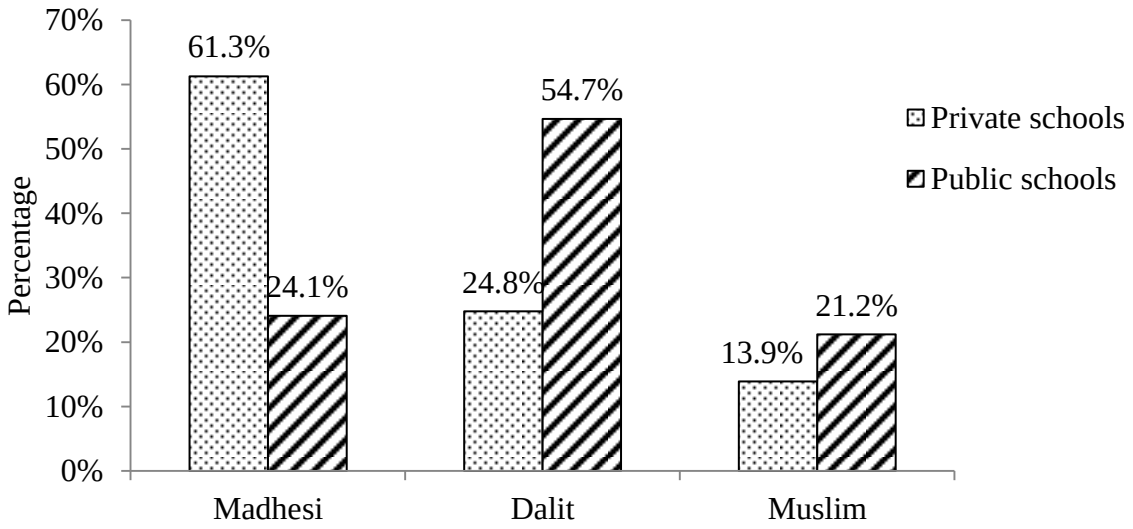

Fig 4.1 Distribution of ethnic groups in survey students

Among the children in private schools, majorities i.e. 61.3% (84) were *Madhesis* whereas 24.80% (34) were *Dalits* and 13.9% (19) were Muslims. Among the children of public schools, majorities i.e. 54.7% (75) were *Dalits*, while 24.1% (33) were *Madhesis* and 21.2% (29) were Muslims. On comparison between private and public school children, the presence of so-called low caste i.e. *Dalits* was found greater in public schools.

In private schools, 4 (4.8%) of Madhesi children were severely thinned, 16 (19.0%) were moderately thinned, 2 (2.4%) were severely stunted and 8 (9.5%) were moderately stunted. Among Dalit children, 1 (2.9%) were severely thinned, 10 (29.4%) were moderately thinned, none were severely stunted and 3 (8.8%) were moderately stunted. Among Muslim children, 2 (10.5%) were severely thinned, 6 (31.6%) were moderately thinned, 1 (5.3%) were severely stunted and none were moderately stunted.

In public schools, 2 (6.1%) of Madhesi children were severely thinned, 4 (12.1%) were moderately thinned, 1 (3.0%) were severely stunted and 10 (30.3%) were moderately stunted. Among Dalit children, 4 (5.3%) were severely thinned, 12 (16.0%) were moderately thinned, 3 (4.0%) were severely stunted and 17 (22.7%) were moderately stunted. Among Muslim children, 3 (10.3%) were severely thinned, 11 (37.9%) were moderately thinned, none were severely stunted and 6 (20.7%) were moderately stunted.

In a study conducted in Dhanusha, the proportion of underweight and stunted *Dalit* children were slightly higher than *non-Dalit* (Sah, 2004). There was significantly higher prevalence of stunting among Dalit children as found by the study conducted in rural VDCs of Sunsari district (Gharti, 2005). *Dalits* are most backward in social, economic, educational, political and religious fields, and are disadvantaged in terms of human dignity and social justice (DWO, 2010). Discrimination against *Dalits* is the irresistible reality of Nepal's social structure. Literacy rate in overall *Dalits* is 10 % and literacy rate among Dalit women is 3.2 % only. More than 70 % of *Dalit* children experience malnutrition (Darnal, 2005). *Dalits* and Muslims are the two groups that are significantly below the national average (83%) among those having complete immunization. Furthermore, *Dalit* and Muslim children (like women from the same groups) suffered most from malnutrition (Dhakal *et al.*, 2013).

4.1.2 Main occupation of family

In Babiya VDC, people were found to be engaged in agriculture, business, foreign employment, service and labor works. Figure 4.2 shows the main occupation of families of private and public school children.

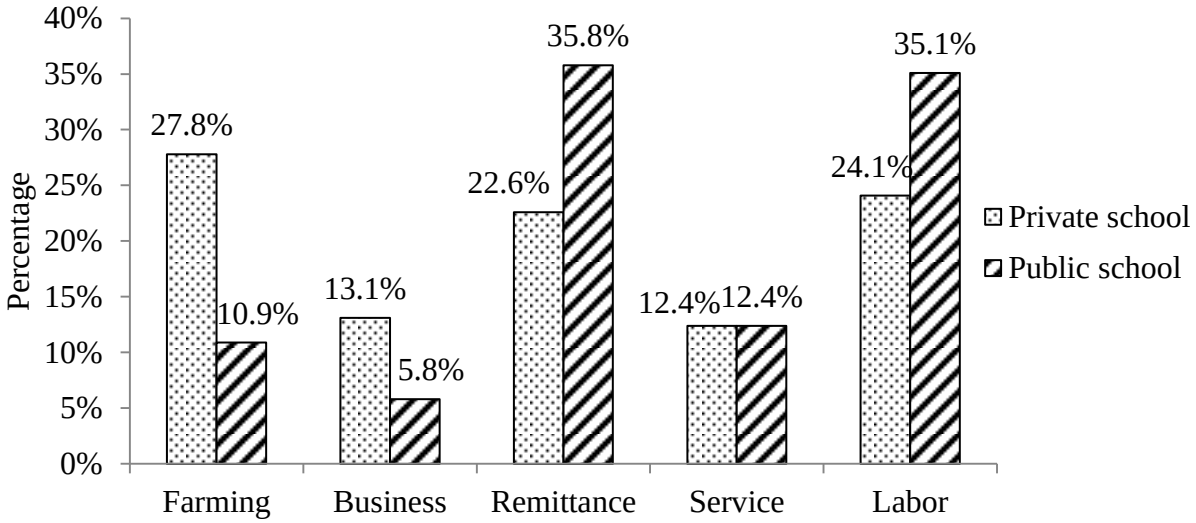

Fig 4.2 Main occupation of families of private and public school children

In private school children 27.8% (38) families were involved in farming, 24.1% (33) families were involved in labor works, 22.6% (31) in foreign employment, 13.1% (18) in business and 12.4% (17) in service. In public school children, 35.8% (49) families were involved in foreign employment, 35% (48) families were involved in labor works 12.4% (17) in service, 10.9% (15) in agriculture and 5.8% (8) in business. On comparison between two type schools, the parents of most of the private school children were engaged in agriculture whereas most of the parents of public school children were engaged in foreign employment and labor.

In private schools, in the children of parents with main occupation as farming, 1 (2.6%) were severely thinned, 7 (18.4%) were moderately thinned, 1 (2.6%) were severely stunted and 1 (2.6%) were moderately stunted. Among the children of parents engaged with main occupation as business, 1 (5.6%) were severely thinned, 4 (22.2%) were moderately thinned, none were severely stunted and 2 (11.1%) were moderately stunted. Among the children of parents engaged with main occupation as remittance, 2 (6.5%) were severely thinned, 8 (25.8%) were moderately thinned, 1 (3.2%) were severely stunted and 4 (12.9%) were moderately stunted. Among the children of parents engaged with main occupation as

service, 1 (5.9%) were severely thinned, 2 (11.8%) were moderately thinned, none were severely stunted and 1 (5.9%) were moderately stunted. Among the children of parents engaged with main occupation as labor, 2 (6.1%) were severely thinned, 11 (33.3%) were moderately thinned, 1 (3.0%) were severely stunted and 3 (9.1%) were moderately stunted.

In public schools, in the children of parents with main occupation as farming, none were severely thinned, 4 (26.7%) were moderately thinned, none were severely stunted and 4 (26.7%) were moderately stunted. Among the children of parents engaged with main occupation as business, none were severely thinned, 2 (25.0%) were moderately thinned, none were severely stunted and 1 (12.5%) were moderately stunted. Among the children of parents engaged with main occupation as remittance, 2 (4.1%) were severely thinned, 12 (24.5%) were moderately thinned, 2 (4.1%) were severely stunted and 12 (24.5%) were moderately stunted. Among the children of parents engaged with main occupation as service, 2 (11.8%) were severely thinned, 4 (23.5%) were moderately thinned, none were severely stunted and 5 (29.4%) were moderately stunted. Among the children of parents engaged with main occupation as labor, 5 (10.4%) were severely thinned, 5 (10.4%) were moderately thinned, 2 (4.2%) were severely stunted and 11 (22.9%) were moderately stunted.

Agriculture is essential for food security and nutrition as it is both a source of food as well as income. Agricultural production helps people generate more income and also helps to make nutritious foods more available, affordable, acceptable, and of higher quality (Shrestha *et al.,* 2012). Malnutrition was found mostly prevalent in children whose parents involved in labor works in a study conducted in school children in urban slums of India (Srivastava *et al.,* 2012).

4.1.3 Annual income

The families of the school children were categorized into different income groups to determine their economic status. Most of the families i.e. 77.4% (106) from private school children were medium income families i.e. having annual income 1 lakh to 3 lakhs and minorities i.e. 7.3% (10) had annual income more than 3 lakhs. Similarly, 67.9% (93) families from public school children had annual income 1-3 lakhs and minorities i.e. 5.1% (7) had annual income more than 3 lakhs. Greater proportion of households of public school children belonged to low income group as compared with private school children

and there were higher number of high income families in private schools than in public schools. Figure 4.3 illustrates annual income of the families of private and public school children.

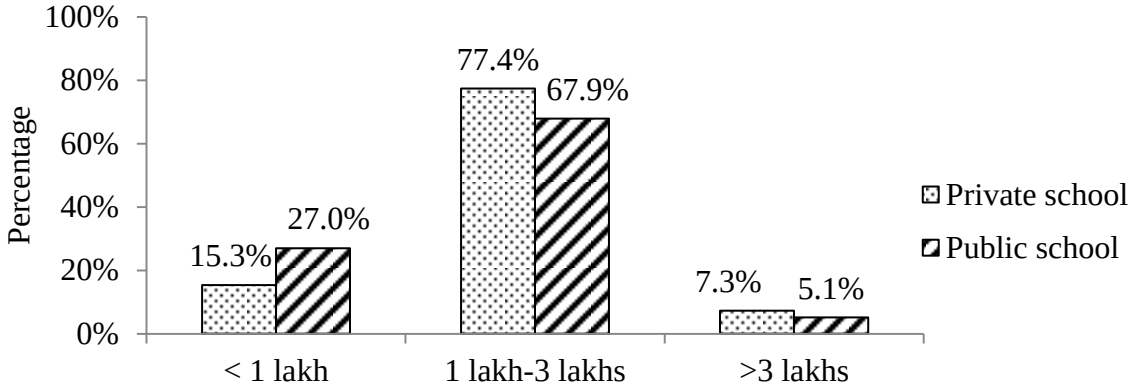

Fig 4.3 Annual income of families of private and public school children

In private schools, in the children of parents with annual income less than 1 lakhs, 3 (14.3%) were severely thinned, 4 (19.0%) were moderately thinned, 1 (4.8%) were severely stunted and 3 (14.3%) were moderately stunted. Among the children of parents with annual income 2 lakhs to 3 lakhs, 4 (4.0%) were severely thinned, 26 (26.3%) were moderately thinned, 2 (2.0%) were severely stunted and 8 (8.1%) were moderately stunted. Among the children of parents with annual more than 3 lakhs, none were severely thinned, 2 (11.6%) were moderately thinned; none were severely and moderately stunted.

In public schools, in the children of parents with annual income less than 1 lakhs, 4 (5.1%) were severely thinned, 7 (21.2%) were moderately thinned, 1 (3.0%) were severely stunted and 13 (39.4%) were moderately stunted. Among the children of parents with annual income 2 lakhs to 3 lakhs, 5 (5.6%) were severely thinned, 13 (14.4%) were moderately thinned, 3 (3.3%) were severely stunted and 16 (17.8%) were moderately stunted. Among the children of parents with annual more than 3 lakhs, none were severely thinned, 7 (50.0%) were moderately thinned, none were severely stunted and 4 (28.6%) were moderately stunted.

In Nepal, poverty is root cause for food insecurity, under-nutrition as well as social deprivation, lack of access to education, healthcare and employment. Food insecurity exhibits throughout Nepal within marginalized communities. Low economic condition and reduced income further worsen under-nutrition problems (FAO, 2010). Economically

sufficient households could live without insufficiency as well as could afford better public services such as education, health services, road accessibility etc. Through these services, household with better economic condition or the region with better economic health could positively impact child nutrition (Bishwakarma, 2011). Comparative to households with the lowest income, children from higher income families are not as much of likely to be stunted (Thapa *et al.*, 2014). The effect of low socio-economic status was the major risk factor for malnutrition in a study conducted in children visiting National medical college in Kathmandu (Rijal *et al.*, 2011). The prevalence of under-weight and stunting was suggestively greater in the lower socioeconomic groups in Sunsari district (Gharti, 2005).

4.1.4 Father's education

The literacy level of fathers of public and private school children was found out in Babiya VDC which is represented by figure 4.4.

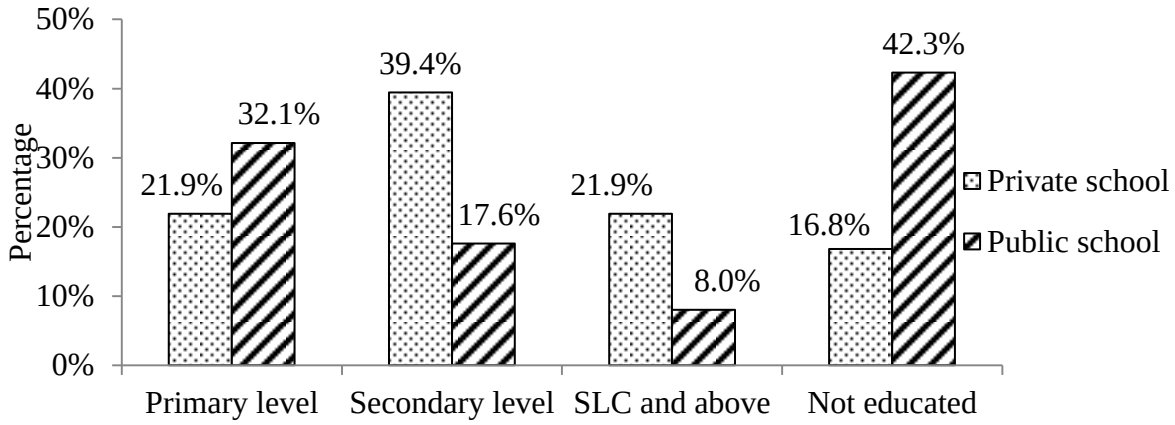

Fig 4.4 Father's education of private and public school children

Among fathers of private school children, 21.9% (30) had primary level of education, 39.4% (54) had secondary level of education, 21.9% (30) had passed SLC and 16.8% (23) were uneducated. Among fathers of public school children, 32.1% (44) had primary level of education, 17.6% (24) had secondary level of education, 8.0% (11) had passed SLC and 42.3% (58) were uneducated.

In private schools, in the children of literate fathers, 7 (6.1%) were severely thinned, 24 (21.1%) were moderately thinned, 3 (2.6%) were severely stunted and 8 (7.0%) were moderately stunted. Among the children of illiterate fathers, none were severely thinned, 8 (34.8%) were moderately thinned, none were severely stunted and 3 (13.3%) were

moderately stunted. In public schools, in the children of literate fathers, 4 (5.1%) were severely thinned, 14 (17.7%) were moderately thinned, 4 (5.1%) were severely stunted and 17 (25.5%) were moderately stunted. Among the children of illiterate fathers, 5 (8.6%) were severely thinned, 13 (22.4%) were moderately thinned, none were severely stunted and 16 (27.6%) were moderately stunted.

The study of nutritional status of 2585 school children in India, aged between 5 and 15 years showed a direct relationship between the levels of literacy of father and the nutritional status of children. The findings recommended an inverse relationship between father's educational standard and malnutrition (Kunwar and Pillai, 2011). The results of a study in Sunsari district suggested that the prevalence of underweight was more among children of illiterate fathers than the children of fathers who were literate of some form of formal education (Gharti, 2005). A study done among school children aged 6-12 years in Indonesia reflected that there was an association between father's education and nutritional status of children (p=0.048) (Hamdani, 2015).

4.1.5 Mother's education

Many studies have shown that mother's education had significant relation with malnutrition (MoHP, 2016). Figure 4.5 shows mother's level of education among private and public school children.

