COMPARATIVE NUTRITIONAL STUDY BETWEEN THE SCHOOL CHILDREN AGED 5-10 YEARS OF PRIVATE AND PUBLIC SCHOOLS OF GAURADAHA MUNICIPALITY, JHAPA

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Comparative Nutritional Study between the School Children Aged 5-10 Years of Private and Public Schools of Gauradaha Municipality, Jhapa.

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Approval Letter

This *dissertation* entitled *Comparative Nutritional Study between the School Children Aged 5-10 Years of Private and Public Schools of Gauradaha Municipality, Jhapa* presented by Prakash Raut has been accepted as the partial fulfillment of the requirement for the Bachelor degree in Nutrition and Dietetics.

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Contents

Abstract

This study was conducted with the aim for comparative nutritional status between primary level school children aged 5-10 years of private and public schools of Gauradaha Municipality, Jhapa. Simple random sampling method was used to determine the sample population. Out of 180 sample size, 90 were from private schools and 90 were from public schools. Anthropometric measurements of the children were taken by measuring their height and weight using standardized tools. To obtain information on socio-demographic characteristics, household characteristics, physical activities etc interview students was done by using structure pre-tested questionnaires. Data were analyzed by using SPSS version 20.0 and WHO Anthro Plus version 1.0.4. Chi-square test was used to find out the factors associated with stunting, underweight and thinness.

The overall prevalence stunting, thinness and underweight in the surveyed area was found to be 41.1%, 20% and 37.7% respectively. Out of which children from private school comprises 20% of stunting, 7.8% of thinness and 13.3% of underweight whereas children from public school comprise 21.1% of stunting, 12.2% of thinness and 24.4% of underweight. Highest percentage of stunting and underweight was found in the age group of 8-10 years i.e.14.4% and 16.7% respectively. Similarly, children who belong to 5-8 yr age group were found to be more thinned i.e. 6.7%. Male child from both private and public school were found to be more stunted, thinned and underweight than female child. Among public school children gender (P= 0.009) and the type of game usually played (P=0.023) was found to be significantly associated with underweight. Factors such as gender (P=0.018), type of house (P=0.020) and purification of water (P=0.030) were found to be significantly associated with thinness of public school children. From public schools, vegetarian children were found to significantly associated (P=0.049) with stunting. No any factors such as family type, father's occupation, birth order and food preferences were found to be significantly associated with stunting, thinness and underweight of children from private school.

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List of Abbreviations

Abbreviations	Full form
BMIZ	Body Mass Index for age Z-score
CBS	Central Bureau of Statistics
CI	Confidence Interval
FCHV's	Female Community Health Volunteers
GoN	Government of Nepal
HAZ	Height for age Z score
IDA	Iron Deficiency Anemia
IFPRI	International Food Policy Research Institute
MoH	Ministry of Health
MoPE	Ministry of Population and Environment
NDHS	Nepal Demographic and Health Survey
NLSS	Nepal Living Standard Survey
PEM	Protein Energy Malnutrition
RDA	Recommended Dietary Allowance
SD	Standard Deviation
UNDP	United Nations Development Programme
UNICEF	United Nations International Children Education Fund
VAD	Vitamin-A Deficiency
WAZ	Weight for age Z score

Part-I

Introduction

1.1 Background

Nutrition is the science that encompasses all aspects of food, how food nourishes our body and influences our health. It also involves studying the factors that influence our eating patterns, making recommendations about the amount we should eat of each type of food, attempting to maintain food safety, and addressing issues related to the global food supply (Thompson and Manore, 2012). Nutritional status refers to the condition of health of the individual as influenced by the utilization of the nutrients. It can be determined only by the correlation of information obtained through a careful medical and dietary history, through physical examination and appropriate laboratory investigation (Srilakshmi, 2014).

Nepal is one of the least developed nations ranking 144th position among 188 countries in the Human Development Index (UNDP, 2016). Nepal Living Standard Surveys (NLSS) showed that in 2010-2011, 25% of population was poor in Nepal, compared to 42% in 1995-96 and 31% in 2003-04 (GoN and MoPE, 2016).

Malnutrition results from the interaction of poor quality diet, lack of health and care environment and behaviors, which are shaped in a part by a host of underlying factors, such as political instability, poor economic development, inequality, etc. One in three people is malnourished in one form or another (IFPRI, 2015). Various forms of malnutrition affect a large group of population in the developing country like Nepal and remain a major public health concern. Malnutrition, household food insecurity and poverty are the prevalent problems existing in our country. The most common form of malnutrition is Protein-Energy Malnutrition (PEM) and the other forms of malnutrition are Iodine Deficiency Disorder (Hiddinnott and Yohannes), Iron Deficiency Anemia (IDA) and Vitamin A deficiency (VAD) (MoHP, 2010).

According to Nepal Demographic and Health Survey (2016), 36% of children under-5 years are chronically malnourished whereas 10% of children under-5 years are acutely malnourished. The composite form of malnutrition (both acute and chronic) affects 27% of under-five children. About 53% of children suffered from some degree of anemia out of which 26% are mildly anemic, 26% are moderately

anemic and 1% severely anemic. 86% of children aged 6-59 months received Vit-A supplements and 95% of children live in household that consume iodized salt (MoH *et al.*, 2016).

1.2 Statement of the problem

The school age period is nutritionally significant because this is the prime time to build up body stores of nutrients in preparation for rapid growth of adolescence (Kumari and Jain, 2005). Protein or calorie deficiency results in underweight, wasting and lowered resistance to infection in children whereas iron deficiency in school age children is associated with decreased immunity, stunted growth, poor cognitive development resulting in lower Intelligence Quotient (IQ) and behavioral abnormalities (Gowri and Sangunam, 2005).

School aged children suffering from under or over nutrition can inhibit a child's physical and mental development. Stunting (low height-for-age) is associated with long-term consequences, such as impaired intellectual achievement and school performance(Frongillo, 1999). It also leads to reduction in adult body size and, subsequently, reduced work capacity and obstetric complications. Thinness or low body mass index (BMI-for-age) can result in delayed maturation, deficiencies in muscular strength and work capacity, and reduced bone density later in life (WHO, 1995). The overweight or obesity also increased the risks of hypertension, metabolic syndrome, non-insulin-dependent (type II) diabetes, and psychological disorders (WHO, 2003). School going children have typically been considered a low risk group for poor health, and often receive few healthcare resources and scant attention. However, this approach ignores the fact that many health problems later in life can be improved or avoided by adopting healthy lifestyle habits in adolescence (Anon., 2003).

Childhood is the age range that needs more attention to nutritional needs. When compared with infants and toddlers, school-age children received less attention both from the parents and the environment, because the attention is focused on the nutritional needs of infants and toddlers. Therefore, school-age children need good nutrition because it can affect the health, fitness, and the motivation in learning itself at school. These school going children gain education either from

public/government schools or from private boarding schools. Basically high class people admit their children to some top ranked private schools whereas middle class people are likely to admit their children in either private boarding school or public schools too. Similarly, people of low income class mostly admit their children in public schools. Exceptionally in some cases it has been found that low income class people also admit their children in private boarding schools and the trend is in increasing order. However, in both categories of schools, the nutrition education seems to be far backward.

No any studies regarding nutritional status of primary level school aged children has been done in Gauradaha Municipality where 22 private and 26 public schools are situated. So the study focus on collecting the information related to the nutritional status of primary school children of Gauradaha.

1.3 Objectives

1.3.1 General Objective

The general objective was to study the nutritional status of school children aged 5-10 years of private and public schools of Gauradaha Municipality, Jhapa.

1.3.2 Specific objective

i. To figure out the prevalence and distribution of malnutrition of primary school children aged 5-10 years of Gauradaha Municipality.
ii. To assess the factors associated with nutritional status among of school going children aged 5-10 years of Gauradaha Municipality.
iii. To compare the nutritional status of children aged 5-10 years of private and public schools of that area.

1.4 Research questions

i. What is the existing nutritional status of children aged 5-10 years studying in private and public schools of Gauradaha Municipality?
ii. Is there any difference in the nutritional status of school going children aged 5-10 years studying in private and public schools of Gauradaha Municipality?

1.5 Significance of the study

The result of the survey will contribute to:

i. Figure out the distribution of the malnutrition among children studying in private and public schools.
ii. Address malnutrition and encourage responsible personalities for the improvement of nutritional status of school children by improving dietary pattern.
iii. Reflect sanitary condition, socio-economic variables, degree of malnutrition and condition of school children.
iv. Provide information to government as well as voluntary organization to take initial step to tackle the problem.
v. Encourage concerned authorities for the proper nutrition planning and implementation of nutrition program effectively.

1.6 Limitations of the study

The limitations of this study are:

1. This study being cross-sectional in nature, seasonal variation may exist.
2. The biochemical and clinical assessment methods were not included in this study.

1.7 Hypothesis

It is based on the hypothesis that there will be no any significant differences between the nutritional status of primary level schools children (5-10years) studying in private and public schools.

Part-II

Literature Review

2.1 Malnutrition

Malnutrition is defined as a diet containing insufficient quantities of nutrients or a diet in which one or more essential nutrients is missing or is present in the wrong proportions(De Souza *et al.*, 2011). It is a major health problem in developing countries affecting 20% of all in the developing world, causing 50% of all child deaths globally. The main nutritional problems faced by a school-age child include wasting, stunting, underweight, anemia, iodine deficiency and vitamin A deficiency (Khuwaja *et al.*, 2005). Undernutrition contributes to half of all deaths and 28% of stunting in children worldwide (Onis *et al.*, 2012). Malnourished children have lowered resistance to infection, early death from common childhood ailments, e.g., diarrheal diseases and respiratory infections. Those who survive, frequent illness saps their nutritional status, putting them into a vicious cycle of recurring sickness, faltering growth and diminished learning ability. More than 70% of children with protein-energy malnutrition live in Asia(Ergin *et al.*, 2007). In developing countries, an estimated 99 million children of primary-school age are not enrolled, and of those enrolled, only 78% complete primary school. Children from developing countries have much lower achievement levels than children in developed countries in the same grade(McGregor *et al.*, 2007).

The World Health Organization (WHO) states that nutritional deficiencies and poor health in primary school age children are among the causes of low school enrollment, high school absenteeism, early dropout from school and poor classroom performance (Saluja *et al.*, 2009). The adverse effects of stunting could affect the adulthood by limiting work capacity owing to reduced muscle mass (Haas *et al.*, 1996). The Maternal and Child Undernutrition Study Group (Victora *et al.*, 2008) reviewed cohort studies from five low‐income and middle‐income countries: Brazil, Guatemala, India, Philippines and South Africa which involved long‐term follow‐up of children into late adolescence and adulthood. The study group concluded that small size at birth and childhood stunting were linked with short adult stature, reduced lean body mass, less schooling, diminished intellectual

functioning, reduced earnings and lower birth weight of infants born to women who themselves had been stunted as children. Recent evidence also indicates that children born to women who are stunted are at greater risk of dying than children of mothers with normal height(Ozaltin *et al.*, 2010). Experimental studies have shown that prenatal or postnatal nutritional deficits may program adult size, metabolism, blood lipids, diabetes, obesity, blood pressure, glomerular hypertrophy, atherosclerosis, behavior, and learning (Cottrell and Ozanne, 2008).

2.2 Types of malnutrition

The World Food Program, a United Nations agency, has identified five main types of malnutrition as the deadliest forms: protein energy malnutrition, in which the body lacks sufficient quantities of all major macronutrients, and deficiencies in iron, vitamin A, iodine and zinc (WFP, 2011).