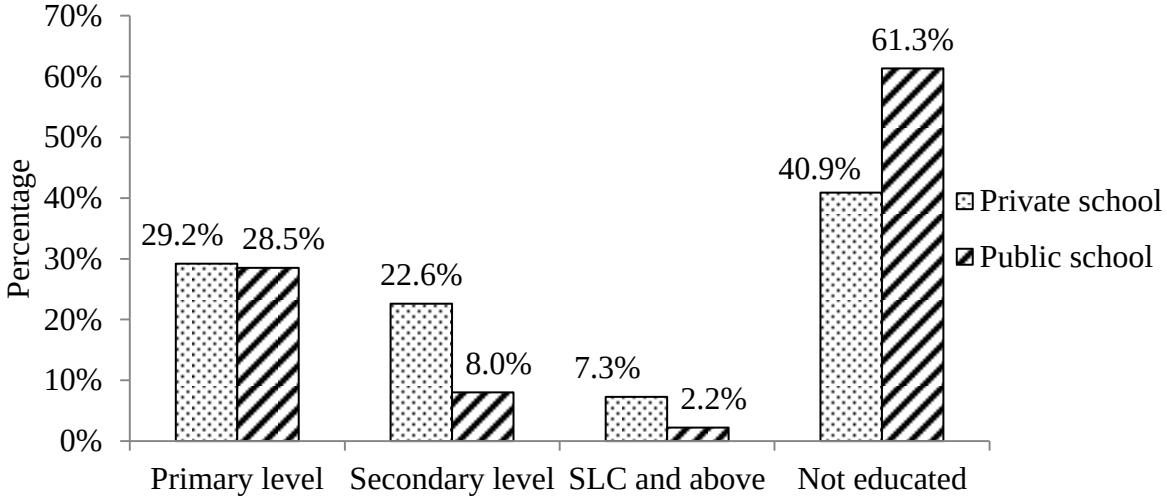

Fig 4.5 Mother's education of private and public school children

Among mothers of private school children, 29.2% (40) had primary level of education, 22.6% (31) had secondary level of education, 7.3% (10) had passed SLC and 40.9% (56)

were uneducated. While, among mothers of public school children, 28.5% (39) had primary level of education, 8.0% (11) had secondary level of education, 2.2% (3) had passed SLC and 61.3% (84) were uneducated. Comparing the educational levels, parents of private school children were more educated than the parents of public school children. Likewise, the parents of private school children were less illiterate than the parents of public school children. The illiteracy rate was high among mothers of public school children (61.3%).

In private schools, in the children of literate mothers, 5 (6.2%) were severely thinned, 20 (24.7%) were moderately thinned, 2 (2.5%) were severely stunted and 4 (4.9%) were moderately stunted. Among the children of illiterate mothers, 2 (3.6%) were severely thinned, 12 (21.4%) were moderately thinned, 1 (1.8%) were severely stunted and 7 (12.5%) were moderately stunted. In public schools, in the children of literate mothers, 3 (5.7%) were severely thinned, 9 (17.0%) were moderately thinned, 2 (3.8%) were severely stunted and 9 (17.0%) were moderately stunted. Among the children of illiterate mothers, 6 (7.1%) were severely thinned, 18 (21.4%) were moderately thinned, 2 (2.4%) were severely stunted and 24 (28.6%) were moderately stunted.

The result of the present study is comparable to the study carried out in school children of Itahari in 2015. Greater number of parents of public school children were found to be illiterate (Neupane, 2015). In a study conducted in primary schools of Dhanusha, mother's education status had noticeable effects on nutritional status of children (Sah, 2004). In a similar study conducted in school children of India, malnutrition was most predominant in students with low parental education, as shown by 42 students (41.6%) and p value was found 0.048 (Hamdani, 2015). In a study carried out among children aged 3-9 years in urban slums of India, maternal education appeared to be associated with better child nutrition (p=0.05) (Panigrahi and Das, 2014).

4.1.6 Type of family

The families of school children were categorized as nuclear and joint families. Figure 4.6 gives a picture of type of families of the children. Among private school children, 45.3% (62) belonged to nuclear families and 54.7% (75) belonged to joint families whereas 65% (89) of public school children were from nuclear families and 35% (48) from joint families.

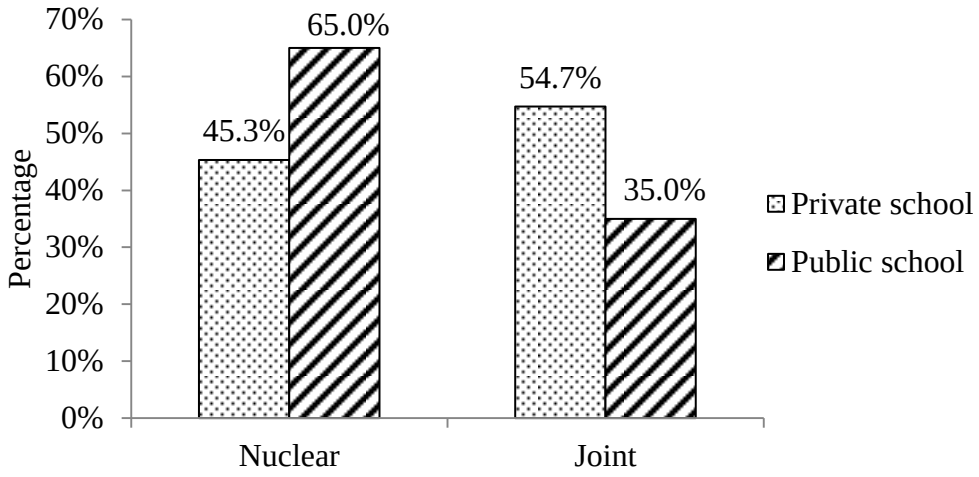

Fig 4.6 Type of family of private and public school children

In private schools, in the children from nuclear family, 3 (4.8%) were severely thinned, 15 (24.2%) were moderately thinned, 1 (1.6%) were severely stunted and 8 (12.9%) were moderately stunted. Among the children from joint family, 4 (5.3%) were severely thinned, 17 (22.7%) were moderately thinned, 2 (2.7%) were severely stunted and 3 (4.0%) were moderately stunted. In public schools, in the children from nuclear family, 6 (6.7%) were severely thinned, 17 (19.1%) were moderately thinned, 1 (1.1%) were severely stunted and 19 (21.3%) were moderately stunted. Among the children from joint family, 3 (6.2%) were severely thinned, 10 (20.8%) were moderately thinned, 3 (6.2%) were severely stunted and 14 (29.2%) were moderately stunted.

Most of the children in private schools belonged to joint family whereas most of the children in public school belonged to nuclear family. Children living in joint family were more likely to suffer chronic malnutrition than children from nuclear families as found by the study conducted in school children of urban slums of India (Srivastava *et al.*, 2012). Living in the joint family was protective factor for both stunting and underweight in children of Belhara VDC, Dhankuta. (Sapkota, 2008).

4.1.7 Family size

Families with less than or equal to four members were considered small families and those with more than four members were considered large families. In private school children, 22.6% (31) children were from household with 1 to 4 members whereas 77.4% (106) were from household with more than 4 members. On the other hand, in public school children, 15.3% (21) children were from household with 1 to 4 members whereas 84.7% (116) were

from household with more than 4 members. The family size of school children is illustrated by figure 4.7.

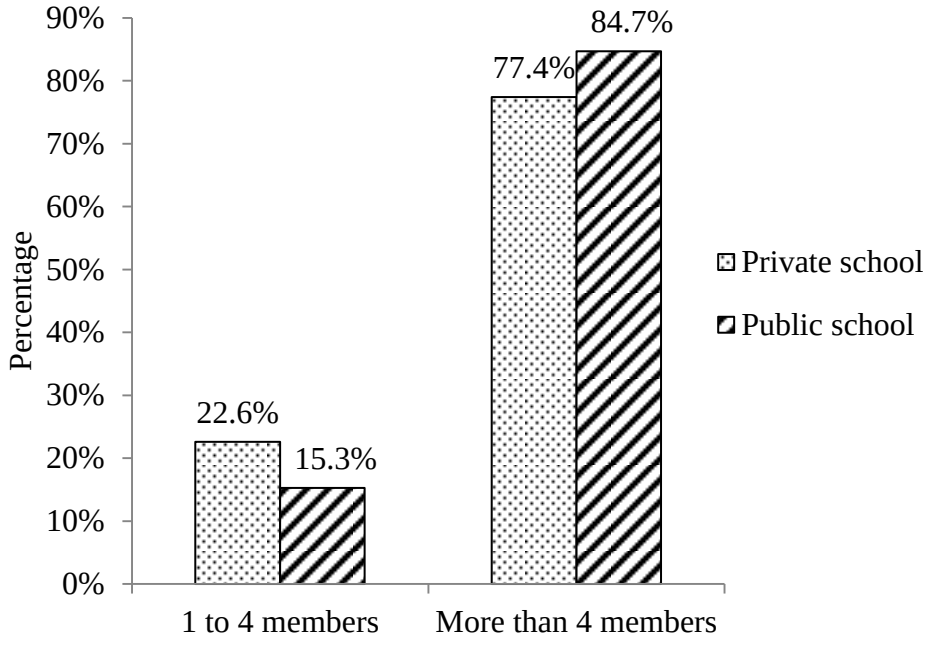

Fig 4.7 Family size of private and public school children

In private schools, in the children from family with less than 5 members, 1 (3.2%) were severely thinned, 8 (25.8%) were moderately thinned, none were severely stunted and 6 (19.4%) were moderately stunted. Among the children from family with 5 or more members, 6 (5.7%) were severely thinned, 24 (22.6%) were moderately thinned, 3 (2.8%) were severely stunted and 5 (4.7%) were moderately stunted. In public schools, in the children from family with less than 5 members, none were severely thinned, 3 (14.3%) were moderately thinned, none were severely stunted and 4 (19.0%) were moderately stunted. Among the children from family with 5 or more members, 9 (7.8%) were severely thinned, 24 (20.7%) were moderately thinned, 4 (3.4%) were severely stunted and 29 (25.0%) were moderately stunted.

The study conducted in Nepal Medical College Teaching Hospital revealed that children from larger family suffer more from malnutrition compared to small family (Rijal *et al.,* 2011). The results of the study carried out in school children aged 6-12 years in Indonesia indicated that the percentage of malnourished children was greatest in a family with the number of members more than 4 among others (p=0.032) (Hamdani, 2015).

4.2 Household characteristics

Out of 274 children's household of public and private schools, every family owned their own houses and none of them rented the houses. Every household were headed by male members. All of them were found to be using tube well as the source of drinking water and none of them used any purification method to purify the water. Similarly, 100% of the households used iodized salt.

In household of children of private schools, 97.8% had kitchen garden and 2.2% did not have kitchen garden whereas 83.2% in public schools had kitchen garden and 16.8% did not have it. Dietary diversification by means of home gardening is a sustainable approach that can address various micronutrient deficiencies. In a study conducted in Philippines, children from households with kitchen gardens had higher dietary diversity scores compared with children who lived in homes without a kitchen garden. Children from households with kitchen gardens were significantly more probable to eat vegetables regularly (Cabalda *et al.,* 2011).

Every household of private school children had toilet facilities whereas households of 94.2% children from public schools had toilet facilities and 5.8% did not have it. Households having toilet facilities had significantly less number of stunted children (52.4%) as compared to 67.9% children in households without toilet facilities (p=0.019) in a study conducted among children aged 3-9 years in slum areas of Bhubaneswar, India (Panigrahi and Das, 2014).

4.3 Child characteristics

4.3.1 Gender

The proportion of males and females in private and public schools in Babiya VDC were found to be unalike. From the total of 137 from private school children included in this study 68.6% (94) were males and 31.4% (43) were females. In public school children, 42.3% (58) were males and 57.7% (79) were females. More percentage of children in private schools was male and less was female. Alternatively, more children in public schools were female and less was male. Figure 4.8 gives a picture of gender distribution in the schools.

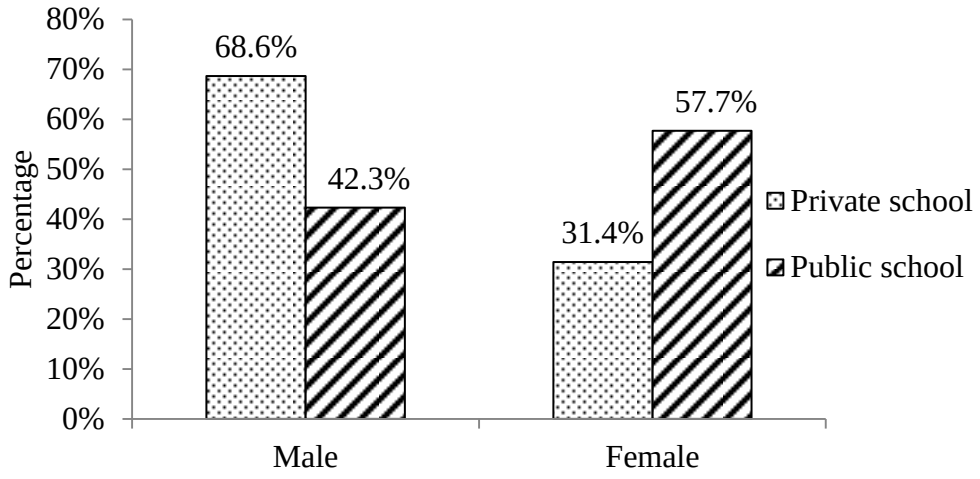

Fig 4.8 Gender distribution in private and public school children

In private schools, among female children, 5 (5.3%) were severely thinned, 24 (25.5%) were moderately thinned, 2 (2.1%) were severely stunted and 3 (3.2%) were moderately stunted. Among male children, 2 (4.7%) were severely thinned, 8 (18.6%) were moderately thinned, 1 (2.3%) were severely stunted and 8 (18.6%) were moderately stunted. In public schools, among female children, 4 (5.1%) were severely thinned, 14 (17.7%) were moderately thinned, 2 (2.5%) were severely stunted and 21 (26.6%) were moderately stunted. Among male children, 5 (8.6%) were severely thinned, 13 (22.4%) were moderately thinned, 2 (3.4%) were severely stunted and 12 (20.7%) were moderately stunted.

This study shows that there is still prevalence of difference in gender concepts in this place. Similar result was found in a research conducted in private and public schools of Itahari (Neupane, 2015). In a study conducted in Haryana, female children were more nutritionally deprived than males (Mishra *et al.*, 2016). Similar results were observed in school age children studying in two schools located in Kavrepalanchowk. Greater proportion of female students were found to be malnourished than their male counterparts (Bhandari and Shrestha, 2012).

4.3.2 Birth weight

Less than 2.5 kg of weight at birth is considered as low birth weight and more than that is considered to be normal birth weight. Figure 4.9 depicts the birth weight of school children in Babiya VDC. In private schools, 19% (26) of children's weight at birth was below

normal (less than 2.5 kg), 74.5% (102) was above normal (above 2.5 kg) and birth weight of 6.6% (9) children was not known. In public schools, 28.5% (39) of children's weight at birth was below normal (less than 2.5 kg), 27.7% (38) was above normal (above 2.5 kg) and birth weight of 43.8% (60) children was not known.

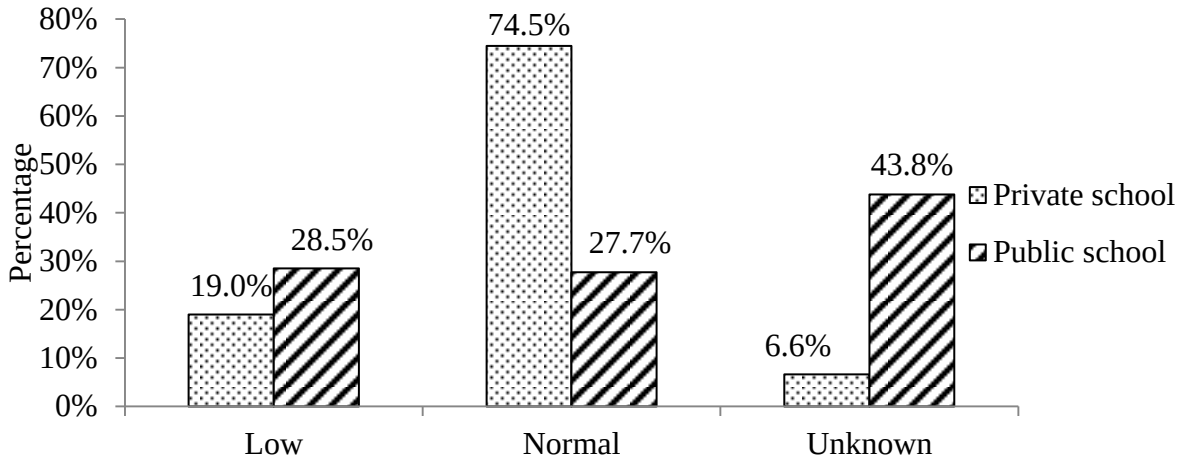

Fig 4.9 Birth weight of private and public school children

In private schools, among low birth weight children, 3 (11.5%) were severely thinned, 7 (26.9%) were moderately thinned, 1 (3.8%) were severely stunted and 2 (7.7%) were moderately stunted. Among normal birth weight children, 2 (2.0%) were severely thinned, 24 (23.5%) were moderately thinned, 1 (1.0%) were severely stunted and 7 (6.9%) were moderately stunted. Among children with unknown birth weight, 2 (22.2%) were severely thinned, 1 (11.1%) were moderately thinned, 1 (11.1%) were severely stunted and 2 (22.2%) were moderately stunted.

In public schools, among low birth weight children, 4 (10.3%) were severely thinned, 7 (17.9%) were moderately thinned, 1 (2.6%) were severely stunted and 16 (41.0%) were moderately stunted. Among normal birth weight children, 3 (7.9%) were severely thinned, 5 (13.2%) were moderately thinned, 3 (7.9%) were severely stunted and 7 (18.4%) were moderately stunted. Among children with unknown birth weight, 2 (3.3%) were severely thinned, 15 (25.0%) were moderately thinned, none were severely stunted and 10 (16.7%) were moderately stunted.

Greater number of students in public school had low birth weight. Children with a low birth weight were less likely to be stunted compared with those with a normal birth weight according to a research carried out in school children of Iran (Esfarjani *et al.*, 2013).

Greater proportions of mothers of public school children were unaware about the birth weight of their children (43.8%) as most of them delivered their babies in home and not in hospitals or health posts. In a study conducted in Nairobi, it was found that among those who were born in health facilities, 37% were stunted compared to those born at home among which 45 % were stunted (Murage *et al.*, 2012).

4.3.3 Birth order

Order of birth is one of the significant predictors of child being stunted (Rahman, 2016). Birth order of school children in Babiya VDC is shown in figure 4.10.

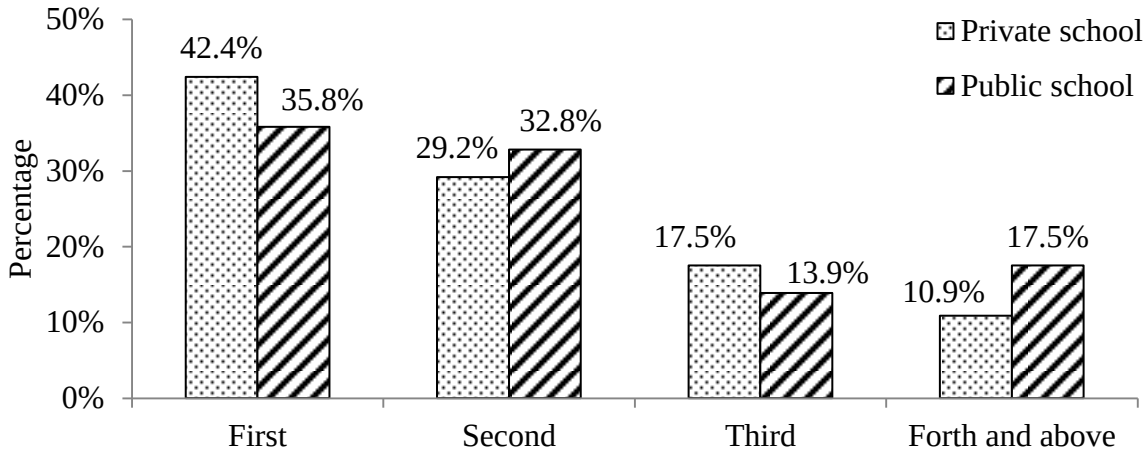

Fig 4.10 Birth order of private and public school children

In private schools, the birth order of 42.4% (58) children was first, 29.2% (40) second, 17.5% (24) third and 10.9% (15) fourth or above. In public schools, the birth order of 35.8% (49) children was first, 32.8% (45) second, 13.9% (19) third and 17.5% (24) fourth or above. Comparing with private schools, more children in public schools had birth order above 3. It indicates that the households of public school children had more number of children than the households of private school children.

In private schools, among children with birth order one, 3 (5.2%) were severely thinned, 15 (25.9%) were moderately thinned, 1 (1.7%) were severely stunted and 8 (13.8%) were moderately stunted. Among children with birth order two, 3 (7.5%) were severely thinned, 13 (32.5%) were moderately thinned, 1 (2.5%) were severely stunted and 1 (2.5%) were moderately stunted. Among children with birth order three, none were severely thinned, 1 (4.2%) were moderately thinned, none were severely stunted and 2 (8.3%) were moderately stunted. Among children with birth order 4 or more, 1 (6.7%) were severely

thinned, 3 (20.0%) were moderately thinned, 1 (6.7%) were severely stunted and none were moderately stunted.

In public schools, among children with birth order one, 1 (2.0%) were severely thinned, 8 (16.3%) were moderately thinned, none were severely stunted and 14 (28.6%) were moderately stunted. Among children with birth order two, 5 (11.1%) were severely thinned, 8 (17.8%) were moderately thinned, 3 (6.7%) were severely stunted and 8 (17.8%) were moderately stunted. Among children with birth order three, 1 (5.3%) were severely thinned, 4 (21.1%) were moderately thinned, none were severely stunted and 6 (31.6%) were moderately stunted. Among children with birth order 4 or more, 2 (8.3%) were severely thinned, 7 (29.2%) were moderately thinned, 1 (4.2%) were severely stunted and 5 (20.8%) were moderately stunted.

In a study conducted in school children in India, children whose birth order was more than second were likely to be malnourished (Srivastava *et al.*, 2012). Similar was the result in school children of urban slums of India; higher proportion of children with birth order more than 2 were suffering from wasting as compared to children having first birth order, which was statistically significant (p=0.010) (Panigrahi and Das, 2014).

4.3.4 Age group

The age group was classified into two groups; 6-9 years and 10-12 years. Figure 4.11 shows the categorization of the school children in those age groups.

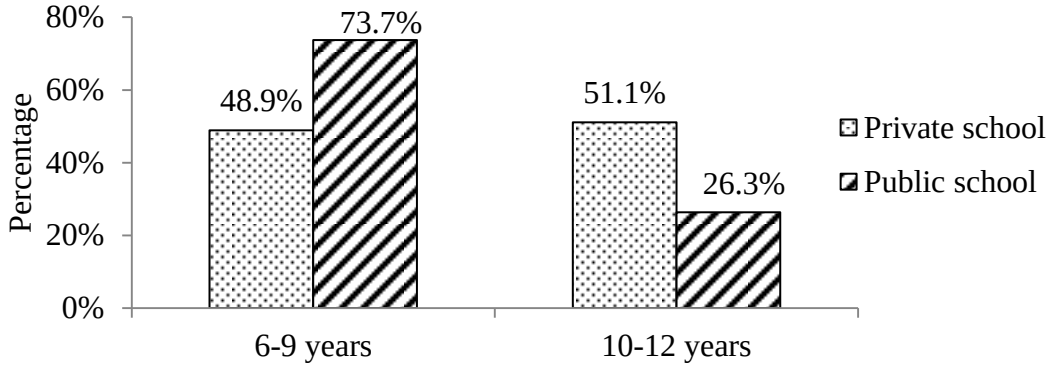

Fig 4.11 Age group of private and public school children

Private school children from age group (6-9) years were 48.9% (67) and (10-12) years were 51.1% (70). Public school children from age group (6-9) years were 73.7% (101) and (10-12) years were 23.6% (36). On comparison, maximum children were from age group

(10-12) years in private schools whereas there were more children from age group (6-9) years.

In private schools, among children with age group 6-9 years, 1 (1.5%) were severely thinned, 13 (19.4%) were moderately thinned, none were severely stunted and 5 (7.5%) were moderately stunted. Among children with age group 10-12 years, 6 (8.6%) were severely thinned, 19 (27.1%) were moderately thinned, 3 (4.3%) were severely stunted and 6 (8.6%) were moderately stunted. In public schools, among children with age group 6-9 years, 5 (5.2%) were severely thinned, 19 (19.8%) were moderately thinned, 3 (3.1%) were severely stunted and 23 (24.0%) were moderately stunted. Among children with age group 10-12 years, 4 (9.8%) were severely thinned, 8 (19.5%) were moderately thinned, 1 (2.4%) were severely stunted and 10 (24.4%) were moderately stunted.

The risk of stunting was significantly higher among age group 10-12 years and the thinness was more prevalent in age group 6-9 years as revealed by the comparative study in public and private primary schools in Egypt (Ali *et al.*, 2013). Among both boys and girls, stunting was distinguished more commonly in the age group 10-12 years among school children in Karnataka (Shivaprakash and Joseph, 2014).

4.4 Maternal characteristics

4.4.1 Age group of mother

Two categories were used to classify the mother's age of school children; below 30 and above 30 years. Age distribution of mothers of private and public school children is demonstrated by figure 4.12.

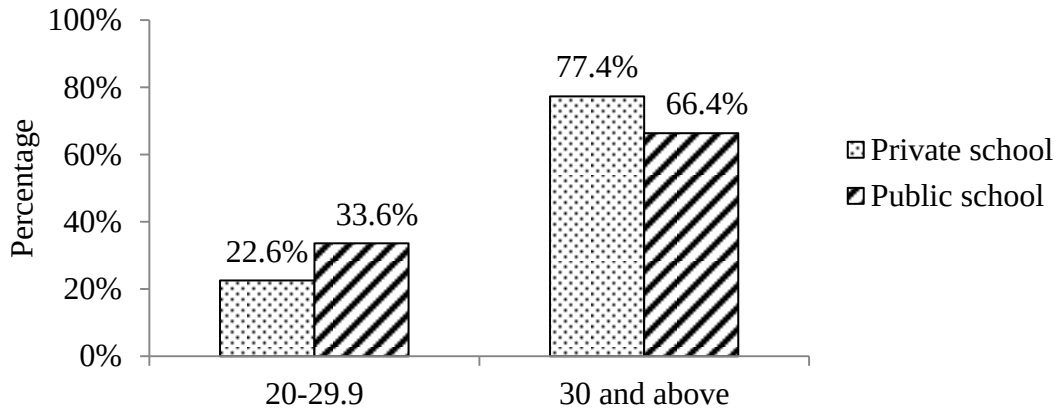

Fig 4.12 Age group of mother of private and public school children

In private school children, 22.6% (31) mothers were from age group (20-29.9) years and 77.4% (106) were from age group more than 30. While, in public school children, 33.6% (46) mothers were from age group (20-29) years and 66.4% (91) were from age group more than 30. Comparing the results, it was found that more number of mothers from public school belonged to younger age group.

In private schools, among mothers of children with age group less than 30 years, 5 (8.2%) were severely thinned, 14 (23.0%) were moderately thinned, 2 (3.3%) were severely stunted and 9 (14.8%) were moderately stunted. Among mothers of children with age group 30 or more years, 2 (2.6%) were severely thinned, 18 (23.7%) were moderately thinned, 1 (1.3%) were severely stunted and 2 (2.6%) were moderately stunted. In public schools, among mothers of children with age group less than 30 years, 4 (8.7%) were severely thinned, 6 (13.0%) were moderately thinned, 2 (4.3%) were severely stunted and 10 (21.7%) were moderately stunted. Among mothers of children with age group 30 or more years, 5 (5.5%) were severely thinned, 21 (23.1%) were moderately thinned, 2 (2.2%) were severely stunted and 23 (25.3%) were moderately stunted.

It was discovered that there were negative associations between younger maternal age and parity, birth weight of children and schooling in a study in five low-income and middle-income countries. Children of young mothers had a greater risk of low birth weight and preterm birth, stunting in infancy, short adult height, poor schooling, and higher adult fasting glucose concentrations (Sinha *et al.*, 2015). Cross-sectional study in 18 countries of Africa, Asia and Latin America confirmed that there were significant associations between low child HAZ and young maternal age at $p<0.10$ (Mason *et al.*, 2016).

4.4.2 Age at marriage

Teenage marriage was common in Babiya VDC. In private schools, 10.2% (14) mothers got married before 15 years of age, 55.5% (76) got married at the age (15-19) years and 34.3% (47) got married above 20 years of age. In public schools, 13.9% (19) mothers got married before 15 years of age, 56.2% (77) got married at the age (15-19) years and 29.9% (41) got married above 20 years of age.

Figure 4.13 shows the categorization of age at which the mothers of private and public school children got married.

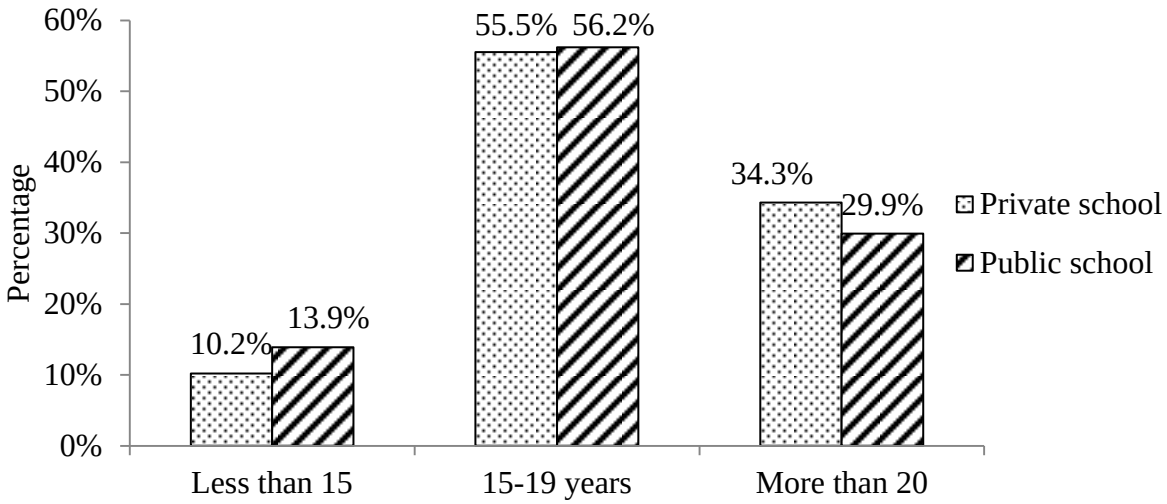

Fig 4.13 Age of mothers of private and public school children at marriage

In private schools, among mothers of children who were married before 15 years of age, 1 (7.1%) were severely thinned, 3 (21.4%) were moderately thinned, none were severely stunted and 1 (7.1%) were moderately stunted. Among mothers of children who were married after 15 years and before 20 years of age, 5 (6.6%) were severely thinned, 17 (22.4%) were moderately thinned, 3 (3.9%) were severely stunted and 7 (9.2%) were moderately stunted. Among mothers of children who were married after 20 years of age, 1 (2.1%) were severely thinned, 12 (25.5%) were moderately thinned, none were severely stunted and 3 (6.4%) were moderately stunted.

In public schools, among mothers of children who were married before 15 years of age, 2 (11.1%) were severely thinned, 2 (11.1%) were moderately thinned, none were severely stunted and 3 (16.7%) were moderately stunted. Among mothers of children who were married after 15 years and before 20 years of age, 6 (7.8%) were severely thinned, 16 (20.8%) were moderately thinned, 3 (3.9%) were severely stunted and 18 (23.4%) were moderately stunted. Among mothers of children who were married after 20 years of age, 1 (2.1%) were severely thinned, 12 (25.5%) were moderately thinned, none were severely stunted and 13 (27.7%) were moderately stunted.

Mother's age at first marriage may point out level of women's empowerment. The median age at first marriage is 17.2 for women in Nepal. Low level of education as well as cultural values that do not give priority to female education and lead to gender discrimination are some of the explanations of the early age of marriage of women in our

country. Early age of marriage leads to early pregnancy and it also increases childbirth parity with relatively shorter birth spacing. Consequently, all of these may affect child nutrition (Bishwakarma, 2011). The mother who got married below 20 years of age had more underweight children compared to those who got married between the age of 21 – 26 years according t0 a study conducted in rural VDCs of Sunsari district (Gharti, 2005).

4.4.3 Age at pregnancy

Alike early marriage, teenage pregnancy was also found to be common in Babiya VDC. The age of mothers of school children at their first pregnancy is depicted by figure 4.14.