2.2.1 Kwashiorkor

Kwashiorkor usually refers to acute PEM and can develop within a few weeks. All systems and functions are affected in kwashiorkor. No single etiological agent is responsible. It is difficult to determine which factors are major contributors and which are responses. Oedema with weight loss has been accepted as the main criteria to identify kwashiorkor. Kwashiorkor is more prevalent in children who are stunted or wasted but it can occur in children of normal size (Jackson and Golden, 1991).

The main symptoms of Kwashiorkor are given bellow (Srilakshmi, 2016):

- Low body weight inspite of oedema, pitting oedema is appears in feet and legs.
- Puffy face
- Growth failure
- Muscle wasting with oedema
- Mental change like apathy and Irritability
- Scaly pigmentation

2.2.2 Marasmus

The term ‘marasmus’ is derived from the Greek word meaning ‘to waste’. It occurs due to the deficiency of protein. It is most predominant form of PEM in developing countries. Marasmus is commonly seen in babies whose mothers had inadequate breast milk and occurs mostly during the child‘s first year. It may also occur when there is too long a reliance on breast milk without complementary solid foods. Improper use of bottle-feeding is closely associated with marasmus, especially in urban areas (FAO, 1997).

The main symptoms of marasmus are given below (Srilakshmi, 2016):

- Severe wasting of muscle mass and growth retardation
- Shrunken eyeball
- Depressed cheeks
- Ribs becomes prominent
- Wrinkled skin
- Loss of subcutaneous fat

2.2.3 Marasmic kwashiorkor

The term marasmic kwashiorkor is used to describe the wasted form of PEM (as with marasmus, there is no subcutaneous fat), which has the characteristics of dermatoses and/or oedema that is seen with kwashiorkor. Pure conditions of marasmus and kwashiorkor are uncommon as there are many cases which are not purely one or the other, but present rather with signs of both. This can be due to changes in diets and seasons (Torún, 2006).

2.2.4 Vitamin A deficiency

Vitamin A deficiency is one of the most common vitamin deficiencies in children throughout the developing world. Sixty-nine percentages of children in Southeast Asia have vitamin A deficiency (Ramkrishna, 2002). Deficiency of vitamin A can lead to blindness i.e. Xerophthalmia (Ramkrishna, 2002), disease mobilization of iron from stores and impair the immune system. Vitamin A is integral to the mucosal lining of small intestine that protects the body from bacteria; thus vitamin A deficiency is associated with higher risk of diseases, such as measles and malaria (Bhaskaram, 2002).

A specific consequence of vitamin A deficiency is xerophthalmia, a severe eye disorder and a primary cause of childhood blindness, which is responsible for 350,000 cases of blinding in children worldwide every year (Whitcher *et al.*, 2001). The prevalence of severe corneal xerophthalmia usually peaks at 2 to 3 years of age, but the prevalence of mild xerophthalmia increases with age beyond 5 years, probably because vitamin A deficiency builds up over time due to a chronic shortage of the vitamin (West and Darnton-Hill, 2008). In addition to causing reduced immune competence and eye disease, vitamin A deficiency is likely to negatively influence iron status (Underwood and Arthur, 1996). Intervention studies showed that vitamin A supplementation or fortification can contribute to anemia control efforts by increasing hemoglobin levels in preschool and school-aged children (Mohanram *et al.*, 1977).

2.2.5 Iron deficiency anemia (IDA)

Anemia is characterized by a low level of hemoglobin in the blood. It is a major health problem, especially among young children and pregnant women. Anemia may lead to maternal mortality, spontaneous abortions, premature births, and low birth weight. The most common cause of anemia is inadequate dietary intake of nutrients necessary for synthesis of hemoglobin, such as iron, folic acid, and vitamin B12 (MoHP, 2012). Iron deficiency is one of the 10 leading risk factors contributing to the global burden of disease, mainly in Asia and Africa (WHO, 2002). IDA can lead to reduced muscle function and work capacity and less explorative behavior in school-aged children (Zimmermann *et al.*, 2000). It is also consistently associated with impaired cognitive function and lower school performance in school aged children (Sungthong *et al.*, 2002).

2.2.6 Iodine deficiency disorder

Iodine deficiency disorders (Hiddinnott and Yohannes) are the world's leading cause of preventable mental retardation and impaired psychomotor development in young children contributing to poor school performance, reduced intellectual ability, and impaired work performance. IDD also may cause cretinism. It increases the risks of still birth and miscarriage in pregnant women. Iodine deficiency is most commonly and visibly associated with goiter. In Nepal, universal iodization of all edible salt is the key intervention implemented to control IDD. Other strategies

include advocacy at national and district levels, mass media campaigns to promote the use of packet iodized salt and awareness rising among health workers and the general public. In MFWR of Nepal, it shows that very small proportion of households (0.2%) had no salt available and salt was found to be adequately iodized in half of interviewed households (50%), i.e. containing 15 ppm or more of iodine (NMISC, 2010). One-quarter of children ate iron-rich foods in the day before the survey, and only 3% were given iron supplements in the week before the survey (MoHP, 2012).

Iodine deficiency is evidently associated with deficits in cognitive function as well. There is evidence from two meta-analyses showing that the intelligence quotients of young and school-aged children from iodine-deficient regions were 12.5 and 13.5 points lower, respectively, than those of children from iodine sufficient regions (Qian *et al.*, 2005).

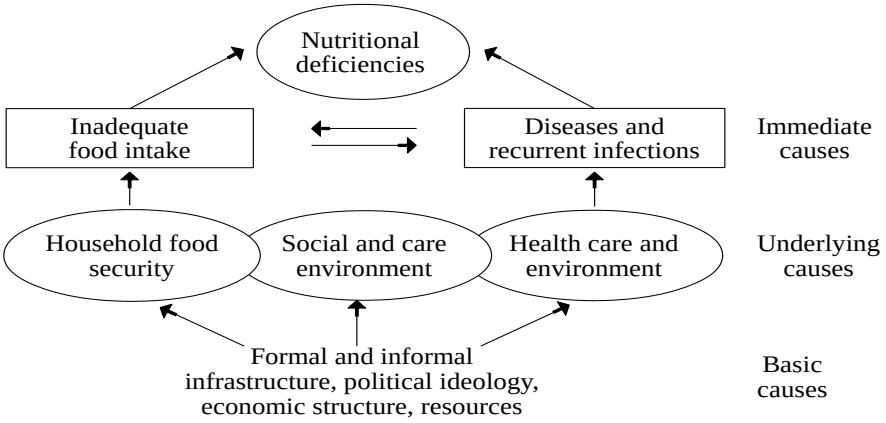
2.2.7 Zinc deficiency

Zinc helps cells to divide and grow and assists the body in healing wounds. It is also necessary for proper function of body immune system. Deficiency of zinc includes frequent infections, hair loss, poor appetite, problems in tasting and smelling and long healing times for wounds. Zinc is found in nuts, legumes, yeast, whole grains, beef, pork and lamb (WFP, 2011).

Zinc deficiency may negatively influence vitamin A absorption, transport, and utilization, especially in marginally nourished individuals, leading to secondary vitamin A deficiency (Christian and West 1998). This might suggest that zinc deficiency can limit the health effect of vitamin A supplementation alone in individuals with coexisting zinc and vitamin A deficiency. Supplementation of malnourished children with zinc, on the other hand, might improve not only zinc but also vitamin A status (Rahman *et al.*, 2002).

2.3 Causes of malnutrition

There are 3 different causes of malnutrition and is classified as immediate, underlying and basic as shown in Fig. 2.1



Source: (UNICEF, 1998)

Fig. 2.1 Conceptual framework of malnutrition

2.3.1 Immediate causes of malnutrition

The immediate causes of malnutrition are inadequate food intake and disease and create a vicious cycle in which diseases and malnutrition exacerbate each other. Malnutrition lowers the body's ability to fight against infection resulting into frequent episodes of illness. Thus, inadequate food intake and diseases must be both addressed to support recovery from malnutrition (UNICEF, 1998).

2.3.2 Underlying causes of malnutrition

The three major underlying causes of malnutrition include inadequate household food security, limited access to adequate health services and/or inadequate environmental health conditions and inadequate care in the households and at community level especially with regards to women and children (UNICEF, 1998).

2.3.3 Basic causes of malnutrition

The basic causes of malnutrition in a community originate at the regional and national level where strategies and policies that affect the allocation of resources (human and, economic, political and cultural) influence what happens at community level. Geographical isolation and lack of access to market due to poor infrastructure can have a huge negative impact on food security, access to

healthcare services as well as healthy environment. The above model characterizes the correlates of malnutrition as factors that impair access to food, maternal and child care, and health care. It is these very factors that impact the growth of children. Consequently, the assessment of children's growth is a suitable indicator for investigating the well-being of children, and for examining households' access to food, health and care (UNICEF, 1998).

2.4 Consequences of malnutrition

2.4.1 Physical and cognitive development

Cognitive development is influenced by many factors, including nutrition. There is an increasing body of literature that suggests a connection between improved nutrition and optimal brain function. Nutrients provide building blocks that play a critical role in cell proliferation, DNA synthesis, neurotransmitter and hormone metabolism, and are important constituents of enzyme systems in the brain(Bhatnagar and Taneja, 2001)(Lozoff and Georgieff, 2006)(Zeisel, 2009).Brain development is faster in the early years of life compared to the rest of the body (Benton, 2010a), which may make it more vulnerable to dietary deficiencies.

Significant brain formation and development takes place beginning from the time the child is in the womb. Early studies of malnourished children showed changes in the developing brain including a slower rate of growth of the brain, lower brain weight, thinner cerebral cortex, decreased number of neurons, insufficient myelinization and changes in the dendritic spines. More recently, neuro-imaging studies have found severe alterations in the dendritic spine apparatus of cortical neurons in infants with severe protein calorie malnutrition. These changes are similar to those described in patients with mental retardation of different causes (Bernitez-Bribiesca *et al.*, 1999).

2.4.2 School performance

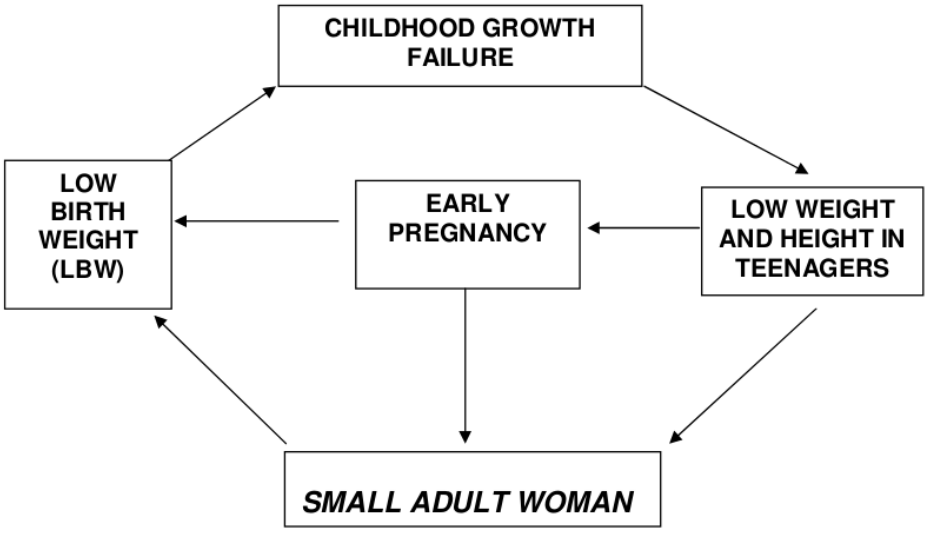
Ross and Mirowsky (1999) state "Schooling builds human capital - skills, abilities, and resources—which ultimately shapes health and well-being." Indeed, more education has been linked to better jobs, higher income, higher socio-economic status, better health care access and housing, better lifestyle, nutrition, and physical

activity (Florence *et al.*, 2008)which are all well-known health determinants. Recent studies have found that severe stunting in the first two years of life is strongly associated with lower test scores in school-age children (age 8-11).