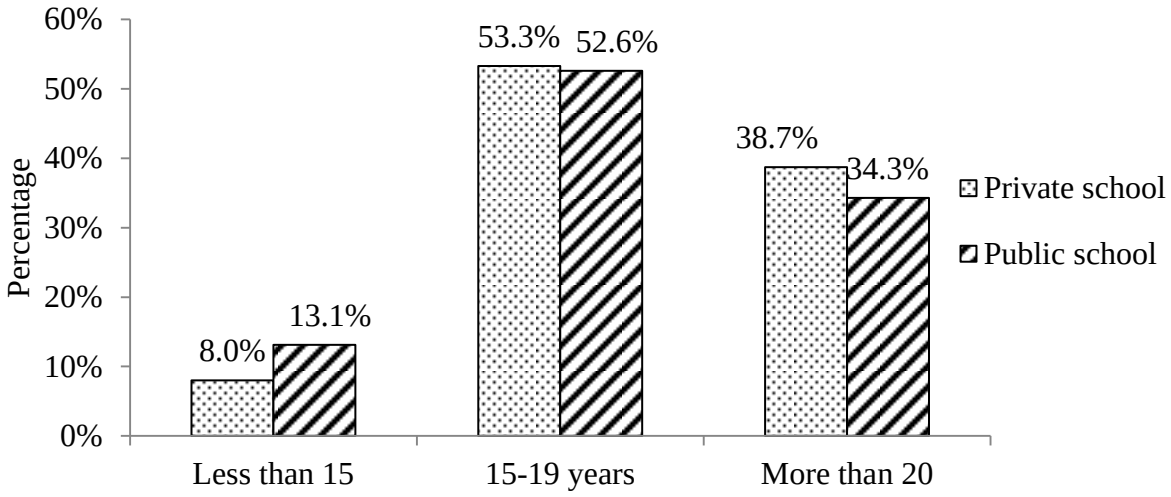

Fig 4.14 Age of mothers of private and public school children at pregnancy

In private schools, 8% (11) mothers got pregnant before 15 years, 53.3% (73) got pregnant at the age (15-19) years and 38.7% (53) above 20 years of age. In public schools 13.1% (18) mothers got pregnant before 15 years, 52.6% (72) got pregnant at the age (15-19) years and 34.3% (47) above 20 years of age. The percentage of mothers of public school children getting married and getting pregnant before 15 years of age is more than that of mothers of private school children.

In private schools, among mothers of children who got pregnant before 15 years of age, 1 (9.1%) were severely thinned, 2 (18.2%) were moderately thinned, none were severely stunted and 1 (9.1%) were moderately stunted. Among mothers of children who got pregnant after 15 years and before 20 years of age, 5 (6.8%) were severely thinned, 17 (23.3%) were moderately thinned, 3 (4.1%) were severely stunted and 5 (6.8%) were moderately stunted. Among mothers of children who got pregnant after 20 years of age, 1

(1.9%) were severely thinned, 13 (24.5%) were moderately thinned, none were severely stunted and 5 (9.4%) were moderately stunted.

In public schools, among mothers of children who got pregnant before 15 years of age, 2 (10.5%) were severely thinned, 2 (10.5%) were moderately thinned, 1 (5.3%) were severely stunted and 3 (15.8%) were moderately stunted. Among mothers of children who got pregnant after 15 years and before 20 years of age, 6 (8.3%) were severely thinned, 13 (18.1%) were moderately thinned, 4 (5.6%) were severely stunted and 17 (23.6%) were moderately stunted. Among mothers of children who got pregnant after 20 years of age, 1 (2.4%) were severely thinned, 9 (22.0%) were moderately thinned, none were severely stunted and 12 (29.3%) were moderately stunted.

In a study conducted in five low-income and middle-income countries, it was found that maternal age were related with lower birth weight, gestational age, child nutritional status, and schooling. Young maternal age at childbearing (≤19 years) was found to be linked with a greater risk of preterm birth and intrauterine growth constraint, infant mortality, and child malnutrition. (Sinha *et al.*, 2015).

Children born to mothers less than 20 years of age at the time of birth were prone to the risk of stunting as established by a study conducted in school age children in Ethiopia. The low nutrient level of mothers during pregnancy could hinder growth of the fetus and the baby throughout childhood. Furthermore, women of less than 20 years are not usually employed and have less or no income to feed their children. Moreover, teenage pregnancy has been related with adverse birth outcomes, including low birth weight and congenital malformations, which can later affect the nutritional status of the children. (Degarege *et al.*, 2015). A study carried out in school children in urban slums of India revealed that the mother's age at child's birth appeared to be significant risk factor for stunting in children as more children (71.4%) born to younger mothers (≤20 years of age) had stunting compared to children born to older women (p=0.015) (Panigrahi and Das, 2014).

4.4.4 Occupation

Most of the mothers in Babiya VDC were housewives. Figure 4.15 demonstrates the proportion of engagement in different occupations by the mothers of private and public school children.

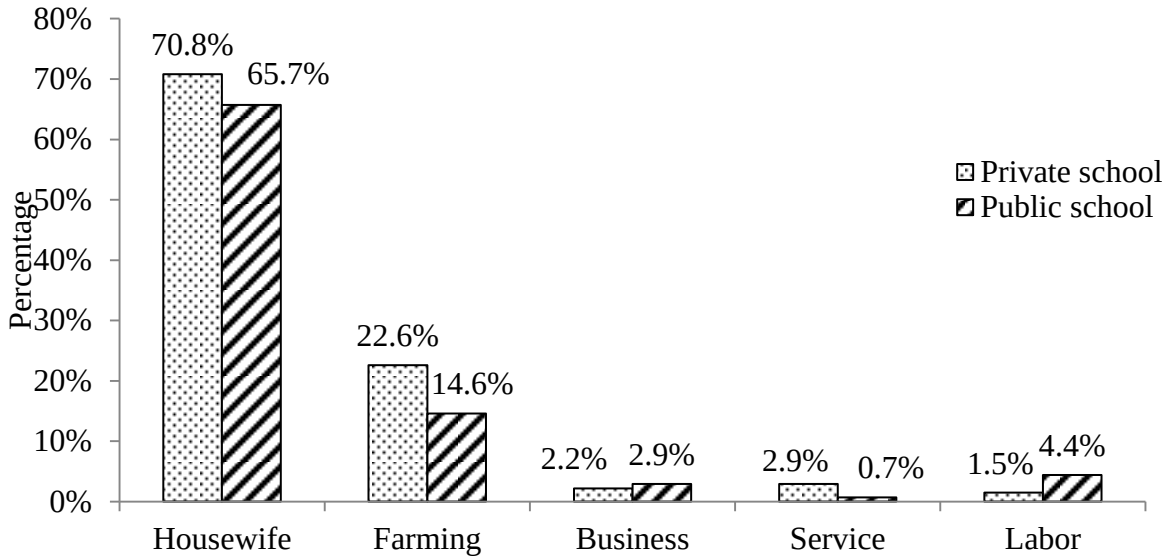

Fig 4.15 Occupation of mothers of private and public school children

In private schools, 70.8% (97) of mothers were housewives whereas 22.6% (31) were engaged in agriculture, 2.2% (3) in business, 2.9% (4) in service and 1.5% (2) in wage earning in private schools. Likewise in public schools, 65.7% (90) were housewives whereas 14.6% (20) were engaged in agriculture, 2.9% (4) in business, 0.7% (1) in service and 16.1% (22) in wage earning. Most proportion of mothers of private school children are housewives than mothers of public school children. The percentage of mothers engaging in low paid jobs such as, wage earning was more in public schools than in private schools.

In private schools, in the children of housewife mothers, 4 (4.1%) were severely thinned, 22 (22.7%) were moderately thinned, 3 (3.1%) were severely stunted and 9 (9.3%) were moderately stunted. Among the children of mothers engaged in farming, 2 (6.5%) were severely thinned, 7 (22.6%) were moderately thinned, none were severely stunted and 1 (3.2%) were moderately stunted. Among the children of mothers engaged in business, 1 (33.3%) were severely thinned, 1 (33.3%) were moderately thinned, none were severely stunted and 1 (33.3%) were moderately stunted. Among the children of mothers engaged in service, none were severely thinned, 1 (25.0%) were moderately thinned, none were severely and moderately stunted. Among the children of mothers engaged in labor works, none were severely thinned, 1 (50.0%) were moderately thinned, none were severely and moderately stunted.

In public schools, in the children of housewife mothers, 5 (5.6%) were severely thinned, 19 (21.1%) were moderately thinned, 4 (4.4%) were severely stunted and 21 (23.3%) were

moderately stunted. Among the children of mothers engaged in farming, 2 (10.0%) were severely thinned, 3 (15.0%) were moderately thinned, none were severely stunted and 5 (25.0%) were moderately stunted. Among the children of mothers engaged in business, none were severely and moderately thinned, none were severely stunted and 1 (25.0%) were moderately stunted. Among the children of mothers engaged in service, 1 (16.7%) were severely thinned, 3 (50.0%) were moderately thinned, none were severely stunted and 3 (50.0%) were moderately stunted. Among the children of mothers engaged in labor works, 1 (6.2%) were severely thinned, 2 (12.5%) were moderately thinned, none were severely stunted and 2 (12.5%) were moderately stunted.

Children having employed mothers were identified to be at greater risk of stunting than those having housewife mothers in a study conducted in school children in Ethiopia. Prevalence of malnutrition among children whose mothers worked outside their home was greater as mother's care played a major role in child nutrition since she was the closest to the child (Degarege *et al.*, 2015). In a study conducted in urban slums of India, the prevalence of malnutrition was found to be higher in children of working mothers. Children of nonworking mothers had better nutritional status than children of working mothers, probably due to more time for caring of children (Srivastava *et al.*, 2012).

4.4.5 Knowledge about malnutrition

Mothers of school children were asked about malnutrition and the findings are depicted by figure 4.16.

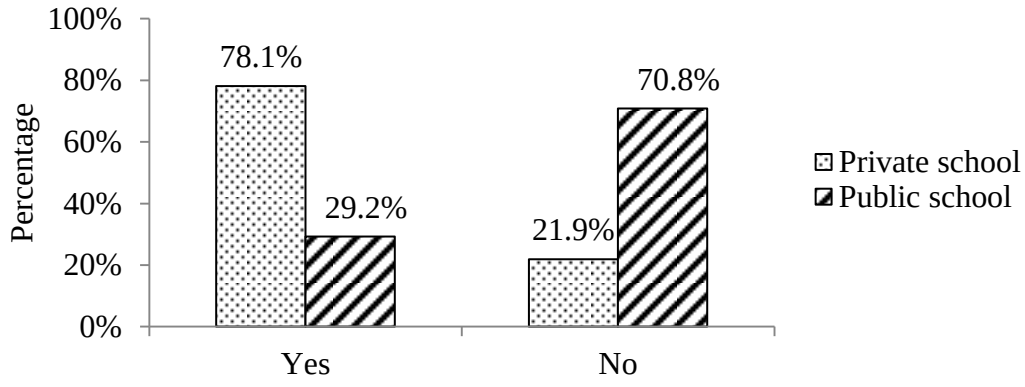

Fig 4.16 Mother's knowledge about malnutrition in private and public schools

In private schools, in the children of mothers who had knowledge about malnutrition, 4 (3.7%) were severely thinned, 21 (19.6%) were moderately thinned, 1 (1.9%) were

severely stunted and 6 (5.6%) were moderately stunted. Among the children of mothers who did not have knowledge about malnutrition, 3 (10.0%) were severely thinned, 11 (36.7%) were moderately thinned, 1 (3.3%) were severely stunted and 5 (16.7%) were moderately stunted. In public schools, in the children of mothers who had knowledge about malnutrition, 2 (5.0%) were severely thinned, 9 (22.2%) were moderately thinned, none were severely stunted and 5 (12.5%) were moderately stunted. Among the children of mothers who did not have knowledge about malnutrition, 7 (7.2%) were severely thinned, 18 (18.6%) were moderately thinned, 4 (4.1%) were severely stunted and 28 (28.9%) were moderately stunted.

Majority of the mothers i.e. 78.1% (107) in private schools had knowledge about malnutrition whereas in public schools, 70.8% of mothers did not know about malnutrition. A study on knowledge of mothers on malnutrition and nutritional status of children in Nigeria revealed a significant positive relationship of child malnutrition with the knowledge of mothers on malnutrition (p=0.164) (Ogunba and Otunla, 2015). A study conducted in New Delhi and Gajipur suggested that there was significant association observed between knowledge status of the mother about prevention of protein-energy malnutrition and prevalence of malnourishment in children (Yadava, 2016).

4.4.6 Knowledge about cause of malnutrition

Mothers of private and public school children considered different reasons responsible for malnutrition in children. Figure 4.17 gives a picture of the causes.

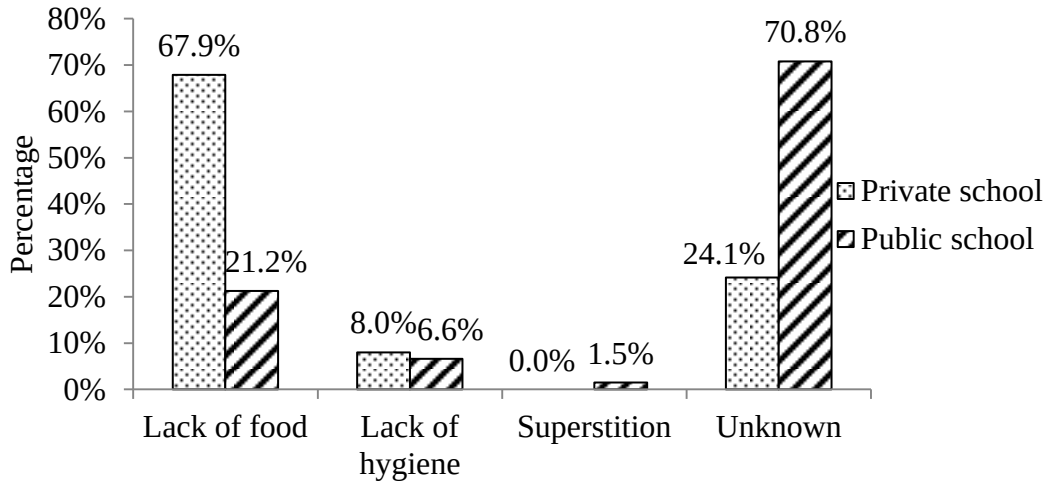

Fig 4.17 Cause of malnutrition as responded by mothers of private and public school children

In private schools, 67.9% (93) knew about the actual cause of malnutrition whereas 24.1% (33) did not know about its cause. Eight percentages of mothers (11) believed lack of hygiene to be the cause of malnutrition and none of the mothers believed in superstition regarding malnutrition. In public schools, 21.2% (29) mothers knew about the actual cause of malnutrition whereas 70.8% (97) did not know about its cause. Also, 6.6% (9) mothers believed lack of hygiene to be the cause of malnutrition and 1.5% (2) others believed in superstition.

In private schools, more mothers knew about malnutrition and its actual cause whereas in public schools, most of the mothers did not know about malnutrition and they also believed superstition to be to be the cause of malnutrition. Belief in traditional healers is still widespread in many parts of Nepal and is also a contributing factor for low health services seeking attitude particularly among the people from vulnerable groups. People choose seeing a nearby traditional healer rather than the nearby health facility (Baral *et al.*, 2017).

A study conducted in Kunchha VDC of Lamjung district concluded that mother's knowledge about the cause of malnutrition was a preventative factor for child's malnutrition (Dhungana, 2013). A study carried out in 991 children to assess the relationship between maternal nutritional knowledge and growth of children living in rural communities discovered that there was a significant positive association between the mother's nutritional knowledge about cause of malnutrition and mean HAZ with p value 0.005 (Saaka, 2014).

The mothers of the school children were asked if they provided their children with vitamin A and deworming capsules. All of the mothers responded that they provided vitamin A and deworming tablets to their children on regular basis.

4.5 Dietary evaluation

4.5.1 24 hour dietary recall

Similarity was found in eating habits amongst overall surveyed children of both private and public schools. Children were found eating same foods that was cooked for other family members. Tea or milk or biscuits were taken by the children for breakfast; rice, daal and curry for lunch; noodles, *momo*, *samosa*, tea, biscuits and other fast food during tiffin

time and rice, daal and curry and roti for dinner. The mean intake of different nutrients among the school children was calculated using food composition table and is given in Table 4.1;

Table 4.1 Mean intake of nutrients among children of private and public schools

Nutrients	**Private school (n=137)**		**Public school (n=137)**	
	Mean	**Std. Deviation**	**Mean**	**Std. Deviation**
Protein (g)	42.51	13.05	34.83	13.98
Fat (g)	27.20	9.47	24.30	8.01
Carbohydrate (g)	261.41	71.15	199.16	78.63
Calories (Kcal)	1451.38	365.52	1145.85	398.25
Calcium (mg)	459.85	28.37	380.62	28.43
Iron (mg)	12.62	6.97	10.04	6.82
Carotene (µg)	1643.28	272.31	1747.48	305.39
Vitamin C (mg)	99.61	67.40	87.81	71.93
Thiamine (mg)	0.94	0.33	0.73	0.33
Riboflavin (mg)	0.62	0.32	0.46	0.27
Niacin (mg)	8.02	2.52	6.42	3.09

The mean intake of nutrients was found greater in private school children than in public school children. The mean intake of calcium, iron, riboflavin and niacin are less than RDA in private school children. Similarly, the average intake of calories, calcium, iron, riboflavin and niacin in public school children are lower than their RDA.

4.5.2 Food frequency

Parents or caretakers of school children were asked about how often their children were fed with milk, meat, fruits and vegetables. The results are as follows:

4.5.2.1 Providing animal's milk

Figure 4.18 describes whether the schools children were provided with animal's milk or not. From the total of 137 from private school children included in this study 89.1% (122) were provided with animal's milk and 10.9% (15) students didn't use to drink animal's milk. In public school children, 83.2% (114) were provided with animal's milk and 16.8% (23) students didn't use to drink animal's milk.

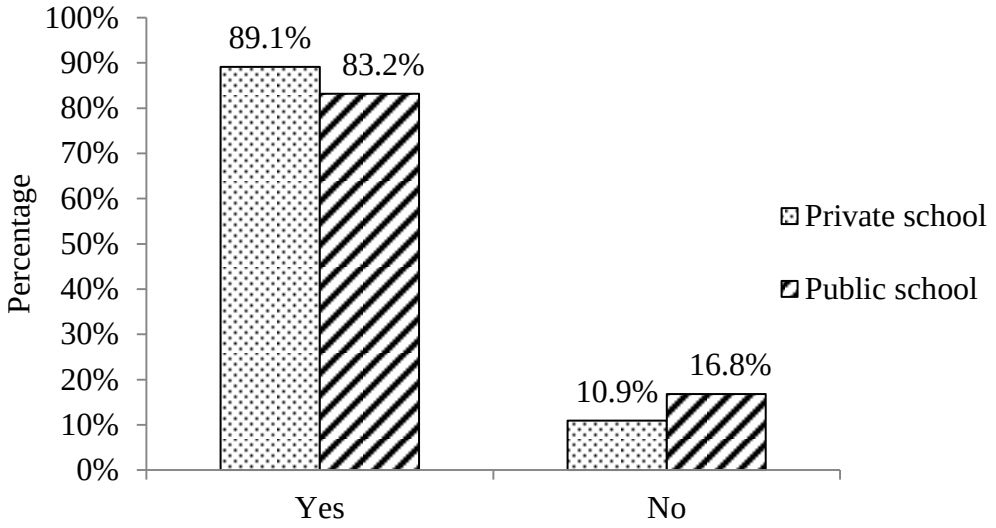

Fig 4.18 Responses about whether the students drank animal's milk or not

4.5.2.2 Frequency of eating meat/fish/poultry

Figure 4.19 explains how often the school children were provided with meat/fish/poultry.

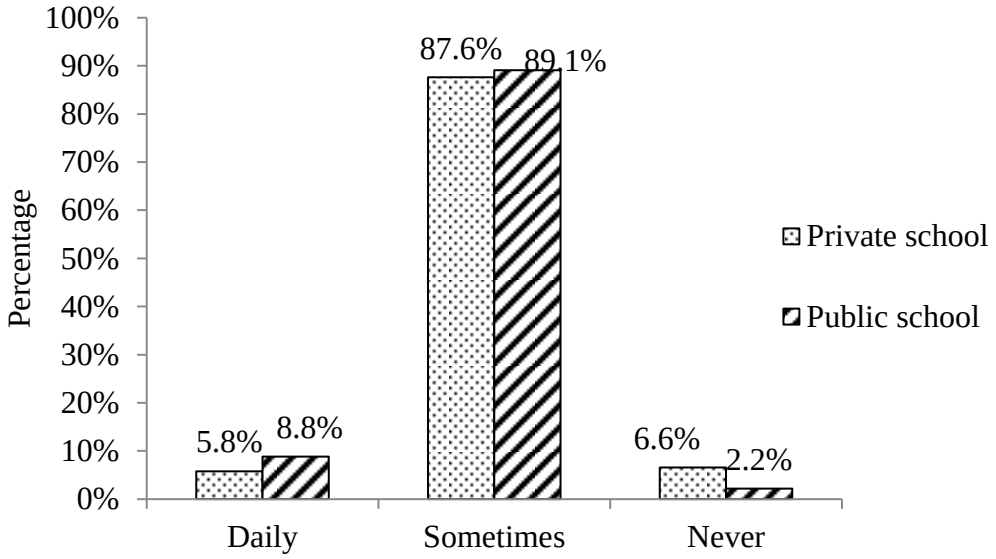

Fig 4.19 Frequency of eating meat/fish/poultry among school children

In private schools, 5.8% (8) children consumed meat/fish/poultry daily, 87.6% (120) consumed sometimes and 6.6% (9) never consumed meat/fish/poultry. In private schools, 8.8% (12) children consumed meat/fish/poultry daily, 89.1% (122) consumed sometimes and 2.2% (3) never consumed meat/fish/poultry.

4.5.2.3 Frequency of eating fruits

Figure 4.20 explains how often the school children consumed fruits.

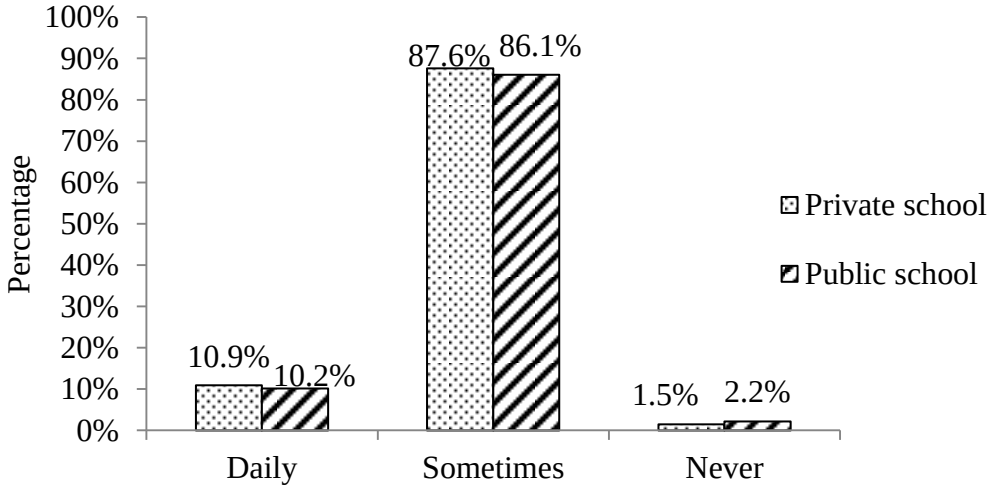

Fig 4.20 Frequency of eating fruits among school children

In private schools, 10.9% (15) children consumed fruits daily, 87.6% (120) consumed sometimes and 1.5% (2) never consumed fruits. In private schools, 10.2% (14) children consumed fruits daily, 86.1% (118) consumed sometimes and 3.6% (5) never consumed fruits.

4.5.2.4 Frequency of eating green vegetables

Figure 4.21 explains how often the school children were provided with green vegetables.

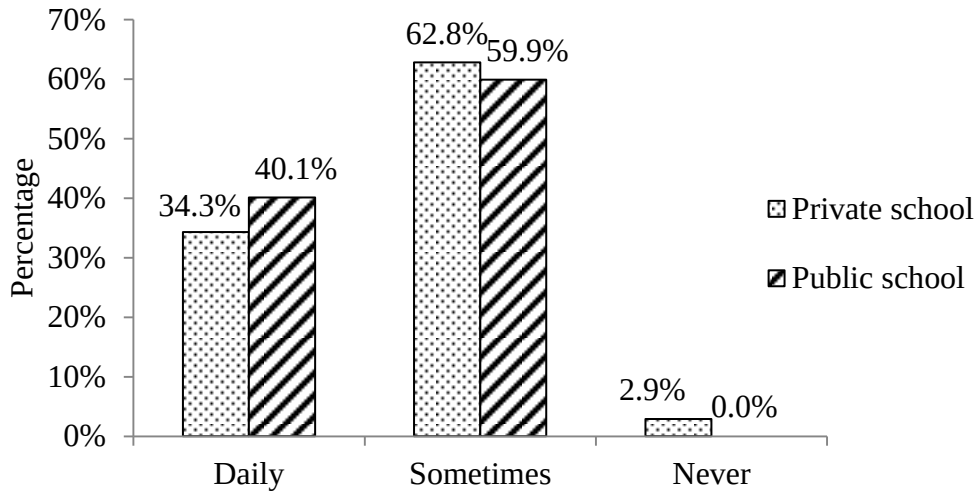

Fig 4.21 Frequency of eating green vegetables among school children

In private schools, 34.3% (47) children consumed green vegetables daily, 62.8% (86) consumed sometimes and 2.9% (4) never consumed green vegetables. In public schools, 40.1% (55) children consumed green vegetables daily and 59.9% (82) sometimes consumed green vegetables.

4.6 Prevalence of malnutrition

In Babiya VDC, 10.2% children were stunted (2.2% severely stunted and 8% moderately stunted) and 28.4% children were thinned (5.1% severely thinned and 23.3% moderately thinned) in private schools. Similarly, 27% children were stunted (2.9% severely stunted and 24.1% moderately stunted) and 26.3% children were thinned (6.6% severely thinned and 19.7% moderately thinned) in public schools. The prevalence of malnutrition in primary level school children in private and public schools in Babiya VDC is shown in figure 4.22.

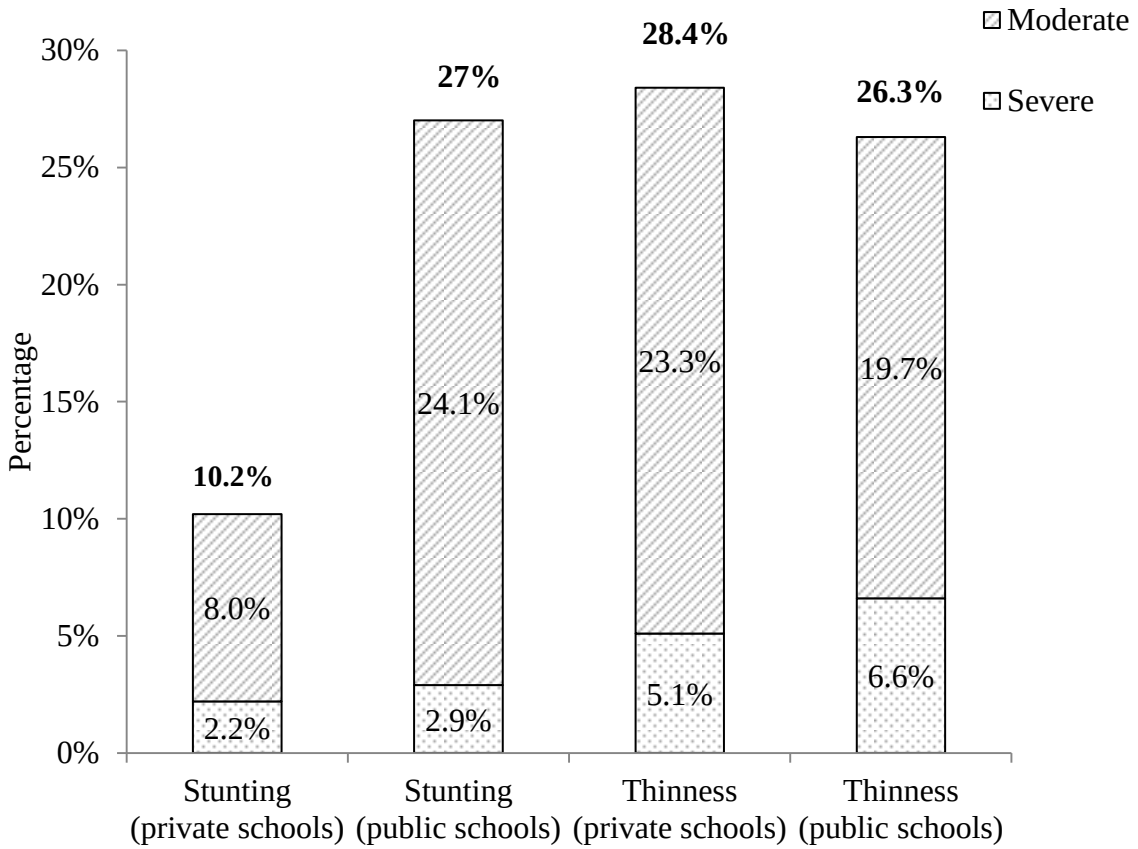

Fig 4.22 Prevalence of stunting and thinness in private and public schools of Babiya VDC

On comparison between two types of school, more proportion of public school children were severely stunted than private school children. Similarly, 6.6% of public school children were severely thinned which was more than the prevalence of severe thinness in private school children (5.1%). The percentage of moderate stunting was higher in public school children than in private school children whereas the percentage of moderate thinness was higher in private school children than in public school children. The prevalence of stunting was higher in public school children than in private school children whereas the prevalence of thinness was slightly more in private school children than in public school children.

In a study carried out in Itahari in 2015, 18.68%, and 5.50% of students in private schools were found to be stunted and thinned respectively while 29.66% and 13.28% of students in public schools were found to be stunted and thinned respectively. In overall students from both types of school, 24.17%, and 9.39% of students were stunted and thinned (Neupane, 2015). The results discovered in the survey in Itahari were not similar as this study. This might be because it was affected by study area. The study was conducted in Itahari sub-metropolitan city which is an urban area. There may be difference in result because of level of education of parents which was found to be higher as compared with this study conducted in Babiya VDC.

The study conducted in Belbari among 150 students of 6-12 years age group reported that 45.34% children from private schools were stunted and 79.33% were underweight which was much greater than the results of this study (Subba, 2003). Stunting and thinness were higher among pupils attending public schools compared to their private schools counterparts as concluded by a study between public and private schools children in Ghana (Agbozo *et al.*, 2016).

4.6.1 Age wise distribution of stunting

The prevalence of stunting was dissimilar in different age group as shown by Table 4.2. In public schools, severe and moderate stunting was higher in age group 6-9 years whereas in private schools, both severe and moderate stunting was higher in age group 10-12 years. The prevalence of stunting was more among the age group 10-12 years in private school children whereas the prevalence was higher in the age group 6-9 years in public school children.

Table 4.2 Age-wise distribution of severe and moderate stunting among private and public school children

HAZ	Private schools (N=137)			Public schools (N=137)		
	6-9 years	**10-12 years**	**All**	**6-9 years**	**10-12 years**	**All**
Severe						
Frequency	0	3	3	3	1	4
Percentage	0.00%	2.20%	2.20%	2.20%	0.70%	2.90%
Moderate						
Frequency	5	6	11	23	10	33
Percentage	3.60%	4.4%	8.00%	16.80%	7.30%	24.10%
Normal						
Frequency	62	61	123	70	30	100
Percentage	45.20%	44.5%	89.80%	51.10%	21.90%	73.00%

In a research conducted in rural school-going children (6-12 Years) of Mandya District, Karnataka, among both boys and girls, stunting was noted more commonly in the age group 10-12 years with 34% in boys and 29.2% in girls (Shivaprakash and Joseph, 2014). In a study in school children in India, stunting was found to be more leading in age group 10-12 years (Srivastava *et al.*, 2012). These results are alike to higher prevalence of stunting in public school children in this study.

4.6.2 Distribution of stunting among gender

Comparing the nutritional status, it was found that stunting was more prevalent in females in both types of school. Table 4.3 depicts gender wise distribution of severe and moderate stunting in private and public school children. In private school children, 2.2% children were severely stunted and 8.0% were moderately stunted. Among 43 females, 0.7% were severely stunted and 5.8% were moderately stunted. Likewise, among 94 males, 1.5% were severely stunted and 2.2% were moderately stunted. In public school children, 3.0% children were severely stunted and 24.0% were moderately stunted. Among 79 females, 1.5% were severely stunted and 15.3% were moderately stunted. Likewise, among 58 males, 1.5% were severely stunted and 8.7% were moderately stunted.

Table 4.3 Distribution of severe and moderate stunting in private and public school children among gender

HAZ	Private schools (N=137)			Public schools (N=137)		
	Female	**Male**	**All**	**Female**	**Male**	**All**
Severe						
Frequency	1	2	3	2	2	4
Percentage	0.70%	1.50%	2.20%	1.50%	1.50%	2.90%
Moderate						
Frequency	8	3	11	21	12	33
Percentage	5.80%	2.20%	8.00%	15.3%	8.70%	24.10%
Normal						
Frequency	34	89	123	56	44	100
Percentage	24.80%	65.00%	89.80%	40.90%	32.10%	73.00%

Comparing the nutritional status between private and public schools, more females in public schools i.e. 16.8% (23) were stunted than in private schools i.e.6.6% (9). Similarly, more males in public schools i.e. 10.2% (14) were stunted than in private schools i.e.3.6% (5). The result of public school of this study is comparable to the study conducted in public and private primary schools in Egypt. It was established that greater number of male students were stunted in public schools (52.7%) than in private schools (27.4%) (Ali *et al.*, 2013). The findings of public schools are similar but unlike private schools as compared to the research carried out in Itahari, in which it was found that more number of male students in both private and public schools were stunted than female students (Neupane, 2015). In a study conducted in school-aged children in Iran, stunting was more prevalent in girls (4.4%) than boys (2.8%, $P < 0.05$) (Esfarjani *et al.*, 2013).

4.6.3 Age wise distribution of thinness

There was variation in age wise distribution thinness in school children as seen in table 4.4. In private schools, thinness was more prevalent in age group 10-12 years whereas in public schools, it was more prevalent in age group 6-9 years. In a study conducted in urban slums of India, thinness was found to be more prevalent in age group 6-9 years (Srivastava *et al.*, 2012).