2.4.3 Economic productivity

Improving nutrition in early childhood leads to substantial increases in wage rates which suggest that investments in early childhood nutrition can be long term drivers of economic growth. This is according to study done on effect of a nutrition intervention on economic productivity in Guatemalan adults which showed an increase of US dollars 0.67 per hour (46%increase in average wages) among those who received a more nutritious supplement compared to those who received a less nutritious supplement (Hoddinott *et al.*, 2008).

2.5 Intergenerational cycle of malnutrition



Source: (ACC/SCN, 1992)

Fig 2.2 The intergenerational cycle of growth failure

The intergenerational cycle of growth failure explains how growth failure is transmitted across generations through the mother. Children born with a low birth weight are more likely to have growth failure during childhood. Thus, in turn, girls born with a low birth weight are more likely to become small adult women. This cycle is accentuated by high rates of teenage pregnancy, as adolescent girls are even more likely to have low-birth-weight babies. Low birth weight is a baby born weighing less than 2.5 kg. Studies revealed that birth weight can be rapidly

improved, even in populations of short adult women, and that improving the diet, both in quantity and quality, be it through food or micronutrient supplementation, fortification with micronutrients, or both, can help achieve this, especially if the pre-pregnancy nutritional status of the mother is taken into account .There is growing evidence that improving the quality of the diet of the mother during the first half of pregnancy can have as big an effect on birth weight as providing food supplements later in pregnancy. Certainly, the risk of delivering a low-birth-weight baby can be determined very early in pregnancy (G. C. S. Smith *et al.*, 2002), and the influence of maternal nutritional status on pregnancy outcomes is more important in early rather than late pregnancy (Neufeld *et al.*, 2004).

2.6 Malnutrition and Infection

The complex interaction between infection and malnutrition creates a hostile environment that perpetuates a vicious circle that leads to the two entities benefiting from each other. Some of the phenomenon involved during different parts of the cycle includes decreases in the activity of macrophages, diminishment of the inflammatory response, and a reduction in the capacity to create specific antibodies. However, there are two effects that can occur in the presence of both malnutrition and infection. The first one is the synergistic effect, and it happens when an infection worsens the malnutrition or when the malnutrition contributes to decreasing the immune response to infection. The second effect is an antagonist mechanism, which occurs less frequently than the synergistic effect. The antagonistic mechanism happens when malnutrition decreases the multiplication of the agent. Malnutrition can make a person more susceptible to infection, and infection contributes to malnutrition, which causes a vicious cycle as shown in the fig 2.3 (Rodriguez-Morales *et al.*, 2016).

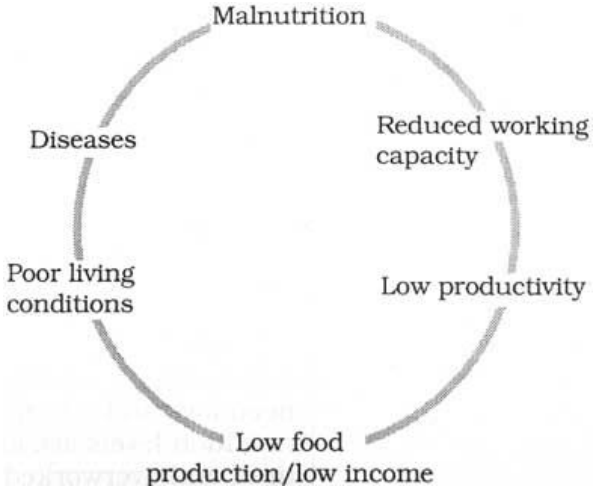


Fig 2.3 Malnutrition and infection cycle

2.7 Nutritional status

Nutritional status is the current body status of a person or a population group, related to their state of nourishment (the consumption and utilization of nutrients). The principal aim of assessing the nutritional status of a community is, to map out the magnitude and geographical distribution of malnutrition as a public health problem, to discover and analyze the ecological factors that are directly or indirectly responsible, and, where possible to suggest appropriate corrective measures, preferably capable of being applied with continuing community participation (WHO, 1996).

This is determined by a complex interaction between internal/constitutional factors and external/environmental factors. Some of these internal factors include age, sex, nutrition, behaviour, physical activity and diseases while the external factors include food safety, cultural, social and economic circumstances. There is increased risk of malnutrition than over-nutrition in children from poor socioeconomic families where the nutrition intake is reduced (Aziz and Devi, 2012). Some disease conditions can also cause reduced absorption of nutrients in the body leading to malnutrition (Katz and Weaver, 2014).

2.8 Factors affecting Nutritional status

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, socio-cultural 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). The factors that affect the nutritional status are discussed below:

1. Inadequate dietary intake

According to FAO (2011), dietary diversity reflects the nutrient quality of an individual's diet. A study on Iran and India reported that increasing dietary diversity scores (DDS) were associated with higher BMI of children (Hooshmand and Udipi, 2013).

2. Impact on immune function

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).

3. Infections

School-age children have been reported to have the highest intensity of worm infection and are detrimental to their physical growth and educational advancement. Severe anemia that is caused as a result of worm infections usually result in undernutrition, disability as well as pain among children (Project, 2008). 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).

4. Socio-economic status

Nutritional status of children does reflect the socioeconomic status of the family and social wellbeing of the community on a whole. The surrounding environment which is sometimes influenced by socioeconomic status also affects the nutritional

status of school aged children status (Srivastava *et al.*, 2012). He also found that mothers' educational status was a strong predictor of child nutritional status. Malnutrition among children is directly or indirectly caused by mother's educational and social status, food availability and access to safe water, these are indicators of socioeconomic status (L. C. Smith and Haddad, 2000).

5. Physical activity

Physical activity and sedentary behaviours such as television viewing, using computer or playing video games act as a key factors of current obesity epidemic (Chung *et al.*, 2012). Decreasing the level of physical activity has a significant role in increasing childhood obesity rates (Bellows *et al.*, 2013).

6. Water, sanitation and hygiene

The body's ability to properly absorb nutrients is affected by diarrhea, soil transmitted helminth infections or parasitic intestinal worm infections and environmental enteropathy (characterized by increased gut permeability and nutrition malabsorption), all caused by inadequate sanitation, insufficient hygiene and unsafe water (Checkley *et al.*, 2008).

2.9 RDA of school aged children

Nutritional Requirements refers to the amount of food, energy and nutrient needed on an average per day by specific group and sex categories to meet the needs of healthy individuals for normal functioning of the body for work and growth (Burk, 1984).

The dietary requirement of school children aged 6-12 years is given below in Table (Srilakshmi, 2014)

Table 2.1 Recommended dietary intake of nutrient for school children (ICMR-2010)

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

2.10 Nutritional status of women in Nepal

In contest of Nepal girls are married soon after the puberty and almost 40% of women have their first child between the age of 15 and 19. The average family diet is the regular food during the pregnancy period. On an average after 22 days of giving birth, most of Nepalese women start their work on fields and they got the same family diet. Most Nepalese women spent their lives in pregnancy and location with 5 to 6 births. Thus whole life of most Nepalese women passes through poor nutritional status and they are always malnourished (Dhakal, 1995). Most of the women in Nepal lack both adequate calorie and micronutrients from their own childhood that results in a very low average Body Mass Index (BMI) as compared to their amount of work burden. A low BMI among mothers causes poor lactation which leads to lowered growth rate in infants. This increases the risk of complication during delivery, and can result in the death of both mothers and children. Anemia is a severe public health problem in Nepal and pregnant women is

likely to result in a newborn with iron depletion. More than two thirds (67%) of non- pregnant and 75% of pregnant women are anemic in Nepal. It is found that 18% of Nepalese mothers suffer from night blindness during pregnancy. Iodine deficiency is also another nutritional problem in Nepal (Pandey, 2007). Similarly, pregnancy induced hypertension (PIH) affects about 7% of first pregnancies and is a leading cause of maternal morbidity and mortality. Eighteen percent of women of reproductive age are thin or undernourished (BMI < 18.5 kg/m2). The proportions of mild thinness (17.0-18.4 kg/m2) and moderate and severe thinness (<17 kg/m2) are 12% and 7%, respectively in Nepal (MoHP, 2012).

2.11 Methods for assessing nutritional status

The assessment of nutritional status can be done using the following information (WHO, 1966).

a) Direct method: Deals with the individual and measures objective criteria such as Anthropometric, Clinical examination, Biochemical and Bio- physical parameters.

b) Indirect method: Use community indices that reflect the community nutritional status or need e.g. Dietary intake, morbidity and mortality rates, as specific mortality and vital statistics.

c) Ecological factors: e.g. Socio-economic status, housing and environmental hygiene, health and education services, conditioning infection.

2.12 Nutritional status indicators

For studies of both individuals and populations, the anthropometric indices can be compared to the reference population using percentiles or Z-score system derived from the reference data. In most industrialized countries, percentiles are used, whereas in low income countries, the use of Z-scores is preferred (Gibson, 2005). Height- and weight based anthropometric indicators are used worldwide to characterize the nutritional status of populations. As such, the SD of Z-scores can be used as quality indicators for anthropometric data. Consequently, height-for-age Z-scores (HAZ), weight-for-age Z-scores (WAZ), weight-for-height Z-scores (WHZ) and body-mass-index-for-age Z-scores (BMIZ) are the widely used indicators (Meia and Grummer-Strawna2007).

Z-score is defined as a score that indicates how far a measurement is from the median, also known as standard deviation (SD) score and is often used to assess anthropometric measures to help evaluate children's growth and nutritional status. Compared to percentiles, Z-scores have a number of advantages: first, they are calculated based on the distribution of the reference population (mean and standard deviation), and thus reflect the reference distribution; second, as standardized quantities, they are comparable across ages, sexes, and anthropometric measures; third, Z-scores can be analyzed as a continuous variable in studies. In addition, they can quantify extreme growth status at both ends of the distribution (Wang and Chen, 2012).

The formula for calculating the Z-score is:

$$\text{Z-score (or SD-score)} = \frac{\text{observed value - median value of the reference population}}{\text{Standard deviation value of reference population}}$$

Interpreting the results in terms of Z-scores has several advantages as follows:

a) The Z-score scale is linear and therefore a fixed interval of Z-scores has a fixed height difference in cm, or weight difference in kg, for all children of the same age. For example, on the height-for-age distribution for a 36-month-old boy, the distance from a Z-score of -2 to a Z-score of -1 is 3.8 cm. The same difference is found between a Z-score of 0 and a Z-score of +1 on the same distribution. In other words, Z-scores have the same statistical relation to the distribution of the reference around the mean at all ages, which makes results comparable across ages groups and indicators.

b) Z-scores are also sex-independent, thus permitting the evaluation of children's growth status by combining sex and age groups

These characteristics of Z-scores allow further computation of summary statistics such as means, standard deviations, and standard error to classify a population's growth status (WHO, 2015). 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). The commonly used anthropometric measurements or indicators of nutritional status for school aged children are briefly discussed in the following section:

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 at national level (WHO, 2010).

c) Overweight: It refers weight for height more than plus two SD of the WHO child growth standards consecutively affects economic productivity 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).

d) 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 Interpretation of cut-off points.

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

(WHO, 2010)

2.13 Literature from previous studies

A cross sectional study was conducted in Lalipur district of Nepal among 319 children of aged 6-12 years showed that mean height, weight and BMI were high in children from Chhetri ethnicity and low in Dalit children. BMI for age was less than 5th percentile in 23.2% of children. The proportions of underweight and stunted children were 10% and 8.3% respectively (Paudel et al., 2017).