Table 4.4 Age-wise distribution of severe and moderate thinness among public school children

BAZ	Private schools (N=137)			Public schools (N=137)		
	6-9 years	**10-12 years**	**All**	**6-9 years**	**10-12 years**	**All**
Severe						
Frequency	1	6	7	5	4	9
Percentage	0.70%	4.40%	5.10%	3.60%	3.00%	6.60%
Moderate						
Frequency	13	19	32	19	8	27
Percentage	9.50%	13.90%	23.40%	13.90%	5.80%	19.70%
Normal						
Frequency	53	45	98	72	29	101
Percentage	38.6%	32.90%	71.50%	52.50%	21.20%	73.70%

4.6.4 Distribution of thinness among gender

In Babiya VDC, more males were thinned in private schools whereas similar proportion of males and females were thinned in public schools. Table 4.5 shows gender wise distribution of severe and moderate thinness in private and public school children.

Table 4.5 Distribution of severe and moderate thinness among private and public school children among gender

BAZ	Private schools (N=137)			Public schools (N=137)		
	Female	**Male**	**All**	**Female**	**Male**	**All**
Severe						
Frequency	2	5	7	4	5	9
Percentage	1.50%	3.60%	5.10%	3.00%	3.60%	6.60%
Moderate						
Frequency	8	24	32	14	13	27
Percentage	5.80%	17.50%	23.30%	10.20%	9.50%	19.70%
Normal						
Frequency	33	65	98	61	40	101
Percentage	24.10%	47.50%	71.60%	44.50%	29.20%	73.70%

In private school children, 5.1% children were severely thinned and 23.3% were moderately thinned. Among 43 females, 1.5% were severely thinned and 5.8% were moderately thinned. Likewise, among 94 males, 3.6% were severely thinned and 17.5% were moderately thinned. In public school children, 6.6% children were severely thinned and 19.7% were moderately thinned. Among 79 females, 3.0% were severely thinned and 10.2% were moderately thinned. Also, among 58 males, 3.6% were severely thinned and 9.5% were moderately thinned.

In private schools, greater proportions of males were severely and moderately thinned than females. Similarly in public schools, more percentages of males were severely thinned than females and more females were moderately thinned than males. Boys had almost two times higher odds of being thin compared to girls in a study conducted by in Ethiopia (Gill *et al.*, 2015). More boys than girls were found to be thin (38.5% vs. 23.6%, p=0.0241) among school aged children in Ghana (Mogre *et al.*, 2013).

4.6.5 Height for age (private school children)

Figure 4.23 represents that the children are malnourished as per height for age as curve obtained in the study does not match with the reference curve as provided by WHO.

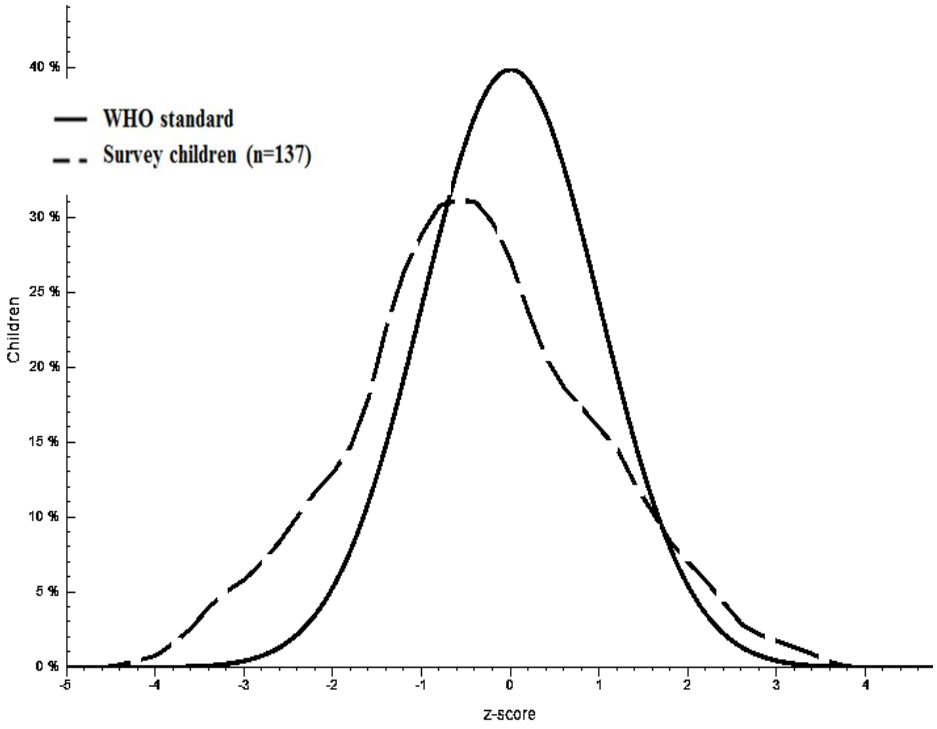

Fig. 4.23 Distribution of height-for-age z-score curve of private school children comparing with WHO standards 2007

The HAZ distribution curve obtained from the private school children in Babiya VDC is different than that of WHO standard curve. The median value of children is slightly shifted to the left indicating that some of the children in the population were stunted as shown in Figure 4.23. The curve shows that, more number of children were within normal range (>-2 to <2 z-score) but there was still prevalence of moderate stunting (>-3 to <-2 z-score) and severe stunting (<-3 z-score). The median value of HAZ in private school children was -0.55.

4.6.6 Height for age (public school children)

The HAZ distribution curve obtained from the public school children in Babiya VDC is different than that of WHO standard curve. Figured 4.24 represents that the children are malnourished as per height for age as curve obtained in the study does not match with the reference curve as provided by WHO.

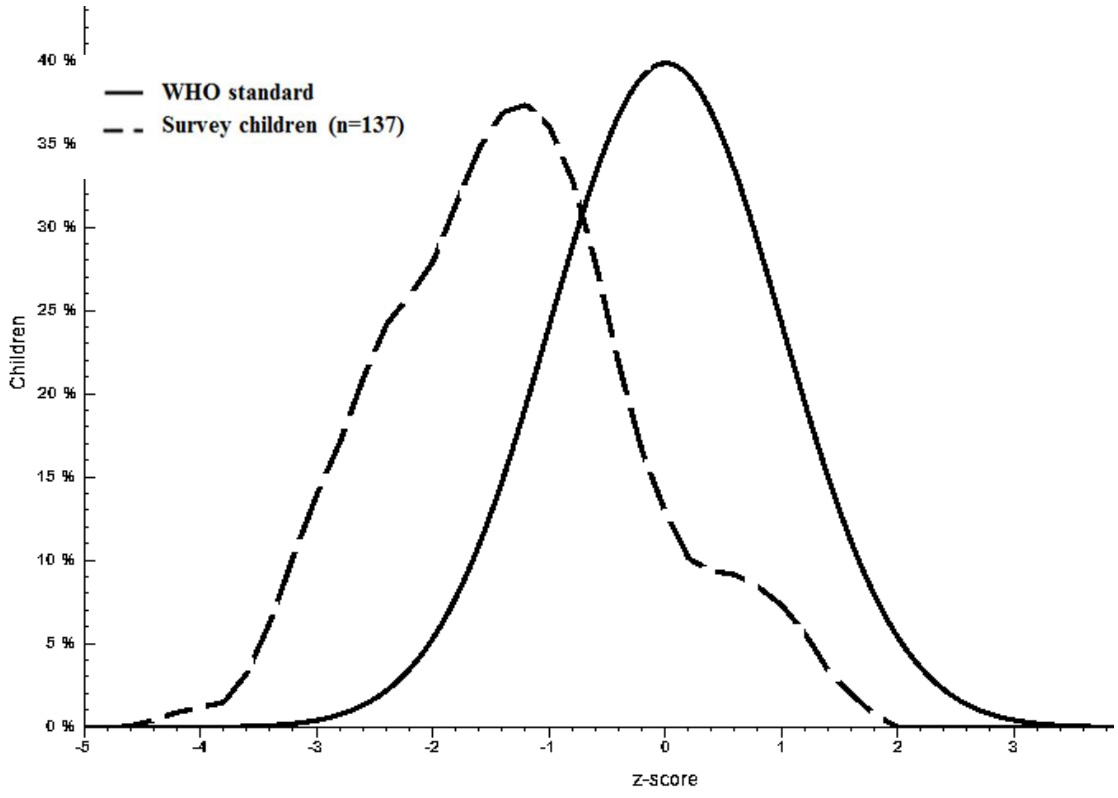

Fig 4.24 Distribution of height-for-age z-score curve of public school children comparing with WHO standards 2007

The median value of children is shifted to the left indicating that most of the children in the population were stunted as shown in Figure 4.24. The curve shows that there was

higher prevalence of moderate stunting (>-3 to <-2 z-score) and some children were also affected by severe stunting (<-3 z-score). The median value of HAZ in public school children was -1.39. The median value obtained was less than that of private school children which indicates that there is higher prevalence of stunting in public schools.

4.6.7 BMI for age (private school children)

The BMI-age z-score distribution curve obtained from the private school children in Babiya VDC is different than that of WHO standard curve. Figure 4.25 represents that the children are malnourished as per BMI for age as curve obtained in the study does not match with the reference curve as provided by WHO.

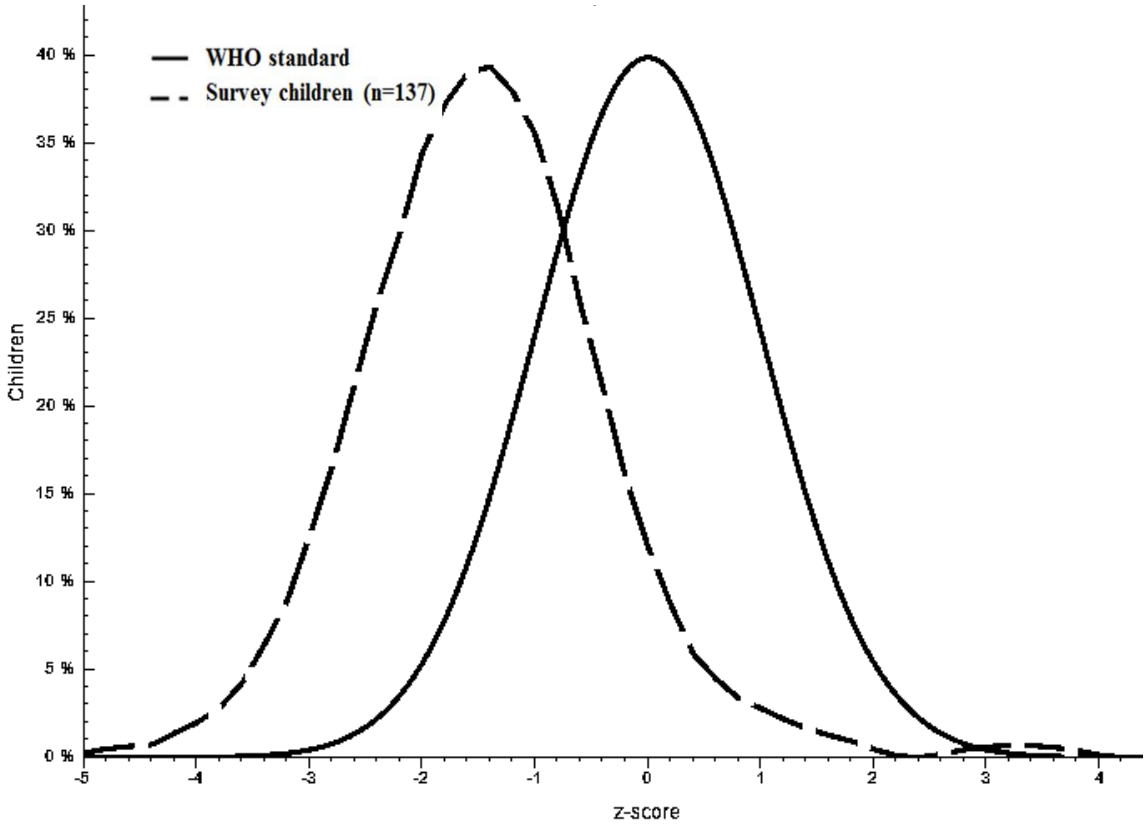

Fig 4.25 Distribution of BMI-for-age z-score curve of private school children comparing with WHO standards 2007

The median value of children is shifted to the left indicating that most of the children in the population were affected as shown in Figure 4.25. The curve shows that more number of children were affected by moderate thinness (>-3 to <-2 z-score) and there was prevalence of severe thinness (<-3 z-score) as well. The median value of BMI-age z-score in public school children was -1.46.

4.6.8 BMI for age (public school children)

The BMI-age z-score distribution curve obtained from the public school children in Babiya VDC is different than that of WHO standard curve. Figure 4.26 represents that the children are malnourished as per BMI for age as curve obtained in the study does not match with the reference curve as provided by WHO.

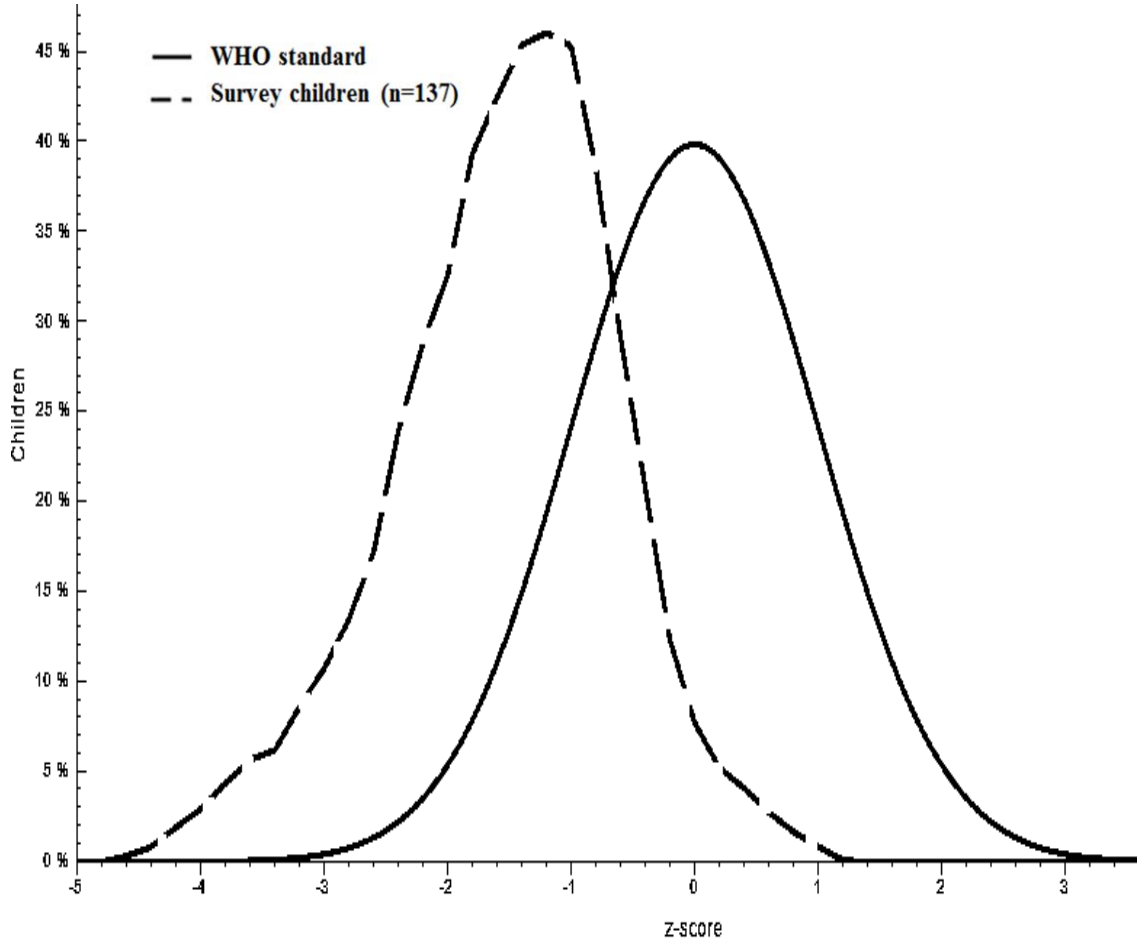

Fig 4.26 Distribution of BMI-for-age z-score curve of public school children comparing with WHO standards 2007

The median value of children is shifted to the left indicating that most of the children in the population were affected as shown in Figure 4.26. The curve shows that there was still prevalence of moderate thinness (>-3 to <-2 z-score) and severe thinness (<-3 z-score). The median value of BMI-age z-score in public school children was -1.28. The median value obtained was more than that of private school children which indicates that there is higher prevalence of thinness in private schools.

4.7 Factors associated with under nutrition of children

Under nutrition was assessed by stunting and thinness and Chi - square test was used to identify the characteristics that were related to nutritional status of children.

4.7.1 Factors associated with stunting in private school children

The chi-square test revealed that gender (p=0.013), adequacy of protein (p=0.000), adequacy of calorie (p=0.047) and age of mother (p=0.007) of private school children were significantly associated with stunting. Table 4.6 shows chi-square test analysis results of factors associated with stunting.