A cross sectional study was conducted in 290 primary school children of age group of 5 to 10 years selected from 6 public schools of PumdiBhumdi village of Kaski district using simple random sampling revealed 35.4%, 44.2%, 12.3% prevalence rate of underweight, stunting and wasting respectively. The socio demographic factor significantly associated with underweight were family occupation ($\chi 2$ value =15.679, P value=0.047) and economic status of family ($\chi 2$ value =15.464, P value<0.001). Education status of mother ($\chi 2$ value =10.691, P value=0.014) was significantly associated with wasting (Banstola and Acharya, 2015).

A cross-sectional study conducted on 438 rural school going children (169 male and 259 female) with the age group 4-16 years children in Kavre district showed prevalence of stunting, thinness and underweight to be 24.54%, 10.05% and 30.85% respectively (Mansur *et al.*, 2015).

A cross-sectional study conducted on Western region of Nepal revelaed58% of mothers of malnourished children did not have adequate knowledge regarding the diet requirements of the child and the nutritional value of food items. There is a

highly significant association of maternal literacy, occupation, income and diet knowledge on child malnutrition (Joshi *et al.*, 2011).

A cross-sectional investigation on parents and children aged 6 to 13 years in elementary schools in Makassar, Indonesia. The participants included 877 children and their parents. The prevalence rates of underweight and overweight among the children were 14.5% and 20.4%, respectively. Underweight was more prevalent in boys. Factors such as mother's level of education, having an underweight father, and playing outdoors on weekends for more than 2 hours were significantly associated with underweight children. By contrast, mothers with high levels of education, overweight parents, sleeping for less than 9 hours, and playing outdoors on weekends for less than 1 hour were significantly associated with overweight children (Syahrul *et al.*, 2016)

Part-III

Materials and methods

3.1 Research Design

Cross-sectional study was carried out to assess the following information

a) Anthropometric measurement of primary level schools children between the age group of
   5- 10 yrs.
b) General survey of the situation of household belonging to the children under study with the help of questionnaire.

3.2 Study area

The study was conducted in Gauradaha Municipality, Jhapa, Mechi zone, Nepal. It is located in the Eastern Terai region as shown in Appendix-C.

3.3 Study variables

Study variables were categorized into two groups: dependent variable and independent variable. 1. Dependent variables

i. Stunting
ii. Underweight
iii. Thinness

2. Independent variables

i. Demographic and socioeconomic characteristics
ii. Child characteristics
iii. Household characteristics
iv. Food preferences and physical activities

3.4 Target Population

The target population of the study was 5-10 yrs school children in Gauradaha Municipality, Jhapa.

Inclusion criteria:

Students present at the day of survey and those of primary level and within age group of 5-10 years.

Exclusion criteria:

Students absent at the day of survey and who does not belong to age group 5-10 years.

3.5 Sampling Technique

Cross-sectional descriptive study was conducted in Gauradaha Municipality. Purposive sampling technique was used for the selection of the study site. Then by using the simple random sampling method schools (private and public) were selected from the list of schools. The students from both schools were selected on the basis of their respective proportions. Then, students were selected from each class by using lottery method by drawing out the roll numbers of students present in the class.

3.6 Sample size determination

The sample size was determined by using a single proportion formula assuming the prevalence rate of malnutrition to be 13%% in the survey area, 95% confidence interval (Hoddinott *et al.*), 5% margin of error (d) and 5% non-response rate was added to the total calculated sample size.

Sample size $n= z^2. P (1-p)/m^2$

Where, n = required sample size

z= confidence interval at 95% (standard value of 1.96)

p = estimated prevalence of malnutrition in project area

m = margin of error at 5% (standard value of 0.05)

Here, p is estimated on the basis of the research conducted by (Joshi *et al.*, 2011)in schools of Kaski district of western Nepal. The result obtained from his study showed that 13% of students were found to be stunted. Thus, 13% is taken as the

estimated prevalence of malnutrition (p) for the calculation of sample size for this research study.

The sample size was obtained as below,

$$n = \underline{z^2 . P . (1- P)} / m^2$$

$$= (1.96^2 * 0.13 * 0.87) / 0.05^2$$

$$= (3.8416 * 0.13 * 0.87) / 0.0025$$

$$= 0.4344/0.0025$$

$$= 173.6$$

$$= 174$$

As some of the parents may refuse or may not be reachable so considering non-response rate as 5%, the adjusted sample size is calculated to be 174+8.7=182.7. Therefore the sample size was 182. Here 180 samples so selected were divided into two halves, 90 in each. 90 samples were taken from the 5 public schools (18 from each) and another 90 from the 5 private schools (18 from each).

3.7 Research Instruments

Equipment used during the survey was:

1. Digital weighing machine: Micro life Pvt. Ltd. Having capacity of 100kg (1 piece).
2. Height measuring scale (Stadiometer):- The height measuring tape of 5ft capacity (1 piece). The minimum measurement capacity was 0.1cm.
3. Questionnaire:- A well designed set of questionnaire to collect information on household characteristics, child characteristics etc.

3.8 Pre-testing

The study site was visited first and designed questionnaire was pre- tested among school children of 5-10 yrs. age group before conducting the final survey. The pre-testing was conducted to establish accuracy of questions and clarity and to check for consistency in the interpretation of questions and to identify ambiguous items.

After review of instruments all suggested revisions were made before being administered in the actual study.

3.9 Validity and Reliability

To ascertain the degree to which the data collection instruments will measure what they purposed to measure, the instruments were validated by a group of professionals from Central Campus of Technology, Department of Nutrition and Dietetics. The questionnaire was also pre-tested prior to data collection to ascertain content and face validity.

Reliability refers to quality control measure of data collected. Before data collection the research assistants were intensively trained on the objectives of the study and on data collection techniques. The process of data collection involved the principal researcher and two research assistants. Questionnaire was checked daily for completeness, consistency and clarity as mentioned earlier.

3.10 Data collection techniques

Primary data was collected using structured questionnaire and anthropometric measurement. Interview with students was done to obtain socio-demographic and economic information.

Secondary data was obtained from Municipality office, Nepal Demographic Health Survey (NDHS), Central Bureau of Statistics, and key informants like Female Community Health Volunteers (FCHV), local leaders etc.

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 students 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 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 Analysis

The collected data was first edited, organized, coded and entered into Microsoft excel 2010. The data were then entered into statistical package for social science (SPSS) version 20.0. and analyzed by using both descriptive and inferential statistics. Anthropometric data were analyzed by using WHO Anthro plus v1.0.4. Chi-square test was used to test the association between dependent and independent variables and also for the factors associated with dependent variable.

3.12 Logistical and Ethical considerations

Permission to conduct survey in Gauradaha Municipality was obtained from the office. Similarly, clearance was obtained from principals of respective schools selected for study. The study participants were provided with an oral consent prior to the survey. Respondents were assured that the data collected was for the purpose of the study and to be treated with the uttermost confidentiality.

PART- IV

Results and discussion

The cross- sectional descriptive study was conducted in Gauradaha Municipality, Jhapa with 180 sample size to compare the nutritional status of 5-10 yrs primary level school studying in private and public schools. The results and findings of the study are:

4.1 Demographic and socio-economic characteristics

Table 4.1 Distribution of caste and religion of the surveyed population (n=180)

Variables	Public school		Private school	
	Frequency	Percent	Frequency	Percent
Caste				
Brahmin	32	35.6	17	18.9
Magar	2	2.2	4	4.4
Chettri	34	37.8	19	21.1
Limbu	2	2.2	5	5.6
Dalit	20	22.2	45	50
Religion				
Hindu	87	96.7	84	93.3
Christian	3	3.3	4	4.4
Buddhist	0	0	2	2.2

Out of 180 surveyed children, 90 children were from public school and 90 were from private school. In terms of caste children public school comprises 35.6% Brahmin, 2.2% Magar, 37.8% Chhetri, 2% Limbu and 20% Dalit. Similarly, children from private school comprise 18.9% Brahmin, 4.4% Magar, 21.1% Chhetri, 5.6% Limbu and 50% Dalit. 96.7% of children from public school were Hindu, 3.3% were Christian and none of them were Buddhist whereas 93.3% of children from private school were Hindu, 4.4% were Christian and 2.2% were Buddhist as shown in the Table 4.1.

Similar finding was observed by the study of primary school children in PhumdiBhumdi village of Kaski district where majority of respondents, (95.9%) were Hindu, (3.1%) Christian and only (1%) were Buddhist. The major ethnic group was upper caste group as (54.9%), followed by (33.3%) so called dalits and relatively advantaged and disadvantaged janajati consisted of 20(6.9%) and 16(4.9%) respectively(Banstola and Acharya, 2015). A cross-sectional study conducted in all the households of Dukuchhap village in Lalitpur district of Nepal showed that mean height, weight and BMI were high in children from Chhetri community and low in Dalit children. BMI for age was less than 5th percentile in 23.2% of children. The proportions of underweight and stunted children were 10% and 8.3% respectively (Paudel *et al.*, 2017).

Table 4.2 Economic characteristics of the surveyed population (n = 180)

Variables	**Private school**		**Public school**	
	Frequency	**Percent**	**Frequency**	**Percent**
Father's occupation				
Agriculture	22	24.4	22	24.4
Business	19	21.1	12	13.3
Foreign employment	25	27.8	30	33.3
Service	10	11.1	4	4.4
Labor	5	5.6	18	20
Others	9	10	3	3.3
Mother's occupation				
Housewife	70	77.8	67	74.4
Business	12	13.3	7	7.8
Foreign employment	4	4.4	6	6.7
Service	1	1.1	1	1.1
Labor	0	0 .00	8	8.9
Others	3	3.3	1	1.1
Annual income				
1 lakh to 3 lakhs	35	38.9	66	73.3
More than 3 lakhs	55	61.1	24	26.7

Table 4.2 showed the major occupation of their father, mother and their annual income. Most of the fathers of children studying in private school had gone to foreign employment (27.8%) and the least percentage of their father's job was labor

(5.6%). Similarly, 24.4% were farmers, 21.15 were businessman, 11.1% were at government service and only 10% were engaged in other activities. Similarly, majority of the fathers of children studying in public school had gone to foreign employment (33.3%), 24.4% were engaged in agriculture, 13.3% were engaged in business, 4.4% were engaged in government service, 20% were labor and 3.3% performed other activities. Most of the mothers of students from private school were housewife (77.8%), 13.3% had their own business, 4.4% were gone for foreign employment, 1.1% worked at government service, 3.3% were engaged in other activities and none of them were labor. Majorities (61.1%) of the children from private school belong to the household whose annual income was more than 3 lakhs and 38.9% of families had income in between 1-3 lakhs. Similarly, majorities (73.3%) of children from public school belong to the household whose annual income is in between 1-3 lakhs and only 26.7% of children belong to family whose annual income was more than 3 lakhs.

A cross sectional study was conducted in 290 primary school children of age group of 5 to 10 years selected from 6 public schools of PumdiBhumdi village of Kaski district using simple random sampling revealed socio demographic factor significantly associated with underweight were family occupation ($\chi 2$ value =15.679, P value=0.047) and economic status of family ($\chi 2$ value =15.464, P value<0.001). Education status of mother ($\chi 2$ value =10.691, P value=0.014) was significantly associated with wasting (Banstola and Acharya, 2015).