Table 4.6 Results of chi-square test for the association of factors with stunting of private school children

Predictors		**HAZ status**		**Chi-square**	**P-value**
		Stunted	**Normal**		
Gender	Female	9 (20.9%)	34 (79.1%)	6.228	0.013*
	Male	5 (5.3%)	89 (94.7%)		
Birth weight	Low BW	3 (11.5%)	23 (88.5%)	5.918	0.152
	Normal BW	8 (7.8%)	94 (92.2%)		
	Unknown	3 (33.3%)	6 (66.7%)		
Caste	*Madhesi*	10 (11.9%)	74 (88.1%)	4.813	0.657
	Dalits	3 (8.8%)	31 (91.2%)		
	Muslim	1 (5.3%)	18 (94.7%)		
Protein intake	Adequate	2 (2.1%)	94 (97.9%)	20.274	0.000*
	Inadequate	12 (29.3%)	29 (70.7%)		
Calorie intake	Adequate	0 (nil.)	35 (100.0%)	3.959	0.047*
	Inadequate	14 (13.7%)	88 (86.3%)		
Age of mother	20-30 years	11 (18.0%)	50 (82.0%)	7.318	0.007*
	>30 years	3 (3.9%)	73 (96.1%)		
Knowledge about malnutrition	Yes	8 (8.4%)	99 (91.6%)	2.148	0.143
	No	6 (20.0%)	24 (80.0%)		

* Statistically significant (p<0.05)

Statistically significant association was found between gender of private school children and stunting in present study (p=0.013). This study shows that there is greater risk of stunting in female children than in male children in private schools. The study informed that 20.9% of female children and 5.3% male children from private schools were stunted. This can be explained in that, there is still existence of gender discrimination in the society and the male child gets more concern in terms of food distribution and care. In a study conducted in Nairobi, Kenya, there were more boys than girls who were stunted (Mwaniki and Makokha, 2013). The prevalence of stunting was higher among girls (50.3%) than their male counterparts (43.1%) according to a research performed among rural adolescents of Darjeeling (Mondal and Sen, 2010). These findings are similar to the results of current study.

Additionally, there was strong association observed between the adequacy of protein intake and stunting in private school children in the study (p=0.000). This study suggested that adequate intake of protein is the preventive factor for stunting in children. The study showed that 2.1% of children whose protein intake was adequate and 29.3% children whose protein intake was inadequate were stunted in private schools of Babiya VDC. Protein is vital for growth and development in children and its insufficiency leads to kwashiorkor. Stunting or linear growth retardation is a form of chronic protein energy malnutrition. The short stature is principally attributable to chronic deficiency of protein and energy (Neumann, 2013). Essential amino acids are the building blocks of proteins that are crucial for human health. Deficiency of essential amino acids in the diet is related to stunted growth. Blood samples revealed that more than 80% of the children with stunted growth had 15-20% lower levels of all nine essential amino acids, compared with those who were growing normally (Brazier, 2016).

Furthermore, there was statistically significant association between the adequacy of calorie intake and stunting in private school children in the study (p=0.047). This study suggested that there is greater risk of stunting in children when they do not consume enough calories. The study showed that none of children whose calorie intake was adequate were stunted and 13.7% children whose calorie intake was inadequate were stunted in private schools of Babiya VDC. Many school-age children grow slower than they ought to due to lack nutrients and calories. Under nutrition occurs when people do not eat or absorb enough nutrients to fulfill their needs for energy and growth, or to keep up a

healthy immune system (Burgess and Danga, 2008). Risk of stunting was found to be 3.3 times lower among children who had adequate energy intake compared to the children who took inadequate energy in a study conducted in Kenya. Alike present study, adequate intake of calories was a preventive factor for stunting (Mwaniki and Makokha, 2013).

Also, statistically significant association was found between the age of mother and stunting in private school children in the study (p=0.007). This can be described in that, most of the mothers of private school children got first pregnancy before the age of 20 years (61.3%). Adolescence pregnancy is one of the risk factor to stunting in children (WHO, 2014b). In low- and middle-income countries, babies born to mothers under 20 years of age face a 50% higher risk of being still born or dying in the first few weeks. Newborns born to adolescent mothers are also more likely to have low birth weight, with the risk of long-term effects like stunting (WHO, 2014a).

Younger mothers might breastfeed for a smaller duration than older mothers and be behaviorally immature and thus less able to attend to their infant's needs. They tend to have lower socioeconomic condition and less schooling than older mothers. If still growing, their nutritional requirements compete with those of the fetus (Sinha *et al.*, 2015). In a study conducted in school-aged children in Iran, children born to adolescent mothers were likely to be stunted (p=0.002) (Esfarjani *et al.*, 2013) which justifies the result of this study.

4.7.2 Factors associated with stunting in public school children

The chi-square test showed that the birth weight of children (p=0.013) and malnutrition knowledge of mother (p=0.014) of public school children were significantly associated with stunting. Table 4.7 shows chi-square test analysis results about the factors associated with stunting.

Table 4.7 Results of chi-square test for the association of factors with stunting of public school children

Predictors		**HAZ Status**		**Chi-square**	**P-value**
		Stunted	**Normal**		
Gender	Female	23 (29.1%)	56 (70.9%)	1.175	0.278
	Male	14 (24.1%)	40 (75.9%)		
Birth weight	Low BW	17 (43.6%)	22 (56.4%)	8.704	0.013*
	Normal BW	10 (26.3%)	28 (73.7%)		
	Unknown	10 (16.7%)	50 (83.3%)		
Caste	*Madhesi*	11 (33.3%)	22 (66.7%)	1.261	0.532
	Dalits	20 (26.7%)	55 (73.3%)		
	Muslim	6 (20.7%)	23 (79.3%)		
Protein intake	Adequate	18 (21.7%)	65 (78.3%)	2.291	0.130
	Inadequate	19 (35.2%)	35 (64.8%)		
Calorie intake	Adequate	2 (16.7%)	10 (83.3%)	1.289	0.256
	Inadequate	35 (28.0%)	90 (72.0%)		
Age of mother	20-30 years	12 (26.1%)	34 (73.9%)	1.300	0.863
	>30 years	25 (27.5%)	66 (72.5%)		
Knowledge about malnutrition	Yes	5 (12.5%)	35 (87.5%)	6.031	0.014*
	No	32 (33.0%)	65 (67.0%)		

* Statistically significant (p<0.05)

Statistically significant association was found between birth weight of public school children and stunting in present study (p=0.013). This study indicates that there is greater risk of stunting in low birth weight children. The study informed that 43.6% of low birth weight children and 26.3% children with normal birth weight from public schools were stunted. Poor nutrition is an acknowledged cause of low birth, particularly in developing

countries. Children with low birth weight have significantly amplified risk of becoming malnourished (Ramakrishnan, 2004). The results of a study conducted in school-aged children of Tehran, Iran are comparable to the present study. Children with low birth weight were less likely to be stunted compared with those with normal birth weight. Mean birth weight was lower in stunted children than their non-stunted counterparts (Esfarjani *et al.*, 2013). In a research conducted in the slums of Nairobi, 62 % of children who had low birth weight (less than 2.5kg) were stunted compared to 36 % of the children who were born with optimal weight (above 2.5kg) (Murage *et al.*, 2012). The results are similar to the present study.

There was statistically significant association between knowledge about malnutrition of mothers of private school children and stunting ($p=0.014$) as well. The study indicated that there is greater risk of stunting in when mothers do not have knowledge about malnutrition. The study showed that 33% of children whose mother did not know about malnutrition were stunted and only 12.5% of children whose mother had knowledge about malnutrition were stunted. This can be clarified in that, the mothers who had knowledge about malnutrition and its causes provided better care to their children to prevent them from malnutrition. In a study conducted by Saaka, fewer number of children born to mothers of higher childcare and nutritional knowledge were found to be stunted compared to children born to women with less knowledge ($p=0.03$) (Saaka, 2014). In a study conducted in Southern Jakarta, the better knowledge of the mother about malnutrition was found to give tendency to less stunted children ($p<0.05$) (Siagian and Halisitijayani, 2014). The findings of these studies support the result of the present study.

4.7.3 Factors associated with thinness in private school children

Knowledge about malnutrition of mothers of private school children was found to be significantly associated with thinness (p=0.012). Table 4.8 shows chi-square test for the association of factors related with thinness of private school children.

Table 4.8 Results of chi-square test for the association of factors with thinness of private school children

Predictors		**BAZ Status**		**Chi-square**	**P-value**
		Thinned	**Normal**		
Gender	Female	10 (23.3%)	33 (76.7%)	0.628	0.428
	Male	29 (30.9%)	65 (69.1%)		
Birth weight	Low BW	10 (38.5%)	16 (61.5%)	2.163	0.339
	Normal BW	26 (25.5%)	76 (74.5%)		
	Unknown	3 (33.3%)	6 (66.7%)		
Caste	*Madhesi*	20 (23.8%)	64 (76.2%)	3.416	0.181
	Dalits	11 (32.4%)	23 (67.6%)		
	Muslim	8 (42.1%)	11 (57.9%)		
Protein intake	Adequate	26 (27.1%)	70 (72.9%)	0.068	0.794
	Inadequate	13 (31.7%)	28 (68.3%)		
Calorie intake	Adequate	6 (17.1%)	29 (82.9%)	2.632	0.105
	Inadequate	33 (32.4%)	69 (67.6%)		
Age of mother	20-30 years	4 (28.6%)	10 (71.4%)	1.370	0.993
	>30 years	35 (28.5%)	88 (71.5%)		
Knowledge about malnutrition	Yes	14 (14.6%)	82 (85.4%)	6.248	0.012*
	No	25 (60.9%)	16 (39.1%)		

* Statistically significant (p<0.05)

The prevalence of thinness in children whose mothers did not have knowledge about malnutrition was 60.9% and its prevalence was 14.6% in children whose mothers were aware about malnutrition (Table 4.8). This can be explained in that; the mothers who are aware about malnutrition are likely to provide adequate food and proper care to their children which can prevent thinness in children to some extent. Alike this study, significant association was established between child nutritional status and mother's knowledge about

causes of kwashiorkor in a study conducted in Ghana (Appoh and Krekling, 2005). According to a study conducted in Sri Lanka, nutritional awareness of mother showed negative relationship with thinness of children signifying that better the knowledge of mother about malnutrition, better is the nutritional status of children (Ekanayake *et al.*, 2005).

4.7.4 Factors associated with thinness in public school children

Caste of public school children (p=0.01) was found to be significantly associated with thinness. Table 4.9 shows, chi-square test analysis results of factors associated with thinness.

Table 4.9 Results of chi-square test for the association of factors with thinness of public school children

Predictors		**BAZ Status**		**Chi-square**	**P-value**
		Thinned	**Normal**		
Gender	Female	18 (22.8%)	61 (77.2%)	1.175	0.278
	Male	18 (31.0%)	40 (69.0%)		
Birth weight	Low BW	11 (28.2%)	28 (71.8%)	0.211	0.900
	Normal BW	8 (21.1%)	30 (78.9%)		
	Unknown	17 (28.3%)	43 (71.7%)		
Caste	*Madhesi*	6 (18.2%)	27 (81.8%)	9.307	0.010*
	Dalits	16 (21.3%)	59 (78.7%)		
	Muslim	14 (48.3%)	15 (51.7%)		
Protein intake	Adequate	18 (21.7%)	65 (78.3%)	2.291	0.130
	Inadequate	18 (33.3%)	36 (66.7%)		
Calorie intake	Adequate	1 (8.3%)	11 (91.7%)	1.289	0.256
	Inadequate	35 (28.0%)	90 (72.0%)		
Age of mother	20-30 years	10 (21.7%)	36 (78.3%)	1.370	0.993
	>30 years	26 (28.6%)	65 (71.4%)		
Knowledge about malnutrition	Yes	10 (21.7%)	36 (78.3%)	0.736	0.391
	No	26 (28.6%)	65 (71.4%)		

* Statistically significant (p<0.05)

The prevalence of thinness was 18.62% in *Madhesi* children, 21.3% in Dalit children and 48.3% in Muslim children according to caste (Table 4.9). The prevalence of thinness was higher among Muslim children. Muslims are one of the highly disadvantaged, marginalized and excluded minority groups with distinct religious and cultural identities in Nepal (Sherpa, 2012). In southern Nepal, fifty percent of children, mostly from minority groups (especially Muslims), suffer from malnutrition according to a study carried out by district development committees with cooperation with UNICEF in 15 southern districts of the country. Illiteracy, poverty, lack of opportunities for development and rising consumer prices are the main causes of malnutrition (Sharma, 2015). A study conducted in adolescents of 10-19 years from 13 districts of Nepal representing the three ecological (Mountain, Hill and the Terai) regions of Nepal suggested that the highest prevalence of under nutrition was observed among Muslim (81%) followed by Hindu (66%) (Mehta *et al.*, 2014). The results are comparable to the present study.

A study of early childhood health in India, Bangladesh and Nepal indicated that thinness for Muslim children in Nepal was statistically significant (Brainerd and Menon, 2015). The proportion of malnourishment was found higher among Muslims (26%) with p-value <0.0001 in a research conducted among 24,108 students aged between six and thirteen years in eastern India (Sarkar *et al.*, 2016). A study based on a survey of the height and weight of more than one lakh children across six states of India noted that the prevalence of malnutrition was significantly higher among children from Muslim households (Dhar, 2016). The finding of the study undertaken among the rural school going children of ages 4 to 14 years in 49 villages of Karnataka suggested that nutrition-related disorders were higher among Muslim communities (75%) with $p<0.05$ (Prabhakar *et al.*, 2006).

Part V

Conclusions and recommendations

5.1 Conclusions

This study has assessed the nutritional status of school children in Babiya VDC which was not explored before and findings are important to understand prevalence and determinants of under-nutrition among 6-12 years children in Babiya VDC. Following points can be concluded from the study.

a) The prevalence of stunting was 10.2% in private schools and 27% in public schools. The prevalence of thinness was 28.4% in private schools and 26.3% in public school children.

b) In private school children, the prevalence of both stunting and thinness was more among age group 10-12 years. In public schools, the prevalence of stunting and thinness was more among the age group 6-9 years.

c) In private schools, more females were stunted than males and more males were thinned than females. The prevalence of stunting was more in females and thinness was similar in both genders in public schools.

d) Gender ($p=0.013$), adequacy of protein ($p=0.000$), adequacy of calorie ($p=0.037$) and age of mother ($p=0.007$) of private school children were significantly associated with stunting whereas in public school children, birth weight ($p=0.013$) of children and knowledge of mother about malnutrition ($p=0.014$) were significantly associated with stunting.

e) Knowledge about malnutrition of mothers of private school children ($p=0.012$) was found to be significantly associated with thinness while, caste of public school children ($p=0.01$) was found to be significantly associated with thinness.

5.2 Recommendations

Based on the results of this study following recommendations could be made in order to reduce the burden of malnutrition in primary level school children in the survey area.

a) Community based nutrition program should be established to tackle the problem of malnutrition at community level depending on the severity of malnutrition identified in this study.

b) Similar longitudinal survey can be conducted to determine the magnitude and distribution of malnutrition and other probable causes of malnutrition.

c) 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 nutritional status.

d) Moreover, to validate the data obtained from anthropometry and household survey, biochemical tests and clinical examination can be performed.

e) Further study can be done to see other unexplained factors that were not included in the present study.

Part VI

Summary

The nutritional status of children affects their physical and mental development. A descriptive cross-sectional study was conducted for comparative study on nutritional status of school children in private and public schools of Babiya VDC, Sunsari as well as to identify the related factors. A structured questionnaire was administered to the mother or care taker of children to determine the associated factors while anthropometric measurement was used to determine the prevalence of malnutrition among survey children based on WHO reference. The nutrient intake was calculated using food composition table. Data collected were analyzed using WHO Anthro Plus version 1.0.4 and SPSS version 20. Chi-square test was used to analyze the factors associated with nutritional status.

In Babiya VDC, 10.2% children were stunted and 28.4% children were thinned in private schools. Similarly, 27% children were stunted and 26.3% children were thinned in public schools. Comparing the nutritional status between genders, more females in public schools (16.8%) are stunted than in private schools i.e. (6.6%). Similarly more males in public schools (10.2%) are stunted than in private schools (3.6%). More females in private schools (21.1%) are thinned than in public schools (13.1%) whereas more males in public schools (13.1%) are stunted than in private schools (7.3%). In private school children, the prevalence of both stunting and thinness was more among the age group 10-12 years. The prevalence of stunting is more among the age group 6-9 years (19.0%) than the age group 10-12 years (8.0%) in public schools. Similarly, the prevalence of thinness is more among the age group 6-9 years (17.5%) than the age group 10-12 years (8.8%).

The chi-square test revealed that gender (p=0.013), adequacy of protein (p=0.000) adequacy of calorie (p=0.037) and age of mother (p= 0.007) of private school children and birth weight of children (p = 0.013) and knowledge of mother about malnutrition (p=0.014) in public school children were significantly associated with stunting. Likewise, knowledge about malnutrition of mothers of private school children (p=0.012) whereas caste of public school children (p=0.01) were found to be significantly associated with thinness. Thus, to reduce the existing prevalence of malnutrition in Babiya VDC, special attention should be given to vulnerable groups such as poorest and the most severely malnourished children and appropriate interventions should be implemented.

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Appendices

Appendix - A

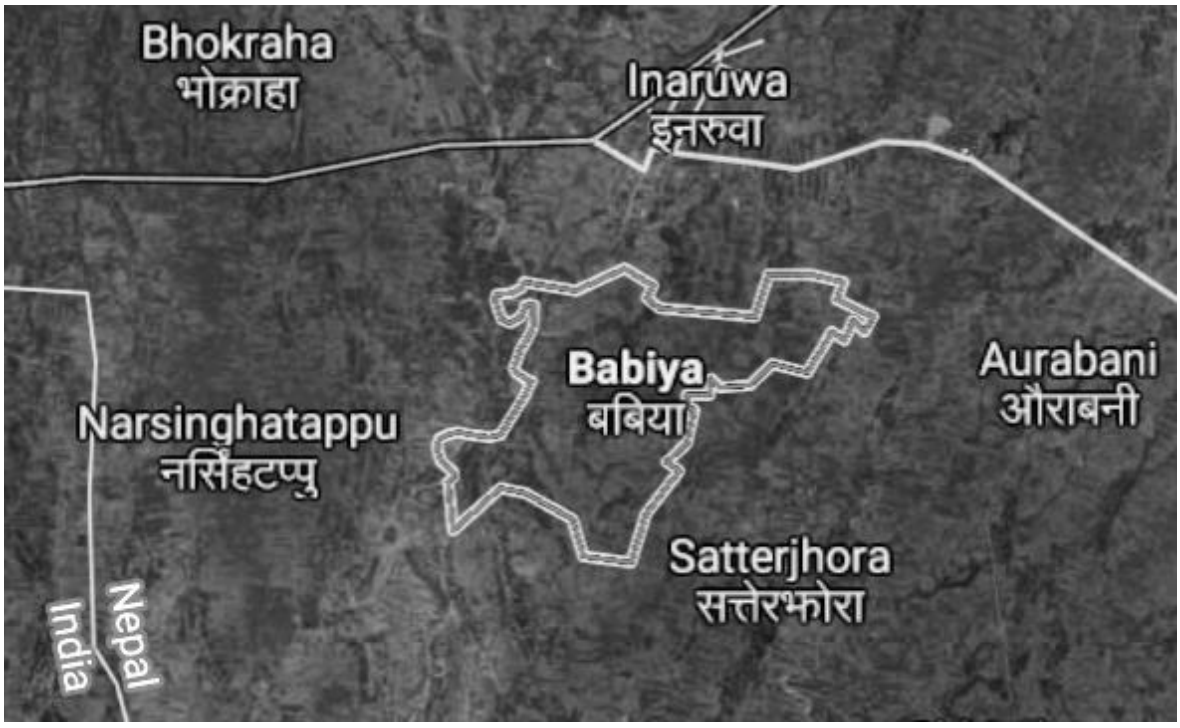
Basic statistics of Babiya VDC

Statistics	Count
Total population	8,524
No. of households	1,545
Male population	4,220
Female population	4,304
No of wards	9
No. of private boarding schools	3
No. of public/government schools	8
Literacy rate	60.84%

Source: (CBS, 2011)

Appendix - B

Map of Survey Site (Babiya VDC)



Appendix - C

Cross-tabulation of thinness and stunting with the factors associated with nutritional status of school children

Factors	Private school				Public school			
	BFA<-3SD	BFA<-2SD	HFA<-3SD	HFA<-2SD	BFA<-3SD	BFA<-2SD	HFA<-3SD	HFA<-2SD
Ethnic groups								
Madhesi	4 (4.8%)	16 (19.0%)	2 (2.4%)	8 (9.5%)	2 (6.1%)	4 (12.1%)	1 (3.0%)	10 (30.3%)
Dalit	1 (2.9%)	10 (29.4%)	0 (nil)	3 (8.8%)	4 (5.3%)	12 (16.0%)	3 (4%)	17 (22.7%)
Muslim	2 (10.5%)	6 (31.6%)	1 (5.3%)	0 (nil)	3 (10.3%)	11 (37.9%)	0 (nil)	6 (20.7%)
Main occupation of family								
Farming	1 (2.6%)	7 (18.4%)	1 (2.6%)	1 (2.6%)	0 (nil)	4 (26.7%)	0 (nil)	4 (26.7%)
Business	1 (5.6%)	4 (22.2%)	0 (nil)	2 (11.1%)	0 (nil)	2 (25.0%)	0 (nil)	1 (12.5%)
Remittance	2 (6.5%)	8 (25.8%)	1 (3.2%)	4 (12.9%)	2 (4.1%)	12 (24.5%)	2 (4.1%)	12 (24.5%)
Service	1 (5.9%)	2 (11.8%)	0 (nil)	1 (5.9%)	2 (11.8%)	4 (23.5%)	0 (nil)	5 (29.4%)
Labor	2 (6.1%)	11 (33.3%)	1 (3.0%)	3 (9.1%)	5 (10.4%)	5 (10.4%)	2 (4.2%)	11 (22.9%)
Annual income of family								
<1 lakh	3 (14.3%)	4 (19.0%)	1 (4.8%)	3 (14.3%)	4 (5.1%)	7 (21.2%)	1 (3.0%)	13 (39.4%)
1 lakh-3 lakhs	4 (4.0%)	26 (26.3%)	2 (2.0%)	8 (8.1%)	5 (5.6%)	13 (14.4%)	3 (3.3%)	16 (17.8%)
>3 lakhs	0 (nil)	2 (11.6%)	0 (nil)	0 (nil)	0 (nil)	7 (50.0%)	0 (nil)	4 (28.6%)
Father's education								
Literate	7 (6.1%)	24 (21.1%)	3 (2.6%)	8 (7.0%)	4 (5.1%)	14 (17.7%)	4 (5.1%)	17 (25.5%)
Illiterate	0 (nil)	8 (34.8%)	0 (nil)	3 (13.3%)	5 (8.6%)	13 (22.4%)	0 (nil)	16 (27.6%)

Factors	Private school				Public school			
	BFA<-3SD	BFA<-2SD	HFA<-3SD	HFA<-2SD	BFA<-3SD	BFA<-2SD	HFA<-3SD	HFA<-2SD
Mother's education								
Literate	5 (6.2%)	20 (24.7%)	2 (2.5%)	4 (4.9%)	3 (5.7%)	9 (17.0%)	2 (3.8%)	9 (17.0%)
Illiterate	2 (3.6%)	12 (21.4)	1 (1.8%)	7 (12.5%)	6 (7.1%)	18 (21.4%)	2 (2.4%)	24 (28.6%)
Type of family								
Nuclear	3 (4.8%)	15 (24.2%)	1 (1.6%)	8 (12.9%)	6 (6.7%)	17 (19.1%)	1 (1.1%)	19 (21.3%)
Joint	4 (5.3%)	17 (22.7%)	2 (2.7%)	3 (4.0%)	3 (6.2%)	10 (20.8%)	3 (6.2%)	14 (29.2%)
Family size								
<5 members	1 (3.2%)	8 (25.8%)	0 (nil)	6 (19.4%)	0 (nil)	3 (14.3%)	0 (nil)	4 (19.0%)
≥5 members	6 (5.7%)	24 (22.6%)	3 (2.8%)	5 (4.7%)	9 (7.8%)	24 (20.7%)	4 (3.4%)	29 (25.0%)
Gender								
Female	5 (5.3%)	24 (25.5%)	2 (2.1%)	3 (3.2%)	4 (5.1%)	14 (17.7%)	2 (2.5%)	21 (26.6%)
Male	2 (4.7%)	8 (18.6%)	1 (2.3%)	8 (18.6%)	5 (8.6%)	13 (22.4%)	2 (3.4%)	12 (20.7%)
Birth Weight								
Low	3 (11.5%)	7 (26.9%)	1 (3.8%)	2 (7.7%)	4 (10.3%)	7 (17.9%)	1 (2.6%)	16 (41.0%)
Normal	2 (2.0%)	24 (23.5%)	1 (1.0%)	7 (6.9%)	3 (7.9%)	5 (13.2%)	3 (7.9%)	7 (18.4%)
Unknown	2 (22.2%)	1 (11.1%)	1 (11.1%)	2 (22.2%)	2 (3.3%)	15 (25.0%)	0 (nil)	10 (16.7%)
Birth order								
1st	3 (5.2%)	15 (25.9%)	1 (1.7%)	8 (13.8%)	1 (2.0%)	8 (16.3%)	0 (nil)	14 (28.6%)
2nd	3 (7.5%)	13 (32.5%)	1 (2.5%)	1 (2.5%)	5 (11.1%)	8 (17.8%)	3 (6.7%)	8 (17.8%)
3rd	0 (nil)	1 (4.2%)	0 (nil)	1 (4.2%)	1 (5.3%)	4 (21.1%)	0 (nil)	6 (31.6%)
4th and more	1 (6.7%)	3 (20.0%)	1 (6.7%)	0 (nil)	2 (8.3%)	7 (29.2%)	1 (4.2%)	5 (20.8%)

Factors	Private school				Public school			
	BFA<-3SD	BFA<-2SD	HFA<-3SD	HFA<-2SD	BFA<-3SD	BFA<-2SD	HFA<-3SD	HFA<-2SD
Age group								
6-9 years	1 (1.5%)	13 (19.4%)	0 (nil)	5 (7.5%)	5 (5.2%)	19 (19.8%)	3 (3.1%)	23 (24.0%)
10-12 years	6 (8.6%)	19 (27.1%)	3 (4.3%)	6 (8.6%)	4 (9.8%)	8 (19.5%)	1 (2.4%)	10 (24.4%)
Age group of mothers								
<30 years	5 (8.2%)	14 (23.0%)	2 (3.3%)	9 (14.8%)	4 (8.7%)	6 (13.0%)	2 (4.3%)	10 (21.7%)
>30 years	2 (2.6%)	18 (23.7%)	1 (1.3%)	2 (2.6%)	5 (5.5%)	21 (23.1%)	2 (2.2%)	23 (25.3%)
Age of mother at marriage								
<15 years	1 (7.1%)	3 (21.4%)	0 (nil)	1 (7.1%)	2 (11.1%)	2 (11.1%)	0 (nil)	3 (16.7%)
15-20 years	5 (6.6%)	17 (22.4%)	3 (3.9%)	7 (9.2%)	6 (7.8%)	16 (20.8%)	3 (3.9%)	18 (23.4%)
>20 years	1 (2.1%)	12 (25.5%)	0 (nil)	3 (6.4%)	1 (2.1%)	12 (25.5%)	0 (nil)	13 (27.7%)
Age of mother at pregnancy								
<15 years	1 (9.1%)	2 (18.2%)	0 (nil)	1 (9.1%)	2 (10.5%)	2 (10.5%)	1 (5.3%)	3 (15.8%)
15-20 years	5 (6.8%)	17 (23.3%)	3 (4.1%)	5 (6.8%)	6 (8.3%)	13 (18.1%)	4 (5.6%)	17 (23.6%)
>20 years	1 (1.9%)	13 (24.5%)	0 (nil)	5 (9.4%)	1 (2.4%)	9 (22.0%)	0 (nil)	12 (29.3%)
Mother's occupation								
Housewife	4 (4.1%)	22 (22.7%)	3 (3.1%)	9 (9.3%)	5 (5.6%)	19 (21.1%)	4 (4.4%)	21 (23.3%)
Farming	2 (6.5%)	7 (22.6%)	0 (nil)	1 (3.2%)	2 (10.0%)	3 (15.0%)	0 (nil)	5 (25.0%)
Business	1 (33.3%)	1 (33.3%)	0 (nil)	1 (33.3%)	0 (nil)	0 (nil)	0 (nil)	1 (25.0%)
Service	0 (nil)	1 (25.0%)	0 (nil)	0 (nil)	1 (16.7%)	3 (50.0%)	0 (nil)	3 (50.0%)
Labor	0 (nil)	1 (50.0%)	0 (nil)	0 (nil)	1 (6.2%)	2 (12.5%)	0 (nil)	2 (12.5%)
Knowledge about malnutrition								
Yes	4 (3.7%)	21 (19.6%)	1 (1.9%)	6 (5.6%)	2 (5.0%)	9 (22.2%)	0 (nil)	5 (12.5%)
No	3 (10.0%)	11 (36.7%)	1 (3.3%)	5 (16.7%)	7 (7.2%)	18 (18.6%)	4 (4.1%)	28 (28.9%)

Appendix - D

Survey Questionnaire

Central Campus of Technology

Dharan-14, Hattisar

Nutrition Survey Questionnaire

A. General Information

Code No. Ward No. ☐	School's name:
Type of school:	Class:
Name of student:	Gender:
Birth date:	Age:
Mother's name:	Age:
Respondent: Father _____ Mother _____ Others: _____	

1. Caste: a) Brahmin b) Chettri c) *Janajati* d) *Dalit* c) *Madhesi* d) Others

2. Religion a) Hindu b) Muslim c) Christian d) Others _____

B. Details about children

Anthropometric measurement of children

Weight:	
Height:	

3. Birth weight of child a) <2.5 kg b) 2.5 kg c) >2.5 kg

C. Family Details

4. Who is the head of household? a) Male b) Female

5. Total family members: _____ _____ Male _____ Female

6. Type of family: Nuclear/ Joint

7. Father's occupation a) Farming b) Business c) Foreign employment d) Service
e) Laborer f) Others

8. Mother's occupation a) Housewife b) Farming c) Business d) Foreign employment
e) Service f) Laborer g) Others

9. Father's educational level: a) primary level b) secondary level c) SLC and above
d) Not educated

10. Mother's educational level: a) primary level b) secondary level c) SLC and above
d) Not educated

11. Number of siblings: _____

12. Birth order: _____

13. Family's monthly income: _____

14. House, currently you living is… a) Own b) Rented

D. Details about mother and her knowledge about nutrition:

15. Mother's age when she got married?
a) Less than 15 years b) 15-19 years c) 20-35 years d) more than 35 years

16. Mother's age at first pregnancy?
a) Less than 15 years b) 15-19 years c) 20-35 years d) more than 35 years

17. Did you give "Vit. A" capsule and "De-worming" tablet to your baby? a) Yes b) No

18. Do you feed animal's milk to your baby? a) Yes b) No

19. In a week, how often do you feed fruits to your baby?
a) Daily b) Sometimes c) Never

20. In a week, how often do you feed green vegetables to your baby?

a) Daily b) Sometimes c) Never

21. In a week, how often do you meat and fish to your baby?

a) Daily b) Sometimes c) Never

22. Do you know about malnutrition? a) Yes b) No

23. If yes, what is the main cause of malnutrition?

a) Lack of food b) Unhygienic practices c) Superstition d) Reason not known

E. Others

24. What is your source of drinking water?

a) Tube well b) River c) Well d)Drinking water tap e)Other

25. Do you purify drinking water? a) Yes b) No

26. Do you have toilet facility in your house? a) Yes b) No

27. Do you use iodized salt? a) Yes b) No

28. Do you have fruit tree in your house? a) Yes b) No

29. Do you have kitchen garden in your house? a) Yes b) No

30. Do you have domestic animals in your house? a) Yes b) No

F. 24 Hour Dietary Recall

Please tell all the food items and quantity of food or drink your child has eaten in previous one full day (24 hours)

Timing	Description of food and drink	Brand name	Serving	Amount
Breakfast (6:00 to 9:00 AM)				
Lunch (9:00 -11:00 AM)				
Snacks (11:00 AM - 5:00 PM)				
Dinner (6:00-11:00)				

Appendix - E

Informed Consent

Date: _____

Namaste!

I, Sukriti Koirala, student of Dietetics, am conducting a dissertation work for the bachelor's degree in Nutrition and Dietetics on the topic "comparative study on nutritional status of primary level school children in private and public schools of Babiya VDC, Sunsari"

I have been told in a language that I understand about the study. I have been told that this is for a dissertation procedure, that my and my son/daughter's participation is voluntary and he/she reserve the full right to withdraw from the study at my own initiative at any time without having to give reason and that refresh to participate or withdraw from the study at any stage will not prejudice my/his/her rights and welfare. Confidentiality will be maintained and only be shared for academic purposes.

I hereby give consent to participate in the above study. I am also aware that I can withdraw this consent at any later date, if I wish to. This consent form being signed voluntarily indicates participate in the study until I decide otherwise. I understand that I will receive a signed and dated copy of this form.

I have signed this consent forms before my participation in the study.

Signature of parent/guardian: _____

Date: _____

I hereby state the study procedures were explained in the detail and all questions were fully and clearly answered to the above mentioned participant /his/her relative.

Investigator's sign: _____

Date: _____

Appendix - F

Permission from school principal

Date _____

To

The Principal,

_____

Subject: Application for permission to conduct research in your school

Respected Sir/Madam

With respect to the above subject, as a part of my academics, I'm interested in conducting a research work with the title- "comparative study on nutritional status of primary level school children in private and public schools of Babiya VDC, Sunsari"

As a part of research I want to collect general information and body measurements of your primary level school children aged between 5-10 years and interaction with their parents. Based on the data collected I will be able to find out the malnourished children and give them proper health education which will be helpful for their growth and improve their academic performances with better school results. I kindly request you to grant permission and support me for conducting the above said research.

Thanking you.

Yours faithfully

Sukriti Koirala

Bachelor in science (Nutrition and Dietetics)

Appendix - G

Photo gallery of data collection