Table 4.3 Socio-demographic characteristics of the surveyed population (n =180)

Variables	Private school		Public school	
	Frequency	**Percent**	**Frequency**	**Percent**
Family Type				
Nuclear	48	53.3	57	63.3
Joint	42	46.7	33	36.7
Father's education				
Primary	12	13.3	35	38.9
Secondary	49	54.4	37	41.1
Higher secondary	29	32.2	7	7.8
Informal education	0	0	11	12.2
Mother's education				
Primary	14	15.6	43	47.8
Secondary	50	55.6	27	30
Higher secondary	26	28.9	8	8.9
Informal education	0	0	12	13.3

From the above Table (4.3) 53.3% of children were from nuclear families and 46.7 % of children were from joint families who belong to private school while children belonging to public school, 63.3% were from nuclear families and 36.7% were from joint families. About more than half (54.4%) of the fathers of children studying in private school had passed secondary education, only 13.3% and 32.2% had passed primary and higher secondary level of education. Most of the fathers of children studying in public school had passed secondary education (41.1%) and only least (7.8%) of them had passed higher secondary education level. Similarly, 38.9% of them had passed primary education and 12.2% of them had received informal education. 15.6% of mothers of private school children had passed primary level, 55.6% had passed secondary level, 28.9% had passed higher secondary level while 47.8% of mothers of public school children had passed primary level, 30% had passed secondary level, 13.3% had received informal education and 8.9% had passed higher secondary level.

A cross-sectional study conducted on Western region of Nepal revelaed58% of mothers of malnourished children did not have adequate knowledge regarding the diet requirements of the child and the nutritional value of food items. There is a highly significant association of maternal literacy, occupation, income and diet knowledge on child malnutrition. Economic status of the household is associated

with the general health and development status of the family. Literate mothers adopt many improved behaviors related to maternal and child health care, feeding and eating practices which ultimately affect the nutritional status of children (Joshi *et al.*, 2011).

4.2 Child characteristics

Out of 90 children from public school 40% were male and 60% were female. Similarly, out of 90 children from private school 52.2% of children were male and 47.8% were female. Among sampled population from private school 46 (51.1%) were first child, 33 (36.7%) were second child, 7 (7.8%) were third child and only few i.e.4 (4.4%) were fourth child according to birth order. Similarly, among sampled population from public school 28 (31.1%) were first child, 47(52.2%) were second child, 9(10%) were third child, 3(3.3%) were fourth child and 1.1% were fifth, sixth and seventh child as shown in table (4.4).

Table 4.4 Child characteristics of the surveyed population (n=180)

	Private school		Public school	
Variables	**Frequency**	**Percent**	**Frequency**	**Percent**
Sex				
Female	43	47.8	54	60
Male	47	52.2	36	40
Birth order				
First	46	51.1	28	31.1
Second	33	36.7	47	52.2
Third	7	7.8	9	10
Fourth	4	4.4	3	3.3
Fifth	0	0	1	1.1
Sixth	0	0	1	1.1
Seventh	0	0	1	1.1
Age classification				
5 to 8 years	16	17.8	21	23.3
8 to 10 years	74	82.2	69	76.7

Only 17.8% of children from private school were in between the age group of 5-8 years and 82.2% were in between the age group of 8-10 years. Out of sampled children from public school, percentage of children belonging to age group 5-8 yrs was 23.3% and 76.7% belongs to 8-10 yr age group.

4.3 Household characteristics

Table 4.5 Household characteristics of the study population (n=180)

	Private school		**Public school**	
Variables	**Frequency**	**Percent**	**Frequency**	**Percent**
Type of house				
Cemented	59	65.6	29	32.2
Wooden	28	31.1	30	33.3
Bamboo and Soil	3	3.3	31	34.4
Purification of water				
Yes	57	63.3	31	34.4
No	33	36.7	59	65.6
Salt Intake				
Iodized	90	100	90	100
Non-Iodized	0	0	0	0
Toilet facility				
Yes	90	100	90	100
No	0	0	0	0

The household characteristics as shown in the above Table 4.5 showed 65.6% of children studying in private school had cemented house, 31.1% had wooden house and 3.3% had house made up of bamboo and soil. Similarly, 32.2% of children studying in public school had cemented house while 33.3% had wooden house and 34.4% had house made of bamboo and soil. Majorities (63.3%) of household of private school children adopted water purification technique and few household (36.7%) drink water directly without purifying. Whereas only few (34.4%) household of public school children purify water before drinking and more than half (65.%) of the household did not purify water. All the household of sampled population used iodized salt and had toilet facility.

Majority of Nepalese households consume salt with iodine; 95% of children live in households that consume iodized salt. The percentage of children living in households that use iodized salt is lowest in State 6 (82%), in the Mid-Western region, and in the lowest wealth quintile. Three in five Nepalese households (62%) have improved sanitation facilities. 38% of households have unimproved sanitation facilities with 15% having no facilities (MoH *et al.*, 2016).

According to Nepal Multiple Indicator Cluster Survey, 93% of population used drinking water from an improved drinking water source. Among those who did not have access to an improved drinking water source, only 14 percent used an appropriate water treatment method. About 67 percent of users of improved drinking water sources had a water source directly on their premises. The education level of the household head and the household's wealth status were both positively associated with having a water source on the premises. Eight out of 10 households (84 percent) with unimproved sources of drinking water had E. coli, whereas it dropped to 70 percent for those households that had an improved source of drinking water (CBS/UNICEF, 2015).

4.4 Food preferences

Table 4.6 Food preferences of the surveyed population (n=180)

	Private school		**Public school**	
Variables	**Frequency**	**Percent**	**Frequency**	**Percent**
Food Source				
Self-production	78	86.7	78	86.7
Purchasing from market	12	13.3	12	13.3
Food preferences				
Vegetarian	10	11.1	3	3.3
Non vegetarian	80	88.9	87	96.7
Water Intake				
1 glass	21	23.3	21	23.3
2-4 glasses	68	75.6	68	75.6
More than 8 glasses	1	1.1	1	1.1

About 86.7% of children from both public and private school belong to the household producing their own food themselves while only 13.3% of them bought food from market. Similarly, 11.1% of children from private school and 3.3% of children from public school were vegetarian while 88.9% of children from private school and 96.7% of children from public school were non-vegetarian. Majorities (75.6%) of children from both type of schools drink 2-4 glasses of water per day, 23.3% of them drink only 1 glass of water per day and very few (1.1%) of them drink more than 8 glasses of water per day.

Encouraging children to drink fluid regularly during physical activity and to drink several glasses of water or other fluid after the physical activity prevents them from dehydration (Agriculture and Services, 2010).

4.5 Physical activities

Based on the means of transportation from school to home among children from private school, 34.4% of them went by walking, 28.9% went by bicycle, 22.2% went by private vehicles and only 14.4% went by public vehicles. Similarly among children from public school, 82.2% went by walking, 12.2% went by bicycle, 4.4% went by private vehicle and very few (1.1%) went by public vehicles.

Table 4.7 showed the homework time per day, 52.2% of children from private school completed their homework within 1 to 2 h, 31.1% completed their homework at less than 1 h and 16.7% of them took to complete their homework for more than 2h. Similarly, 55.6% of children from public school completed their homework within 1 to 2 h, 42.2% completed their homework at less than 1 h and 2.2% of them took to complete their homework for more than 2h.

Table 4.7 Physical activities of the surveyed populations (n=180)

	Private		Public	
Variables	**Frequency**	**Percent**	**Frequency**	**Percent**
Means of transportation from school to home				
private vehicles	20	22.2	4	4.4
public vehicles	13	14.4	1	1.1
Bicycle	26	28.9	11	12.2
Walking	31	34.4	74	82.2
Homework time per day				
1 to 2 h	47	52.2	50	55.6
less than 1 h	28	31.1	38	42.2
more than 2 h	15	16.7	2	2.2
TV and computer time				
1 to 2 h	34	37.8	47	52.2
less than 1 h	54	60	40	44.4
more than 2 h	2	2.2	3	3.3
Activities in break time				
Sit, eat, talk, study	42	46.7	27	30
Walk	0	0	3	3.3
Play, Run	48	53.3	60	66.7

Among children from private school 60% of them spend less than 1h on Television (TV) and computer, 37.8% spend 1-2h per day and 2.2% spend more than 2h per day. Similarly, 44.4% of children from public school spend less than 1h on Television (TV) and computer, 52.2% spend 1-2h per day and 3.3% spend more than 2h per day. More than half (53.3%) of children from private school involved in playing and running activities in break time while 46.7% of them just sit, eat, talk and study in break time. 66.7% of children from public school engaged in different activities during break time like playing and running, 30% of them performed activities like sitting, eating, talking and studying and only 3.3% of them were involved in walking.

4.6 Nutritional status of primary level school children aged 5-10 years of Gauradaha Municipality

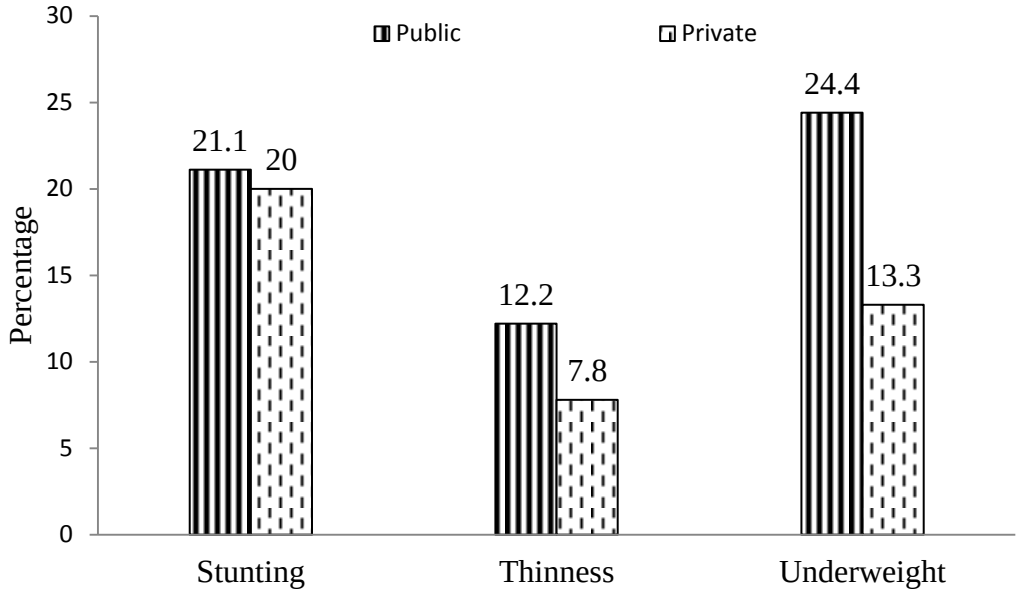


Fig 4.1 Nutritional status of 5-10 years children of both private and public school of the study area

Among 180 studied populations from both private and public school, the overall prevalence of stunting, thinness and underweight was found to be 41.1%, 20% and 37.7% respectively. From the above Fig.4.1 children from private school comprises 20% of stunting, 7.8% of thinness and 13.3% of underweight whereas children from public school comprise 21.1% of stunting, 12.2% of thinness and 24.4% of underweight. The prevalence of malnutrition was higher in children from public school compared to that of children from private school.

4.7 Distribution of malnutrition according to age group of both private and public school

Table 4.8 Age wise distribution of malnutrition of children from public school (n=90)

		HAZ		BAZ		WAZ	
Age (Yr.)	**N**	**Stunted**	**Normal**	**Thin**	**Normal**	**UnderWt**	**Normal**
5-8	42	6.70%	40%	6.70%	40%	7.80%	38.90%
8-10	48	14.40%	38.9%	5.60%	47.80%	16.70%	36.70%

Out of 180 surveyed children, 90 children were from public school and the study showed that highest percentage of stunting and underweight was found in the age group of 8-10 years i.e.14.4% and 16.7% respectively. Similarly, children who belong to 5-8 yrs age group were found to be more thinned i.e. 6.7% as shown in the Table above 4.8.

Table 4.9 Age wise distribution of malnutrition of children from private school (n=90)

		HAZ		BAZ		WAZ	
Age (Yr.)	**N**	**Stunted**	**Normal**	**Thinned**	**Normal**	**Underweight**	**Normal**
5-8	41	5.60%	40%	2.20%	43.30%	3.30%	42.20%
8-10	49	14.40%	40%	5.60%	48.90%	10%	44.40%

Out of 180 surveyed children, 90 were from private school and the study revealed that highest percentage of stunting (14.4%), thinness (5.6%) and underweight (10%) was found in the age group of 8-10 years than children belonging to the age group of 5-8 years as shown in the Table (4.9).

4.8 Distribution of malnutrition according to gender of both private and public school

Out of 180 studied population, 43 were females and 47 were males belonging to private school whereas 54 were females and 36 were males belonging to public school. The study result showed male child from both private and public school were found to be more stunted, thinned and underweight than female child as shown in the Table 4.10.

Table 4.10 Distribution of malnutrition according to gender of both private and public school

Gender	N	HAZ (%)		WAZ (%)		BMIZ (%)	
Private		**<-3 SD**	**<-2SD**	**<-3 SD**	**<-2 SD**	**<-3 SD**	**<-2SD**
Female	43	Nil	8.9	2.2	2.2	Nil	2.2
Male	47	1.1	10	2.2	6.7	1.1	4.4
Public							
Female	54	6.4	3.2	2.1	6.4	1.1	2.1
Male	36	1.1	9.6	3.2	11.7	1.1	7.4

4.9 Distribution of malnutrition according to height for age of public school

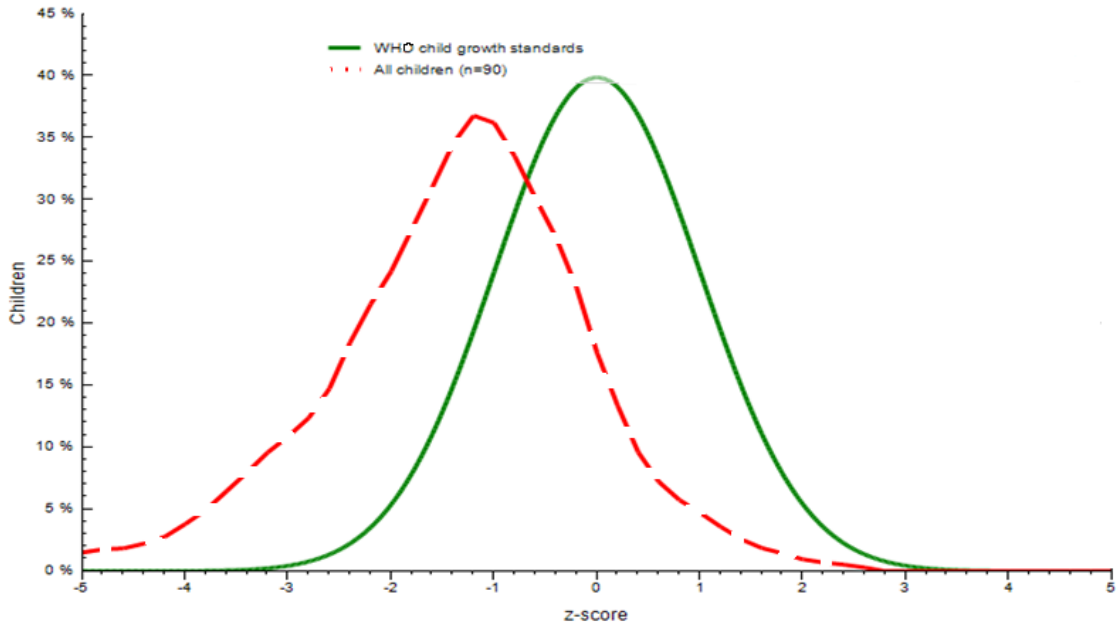


Fig 4.2 Distribution of height for age Z-score curve of public school children with reference to WHO standard

The height for age Z-score curve of public school children is slightly skewed to the left side of WHO standard curve as shown in the Fig 4.2. The median height for age z-score was found to be -1.2 which is less by 1.2 with reference WHO standard. A HAZ < -2SD defines the presence of chronic malnutrition. Among 90 surveyed populations from public school of Gauradaha Municipality, the prevalence of

stunting was found to be 21.1% where 12.8% were moderately stunted and 7.4% severely stunted.

4.10 Factors associated with stunting of public school children

Table 4.11 Result of chi-square test for factors associated with stunting of public school

Variables		Height for Age		χ^2 value	P-value
		Stunted n (%)	Normal n (%)		
Gender	Female	9 (16.7%)	45 (83.3%)	1.6	0.206
	Male	10 (27.8%)	26 (72.2%)		
Type of house	Cemented	4 (13.8%)	25 (86.2%)	2.123	0.346
	Wooden	6 (20%)	24 (80%)		
	Bamboo and soil	9 (29%)	22 (71%)		
Purification of water	Yes	5 (16.1%)	26 (83.9%)	0.705	0.401
	No	14 (23.7%)	45 (76.3%)		
Food preferences	Vegetarian	2 (66.7%)	1 (33.3%)	3.867	0.049*
	Non-vegetarian	17 (19.5%)	70 (80.5%)		
Means of transportation	Private vehicle	1 (25%)	3 (75%)		
	Public vehicle	0 (0%)	1 (100%)	1.412	0.703
	Bicycle	1 (9.1%)	10 (90.9%)		
	Walking	17 (23%)	57 (77%)		
Type of game usually played	Outdoor	4 (44.4%)	5 (55.6%)	3.269	0.071
	Indoor	15 (18.5%)	66 (81.5%)		

*Statistically significant (P-value <0.05)

Vegetarian children were found to significantly associated (P=0.049) associated with stunting. The result is in accordance with the study conducted among rural school going children aged 4-16 yrs in Kavre district.(Mansur *et al.*, 2015).

4.11 Distribution of malnutrition according to weight for age of public school

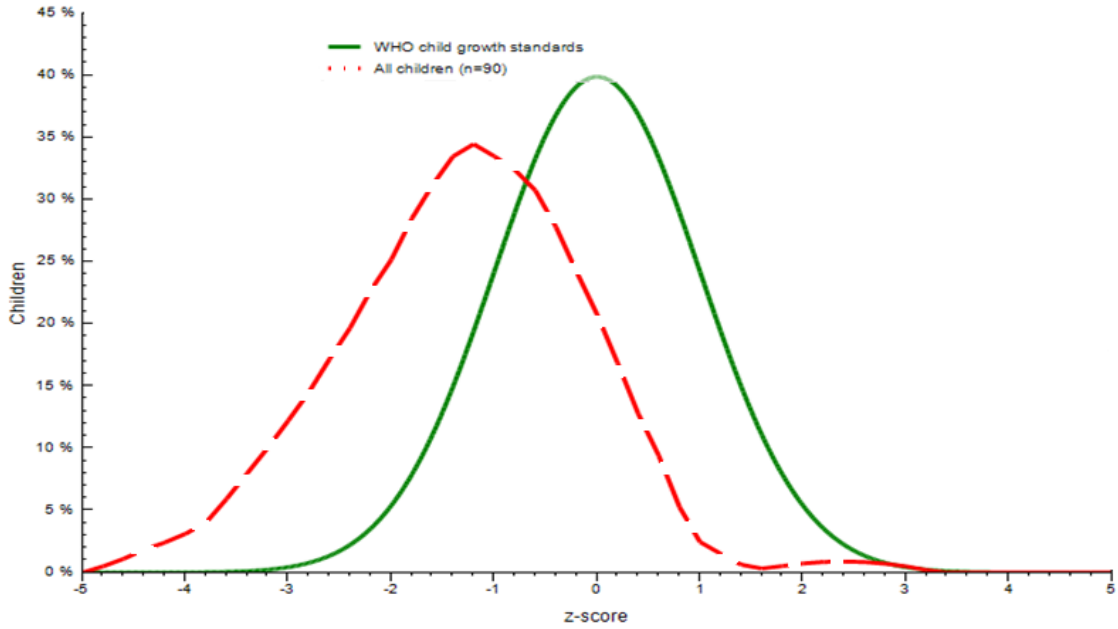


Fig 4.3 Distribution of weight for age Z-score curve of public school children with reference to WHO standard

The weight for age Z-score curve of public school children is slightly skewed to the left side of WHO standard curve as shown in the Fig 4.3. The median weight for age z-score was found to be -1.2 which is less by 1.2 with reference WHO standard. A WAZ < -2SD defines the presence of both acute and chronic malnutrition. Among 90 surveyed populations from public school of Gauradaha Municipality, the prevalence of underweight was found to be 24.4% where 18.1% were moderately underweight and 5.3% severely underweight.

4.12 Factors associated with underweight of public school children

Table 4.12 Result of chi-square for factors associated with underweight of public school

Variables		Weight for age		χ^2 value	P-value
		UnderWt	Normal		
Gender	Female	8 (14.8%)	46 (85.2%)	6.778	0.009*
	Male	14 (38.9%)	22 (61.1%)		
Type of house	Cemented	6 (20.7%)	23 (79.3%)		
	Wooden	7 (23.3%)	23 (76.7%)	0.595	0.743
	Bamboo and soil	9 (29%)	22 (71%)		
Purification of water	Yes	10 (32.3%)	21 (67.7%)	1.563	0.211
	No	12 (20.3%)	47 (79.7%)		
Food preferences	Vegetarian	1 (33.3%)	2 (66.7%)	0.133	0.716
	Non-vegetarian	21 (24.1%)	66 (75.9%)		
Means of transportation	Private vehicle	1 (25%)	3 (75%)		
	Public vehicle	0 (0%)	1 (100%)	0.372	0.946
	Bicycle	3 (27.3%)	8 (72.7%)		
	Walking	18 (24.3%)	56 (75.7%)		
Type of game played	Outdoor	5 (55.6%)	4 (44.4%)	5.241	0.022*
	Indoor	17 (21%)	64 (79%)		

*Statistically significant (P-value <0.05)

As shown in the table (4.16) the percentage of underweight boys were significantly higher than the percentage of underweight girls. Gender (P=0.009) and type of game usually played (P=0.022) was found to be significantly associated with underweight.

The result is in accordance to the study conducted by (Prakash and Yadav, 2017) which signifies that most of the boys (70%) were found to be underweight than girls (30%).This finding was similar to the study conducted in Indonesia which showed more boys than girls were underweight. Factors such as mother's level of education, having an underweight father, and playing outdoors on weekends for more than 2 hours were significantly associated with underweight children. By

contrast, mothers with high levels of education, overweight parents, sleeping for less than 9 hours, and playing outdoors on weekends for less than 1 hour were significantly associated with overweight children

4.13 Distribution of malnutrition according to BMI for age of public school

The BMI for age Z-score curve of public school children is slightly skewed to the left side of WHO standard curve as shown in the Fig 4.4. The median BMI for age z-score was found to be -0.8 which is less by 0.8 with reference WHO standard. Among 90 surveyed populations from public school of Gauradaha Municipality, the prevalence of thinness was found to be 12.2% where 9.6% were moderately underweight and 2.1% severely underweight.

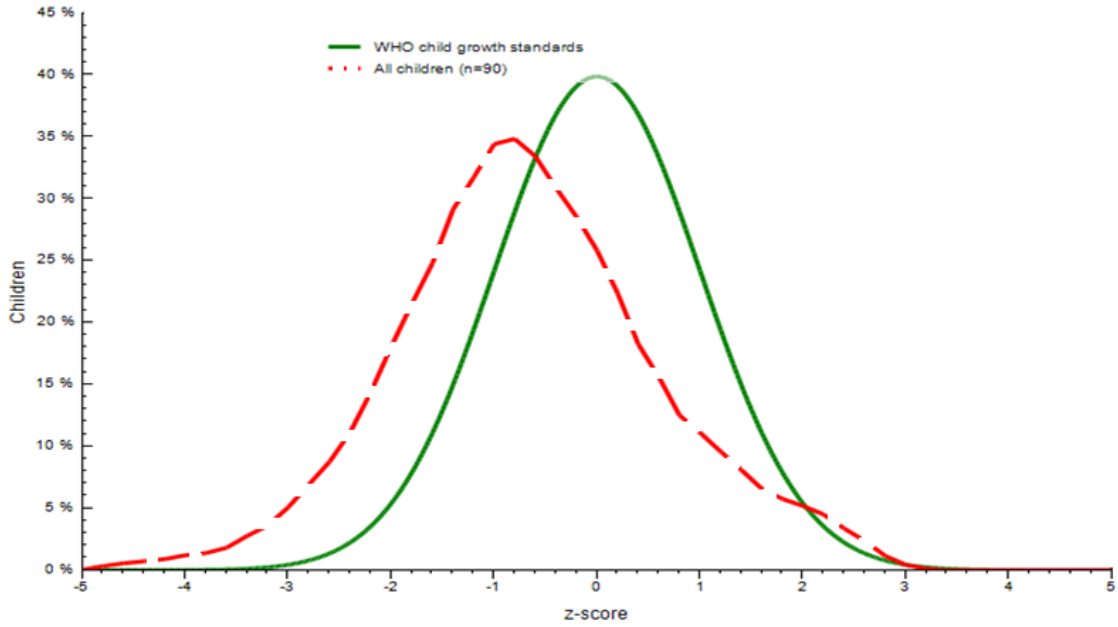


Fig 4.4 Distribution of BMI for age Z-score curve of public school children with reference to WHO standard

4.14 Factors associated with thinness of public school children

Table 4.13 Result of chi-square for factors associated with thinness of public school

Variables		BMI for age		χ^2 value	P-value
		Thinned	**Normal**		
Gender	Female	3 (5.6%)	51 (94.4%)	5.593	0.018*
	Male	8 (22.2%)	28 (77.8%)		
Type of house	Cemented	4 (13.8%)	25 (86.2%)		
	Wooden	7 (23.3%)	23 (76.7%)	7.835	0.020*
	Bamboo and soil	0 (0%)	31 (100%)		
Purification of water	Yes	7 (22.6%)	24 (77.4%)	4.729	0.030*
	No	4 (6.8%)	55 (93.2%)		
Food preferences	Vegetarian	0 (0%)	3 (100%)	0.432	0.511
	Non-vegetarian	11 (12.6%)	76 (87.4%)		
Means of transportation	Private vehicle	0 (0%)	4 (100%)		
	Public vehicle	0 (0%)	1 (100%)		
	Bicycle	1 (9.1%)	10 (90.9%)	0.912	0.823
	Walking	10 (13.5%)	64 (86.5%)		
Type of game played	Outdoor	1 (11.1%)	8 (88.9%)	0.012	0.915
	Indoor	10 (12.3%)	71 (87.7%)		

*Statistically significant (P-value <0.05)

Factors such as gender (P=0.018), type of house (P=0.020 and purification of water (P=0.030) were found to be significantly associated with thinness of private school children.

4.15 Distribution of malnutrition according to height for age of private school

The height for age Z-score curve of private school children is slightly skewed to the left side of WHO standard curve as shown in the Fig 4.5. The median height for age z-score was found to be -1.3 which is less by 1.3 with reference WHO standard. A HAZ < -2SD defines the presence of chronic malnutrition. Among 90 surveyed populations from private school of Gauradaha Municipality, the prevalence of stunting was found to be 20% where 18.9% were moderately stunted and 1.1% severely stunted.

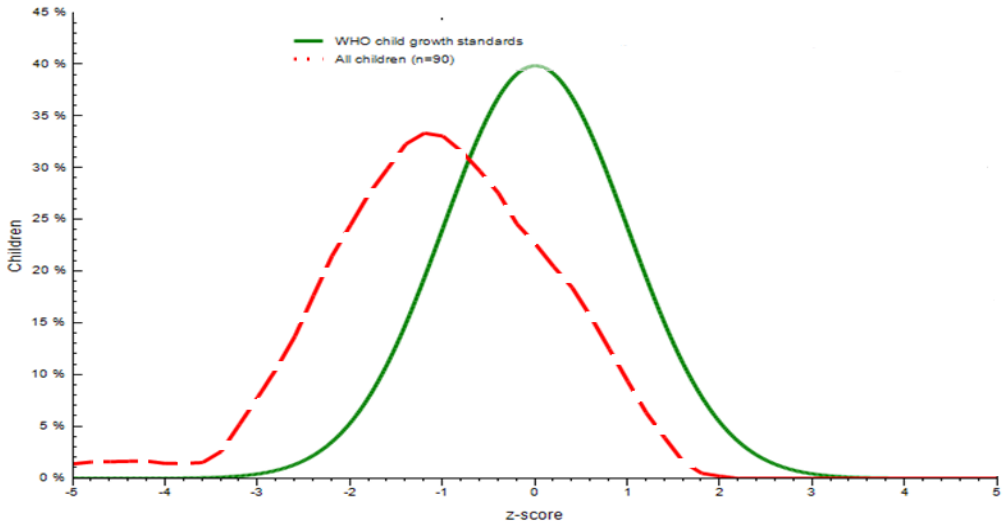


Fig 4.5 Distribution of height for age Z-score curve of private school children with reference to WHO standard

4.16 Factors associated with stunting of private school children

Table 4.14 Result of chi-square test for factors associated with stunting of private school

Variables		Height for age		χ^2 value	P- value
		Stunted	**Normal**		
Family type	Nuclear	6 (12.5%)	42 (87.5%)	0.057	3.616
	Joint	12 (28.6%)	30 (71.4%)		
Father's occupation	Agriculture	5 (22.7%)	17 (77.3%)		
	Business	3 (15.8%)	16 (84.2%)		
	Foreign Employment	5 (20%)	20 (80%)	0.093	9.438
	Service	5 (50%)	5 (50%)		
	Labor	0 (0%)	5 (100%)		
	Others	0 (0%)	9 (100%)		
Birth order	First	6 (13%)	40 (87%)		
	Second	6 (18.2%)	27 (81.8%)	0.021	9.745
	Third	4 (57.1%)	3 (42.9%)		
	Fourth	2 (50%)	2 (50%)		
Purification of water	Yes	9 (15.8%)	48 (84.2%)	0.189	1.722
	No	9 (27.3%)	24 (72.7%)		
Food preferences	Vegetarian	0 (0%)	10 (100%)	0.094	2.813
	Non-vegetarian	18 (22.5%)	62 (77.5%)		

*Statistically significant (P-value <0.05)

No any factors such as family type, father's occupation, birth order, and purification of water and food preferences were found to be significantly associated with stunting of children from private school as shown in the above table (4.11).

4.17 Distribution of malnutrition according to weight for age of private school

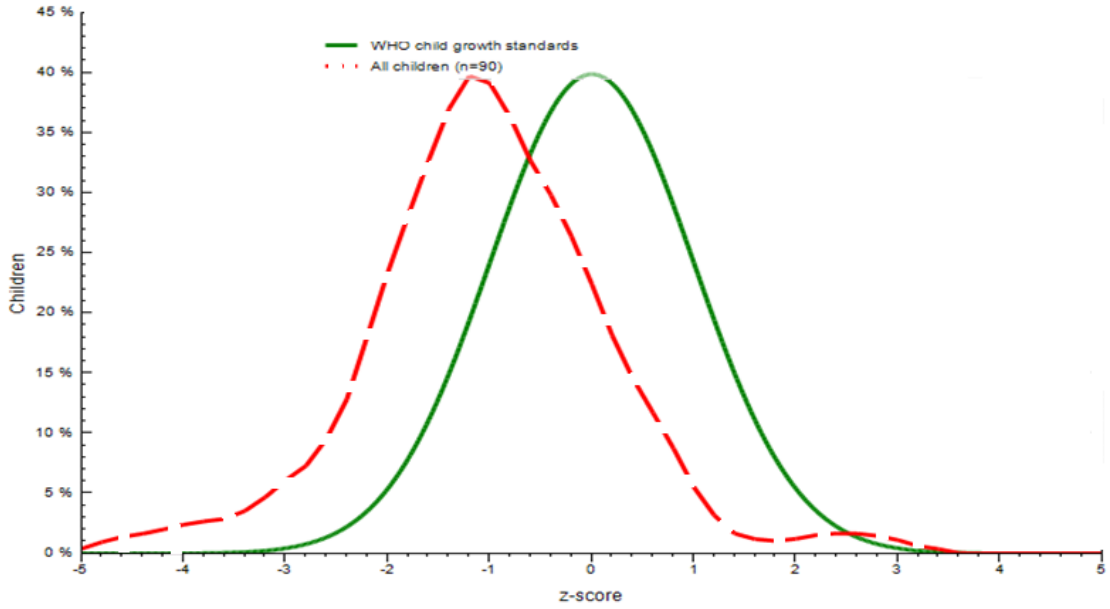


Fig 4.6 Distribution of weight for age Z-score curve of private school children with reference to WHO standard

The weight for age Z-score curve of private school children is slightly skewed to the left side of WHO standard curve as shown in the Fig 4.6. The median weight for age z-score was found to be -1 which is less by 1 with reference WHO standard. A WAZ < -2SD defines the presence of both acute and chronic malnutrition. Among 90 surveyed populations from private school of Gauradaha Municipality, the prevalence of underweight was found to be 13.3% where 8.9% were moderately underweight and 4.4% severely underweight.

4.18 Factors associated with underweight of private school children

Table 4.15 Result of chi-square for factors associated with underweight of private school children

Variables		Weight for age		χ^2 value	P- value
		Underweight	Normal		
Family type	Nuclear.	5 (10.4%)	43 (89.6%)	0.384	0.757
	Joint	7 (16.7%)	35 (83.3%)		
Father's occupation	Agriculture	3 (13.6%)	19 (86.4%)		
	Business	2 (10.5%)	17 (89.5%)		
	Foreign Employment	4 (16%)	21 (84%)	0.916	1.477
	Service	2 (20%)	8 (80%)		
	Labor	0 (0%)	5 (100%)		
	Others	1 (11.1%)	8 (88.9%)		
Birth order	First	3 (6.5%)	43 (93.5%)		
	Second	6 (18.2%)	27 (81.8%)	0.066	7.178
	Third	1 (14.3%)	6 (85.7%)		
	Fourth	2 (50%)	2 (50%)		
Purification of water	Yes	5 (8.8%)	52 (91.2%)	0.094	2.799
	No	7 (21.2%)	26 (78.8%)		
Food preferences	Vegetarian	0 (0%)	10 (100%)	0.188	1.731
	Non-vegetarian	12 (15%)	68 (85%)		

*Statistically significant (P-value <0.05)

No any factors were found to be significantly associated with underweight of private school children.

4.19 Distribution of malnutrition according to BMI for age of private school

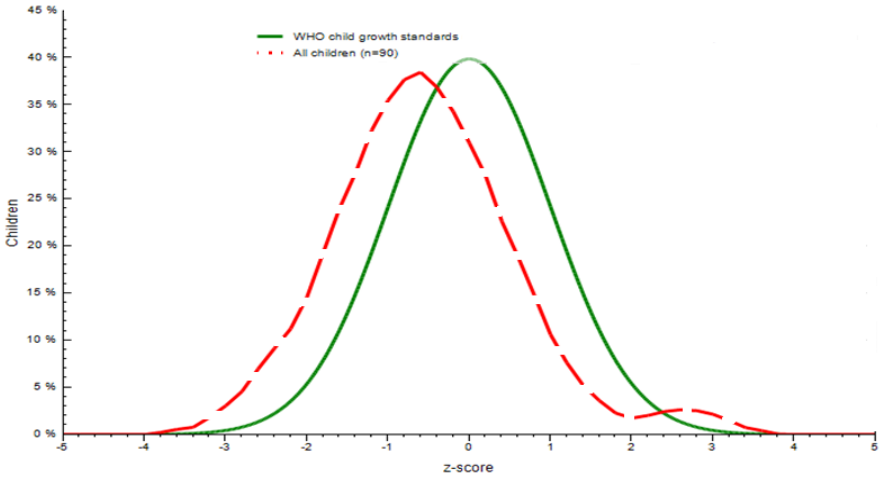


Fig 4.7 Distribution of BMI for age Z-score curve of private school children with reference to WHO standard

The BMI for age Z-score curve of private school children is slightly skewed to the left side of WHO standard curve as shown in the Fig 4.5. The median BMI for age z-score was found to be -0.5 which is less by 0.5 with reference WHO standard. Among 90 surveyed populations from private school of Gauradaha Municipality, the prevalence of thinness was found to be 7.8% where 6.7% were moderately thinned and 1.1% severely thinned.

4.20 Factors associated with thinness of private school children

Table 4.16 Result of chi-square for factors associated with thinness of private school children

Variables		BMI for age		χ^2 value	P-value
		Thinned	Normal		
Family type	Nuclear	5 (10.4%)	43 (89.6%)	0.318	0.999
	Joint	2 (4.85)	40 (95.2%)		
Father's occupation	Agriculture	1 (4.5%)	21 (95.5%)		
	Business	2 (10.5%)	17 (89.5%)		
	Foreign Employment	2 (8%)	23 (92%)	0.949	1.152
	Service	1 (10%)	9 (90%)		
	Labor	0 (0%)	5 (100%)		
	Others	1 (11.1%)	8 (88.9%)		
Birth order	First	1 (2.2%)	45 (97.8%)		
	Second	5 (15.2%)	28 (84.8%)	0.08	6.76
	Third	0 (0%)	7 (100%)		
	Fourth	1 (25%)	3 (75%)		
Purification of water	Yes	5 (8.8%)	52 (91.2%)	0.643	0.214
	No	2 (6.1%)	31 (93.9%)		
Food preferences	Vegetarian	0 (0%)	10 (100%)	0.33	0.949
	Non-vegetarian	7 (8.8%)	73 (91.2%)		

No any factors such as family type, father's occupation, birth order, and purification of water and food preferences were found to be significantly associated with thinness of children from private school as shown in fig 4.12

Part V

Conclusions and recommendations

5.1 Conclusions

The following conclusions were made from the study:

1. The prevalence of malnutrition in private school was 20% stunting, 7.8% thinness and 13.3% underweight whereas prevalence in public school was 21.1% stunting, 12.2% thinness and 24.4% underweight.
2. Comparatively the prevalence of underweight and thinness was found high in public school by 11.1% and 3.4% respectively than in private school.
3. Factors such as gender (P=0.018), type of house (P=0.020 and purification of water (P=0.030) were found to be significantly associated with thinness of public school children.
4. Gender (P=0.009) and type of game played (P=0.022) was found to be significantly associated with underweight of public school children.
5. No any factors were found significantly associated with the stunting, wasting, and Underweight of private school children.

5.2 Recommendations

1. Cross-sectional survey should be conducted periodically with special emphasis on the nutritional status of school aged children.
2. A large number of school and children should be included in future studies of this kind.
3. More information on dietary habits, duration and type of sporting activities should be sought.
4. Teams of health care professionals should develop and implement preventive and management programs to cure the potential economic drain that could result from childhood malnutrition.
5. There is need of Multi Sectorial Nutritional Plan to solve the existing problems of malnutrition.

Part- VI

Summary

A cross-sectional study was conducted among 180 sample population of Gauradaha Municipality, Jhapa for comparative nutritional study between primary level school children aged 5-10 yrs school of private and public schools of Gauradaha. Simple random sampling method was used for the collection of data. Anthropometric measurements like height, weight were taken and BMI was also calculated to assess nutritional status of primary level school aged children. A structured questionnaires were asked to the children about their food preferences, physical activities information on socioeconomic characteristiccs and household characteristics. Data obtained were analyzed by using SPSS version 20.0 and WHO Anthro Plus version 1.0.4. Chi-square test was used to find out the factors associated with stunting, underweight and thinness.

The overall prevalence stunting, thinness and underweight in the surveyed area was found to be 41.1%, 20% and 37.7% respectively. Out of which children from private school comprises 20% of stunting, 7.8% of thinness and 13.3% of underweight whereas children from public school comprise 21.1% of stunting, 12.2% of thinness and 24.4% of underweight. Highest percentage of stunting and underweight was found in the age group of 8-10 years i.e.14.4% and 16.7% respectively. Similarly, children who belong to 5-8 yr age group were found to be more thinned i.e. 6.7%.Out of 180 studied populations, 43 were females and 47 were males belonging to private school whereas 54 were females and 36 were males belonging to public school. The study result showed male child from both private and public school were found to be more stunted, thinned and underweight than female child.

Most of the fathers of children studying in both private and public school had gone to foreign employment i.e. 27.8% and 33.3% respectively. Most of the mothers of students from private school were housewife (77.8%). Majorities (61.1%) of the children from private school belong to the household whose annual income was more than 3 lakhs whereas majorities (73.3%) of children from public school belong to the household whose annual income is in between 1-3 lakhs. 53.3% of

children were from nuclear families and 46.7 % of children were from joint families who belong to private school while children belonging to public school, 63.3% were from nuclear families and 36.7% were from joint families. Regarding father's education, more than half (54.4%) of the fathers of children studying in private school had passed secondary education and only 41.1% of fathers of children studying in public school had passed secondary education. Regarding mother's education, 28.9% of mothers of private school children had passed higher secondary level while only 8.9% of mothers of public school children had passed higher secondary level.

Among 180 studied populations, 65.6% of children studying in private school had cemented house, 31.1% had wooden house and 3.3% had house made up of bamboo and soil. Similarly, 32.2% of children studying in public school had cemented house while 33.3% had wooden house and 34.4% had house made of bamboo and soil. Majorities (63.3%) of household of private school children adopted water purification technique whereas only few (34.4%) household of public school children purify water before drinking. Almost all of the household of sampled population used iodized salt and had toilet facility.

The study showed 11.1% of children from private school and 3.3% of children from public school were vegetarian. Majorities (75.6%) of children from both type of schools drink 2-4 glasses of water per day, 23.3% of them drink only 1 glass of water per day and very few (1.1%) of them drink more than 8 glasses of water per day.

Regarding the means of transportation from school to home among children from private school, 34.4% of them went by walking, 28.9% went by bicycle, 22.2% went by private vehicles and only 14.4% went by public vehicles. Similarly among children from public school, 82.2% went by walking, 12.2% went by bicycle, 4.4% went by private vehicle and very few (1.1%) went by public vehicles. 52.2% and 55.6% of children from private and public school completed their homework within 1 to 2 h.

Among 180 sampled children 60% of children from private school spend less than 1h on Television (TV) and computer whereas only 44.4% of children from public

school spend less than 1h on Television (TV) and computer. More than half (53.3%) of children from private school involved in playing and running activities in break time while 46.7% of them just sit, eat, talk and study in break time. 66.7% of children from public school engaged in different activities during break time like playing and running, 30% of them performed activities like sitting, eating, talking and studying and only 3.3% of them were involved in walking.

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Appendices

Appendix-A

Questionnaire

A. GENERAL INFORMATION

School's Code: ☐☐ Date of interview (B.S.):

Yr.	Mth	da

Student's Code No.: ☐☐☐ Class: ☐☐

Name of child: _____

Date of birth (B.S.):

Yr.	Mth.	day

Age (in years):_____

Address -Municipality: Gauradaha Ward no: _____

Tole:_____

Gender

a. Male b. Female

Caste/Ethnicity:

a. Brahmin
b. Chhettri
c. Tharu
d. Magar
e. Thakuri
f. Others:_____

Religion:

a. Hindu
b. Muslim
c. Christian
d. Buddhist
e. Others: _____

B. ANTHROPOMETRIC INFORMATION

	Reading 1	Reading 2	Reading 3	Mean reading
Height (cm)				
Weight (kg)				

C. FAMILY INFORMATION

1. Type of family: a) Nuclear b) Joint
2. Number of family members: _____
3. Occupation (of father):
   a. Agriculture
   b. Service
   c. Labour
   d. Business
   e. Foreign employment

f. Others:_____ __

4. Occupation (of mother):

a. Housewife
b. Agriculture
c. Service
d. Labor
e. Business
f. Foreign employment
g. Others_____

5. Family income:

a. Less than Rs. 1 Lakh annually (less than Rs. 8300 monthly)
b. Rs. 1 lakh to 3 lakhs (Rs. 8300 to 25000 monthly)
c. More than Rs. 3 lakhs (more than Rs.25000

6. Father's Education level:

a. University level
b. Secondary
c. Basic
d. Informal
e. Illiterate
f. Not aware

7. Mother's education level :

a. University level
b. Secondary
c. Basic
d. Informal
e. Illiterate
f. Not aware

8. How many siblings do you have?

Total: _____ Brothers: _____ Sisters:_____

9. Your sequence among siblings(from the eldest):_____

10. Which is your main source of drinking water in your family?

a. Tube well
b. Well
c. River
d. Drinking water tap
e. Other: _____

11. Is the water purified?

a. Yes
b. No

12. Do you have toilet facility in your house?

a. Yes
b. No

13. What is the main source of food for your family?

a. Own production
b. Purchased from market
c. Other:_____

D. DIETARY INTAKE AND FOOD HABITS *(students may answer more than one option, for such answer what we can do?)*

14. What are you?

a. Vegan
b. Lacto-vegetarian
c. Lacto-ovo vegetarian
d. Non-vegetarian

15. If non vegetarian, what do you prefer to eat?

a. Fish
b. White meat (chicken/duck)
c. Red meat (goat/buffalo/pork)

16. How many glasses (fix the volume) of water do you drink/day?

a. 1
b. 2-4
c. 5-7
d. 8 or more

17. Do you have daily pocket money? (What to do if he occasionally gets pocket money?)

a. Yes
b. No

18. Do you buy food from school canteen?

a. Yes
b. No

If yes, what type?

_____

19. Do you smoke?

a. Yes
b. No

20. Do you drink alcoholic beverages?

a. Yes
b. No

E. PHYSICAL ACTIVITY

21. Which form of transport do you normally use when travel to and from school and apart from your journey to and from school?

a. Private vehicle
c. Public transport
b. Cycle
d. Walk

22. How many hours per day do you spend on doing your homework?
a. None
c. 1 to 2 hours a day
b. Less than an hour a day
d. More than 2 hours a day

23. How many hours per day do you spend watching TV or Video or using computer?
a. None
c. 1 to 2 hours a day
b. Less than an hour a day
d. More than 2 hours a day

24. What do usually do at school breaks?
a. Sitting down (talking, reading or eating)
b. Standing or walking around
c. Running or playing games

25. Do you normally play games or perform physical activities outside school?
a) Yes
b) No

If yes, what type?

a. Play games
d. Gymming
g. Yoga
b. Aerobics/zumba
e. Running/jogging
c. Swimming
f. Walking

26. In a day, how many minutes do you do such activity? _____ Minutes

Appendix-B

Study Site