NUTRITIONAL STATUS AND DIETARY DIVERSITY OF PRIMARY SCHOOL CHILDREN IN PRIVATE AND PUBLIC SCHOOLS OF KAMAL RURAL MUNICIPALITY, JHAPA

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Nutritional Status and Dietary Diversity of Primary School Children in Private and Public Schools of Kamal Rural Municipality, Jhapa

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

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Approval Letter

This *dissertation* entitled ***Nutritional Status and Dietary Diversity of Primary School Children in Private and Public Schools of Kamal Rural Municipality, Jhapa*** presented by **Karuna Baruwal** has been accepted as the partial fulfillment of the requirement for the **B.Sc. degree** in **Nutrition and Dietetics**.

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Abstract

This study was conducted to assess the disparities in nutritional status and dietary diversity of primary school children among private and public school in Kamal rural municipality. A cross-sectional study was done in 190 students (95 from each type of school) with a structured questionnaire. Weight and height were taken and the indicators for nutritional status were underweight, stunting, thinness and obesity. The data entry and data analysis were performed with Microsoft package 21 (Excel and Word) and SPSS Statistics version 20. A Chi-square and fisher's exact test were used to find the association between variables.

The study resulted that more students in public school (24.30%) were underweight as compared to that of private school (14.80%). Greater number of students from public school (14.70%) were stunted than that of private school (10.50%). The thinness was also more common among public school students (16.90%). But the prevalence of overweight was found only in private school (17.9%). The mean dietary diversity score of students in public school was found to be 3.66 ± 1.017 whereas private school students was found to be 4.08 ± 0.996. Several factors were reported to have an association with underweight among private and public school's students such as parent's education level, maternal occupation, frequency of fruit consumption, birth weight of child and so on. Likewise, gender of students was found associated with stunting in public school. Consumption of carbonated beverages, source of drinking water, number of meals in a day and so on were found associated with thinness/overweight in private school and caste/ethnicity, birth order, presence of kitchen garden and so on were found associated with thinness in public school.

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List of Abbreviations

Abbreviation	Full form
ASPEN	American Society for Parenteral and Enteral Nutrition
BAZ	BMI-for-age Z-score
BW	Birth Weight
BMI	Body Mass Index
CDC	Centers for Disease Control and Prevention
CHO	Carbohydrates
DDS	Dietary Diversity Score
DFTQC	Department of Food Technology and Quality Control
EAR	Estimated Average Requirement
FANTA	Food and Nutrition Technical Assistance
FAO	Food and Agricultural Organization
FFQ	Food Frequency Questionnaire
GLV	Green Leafy Vegetables
HAZ	Height-for-age Z-score
ICMR	Indian Council for Medical Research
IDDS	Individual Dietary Diversity Score
LBW	Low Birth Weight
NBW	Normal Birth Weight
NDHS	Nepal Demographic Health Survey
RDA	Recommended Daily Allowance

SAC	School Aged Children
SDGs	Sustainable Development Goals
SD	Standard Deviation
SPSS	Statistical Package for Social Science
UNICEF	United Nations Children Fund
WAZ	Weight-for-age Z-score
WFA	Weight-for-age
WFH	Weight-for-height
WHO	World Health Organization

PART I

Introduction

1.1 Background of the study

Many governments, multilateral and bilateral organisations, and other stakeholders recognise that children's development and achievement in school are influenced by their health and nutrition during the primary school years. It is well-known that the mental and physical growth of a child can be hindered during the school years by under or overnutrition (Best *et al.*, 2010).

Globally, 149.2 million children under 5 suffered from stunting in 2020. In 2020, 45.4 million children under 5 were affected by wasting, of which 13.6 million were severely wasted. There are now 38.9 million children under 5 with overweight globally, an increase of nearly 6 million since 2000 (WHO *et al.*, 2021). Stunting and wasting are the most common nutritional problems among school aged children. At this point, undernutrition is a common cause of low school attendance, high absenteeism, early dropout rates, poor classroom performance, and poor general wellbeing, which in turn leads to low educational achievement and low intellectual and physical ability in adulthood (Getaneh *et al.*, 2019).

In developing countries, stunting and wasting are common in school-age children. High rates of stunting in children indicate that there may also be a long-term deficit in mental and physical development that prevents children from taking full advantage of school-based learning opportunities. Strong evidence from epidemiological studies links undernutrition in the mother and early childhood to an increased adult risk of certain chronic diseases. Infection and insufficient food intake can may lead to malnutrition. Malnutrition and stunted growth are synonymous in children. Children that are malnourished are underweight and shorter than they should be for their age (Mwaniki and Makokha, 2013).

There are several factors that contribute to undernutrition in school children; the two main independent indicators for underweight were the level of home food insecurity and low maternal education. Large family sizes, poor carbohydrate intake, and the degree of food poverty in the home are all independent predictors of low BMI for age (Wolde *et al.*, 2015).

Malnutrition in children ages 5–19 years has profound consequences on education and health outcomes, although more studies and analyses could determine the extent of this impact on national development. Malnutrition brought on by insufficient food intake and helminth infections raises the risk of underweight, anaemia, and illness in children between the ages of five and nine. These conditions also lower attendance, academic performance, and years spent in primary school (Galloway, 2017).

Diet has an impact on children's nutritional status. Varying the meals that are available for consumption could help minimise both undernutrition and overnutrition (Hooshmand and Udipi, 2013). School-age children require a wide variety of healthy foods, which must be progressively adjusted in portion size and quantity to suit their increasing energy requirements because they have a slow and steady growth pattern ahead of puberty (Traoré *et al.*, 2022).

Factors leading to stunting among school aged children are child age, source of potable water, DDS < 4 and anaemia. On the other hand, risk factors for wasting are family poverty, alcohol consumption, mother age and education, and children age (Getaneh *et al.*, 2019)

1.2 Problem statement and justification.

Nepal's urbanisation tendency has become becoming increasingly a problem, with immediate health effects. The progress of urbanisation leads to a significant rise in risk factors associated to lifestyle. A society's disease pattern can change due to dietary changes from one of infectious and communicable diseases predominating to one of double-disease burden with rising obesity and noncommunicable diseases (NCDs) prevalence (Vaidya *et al.*, 2010).

Of the children under five who suffered from wasting in 2020, 13.6 million were severely wasted. These numbers have probably been made worse by COVID-19, which could indicate that 15%, or 1.15 times, more children were affected by wasting in 2020 than previously estimated. This is because household wealth declined and affordability and availability of nutrient-dense food was affected (WHO *et al.*, 2021).

As per NDHS 2022, 25% of children under age 5 are stunted, 8% are wasted, 19% are underweight, and 1% are overweight. 48% of children age 6–23 months receive meals with

a minimum dietary diversity, 82% receive meals at the minimum frequency, and 43% are fed a minimum acceptable diet. Forty-three percent of children age 6–23 months consume sweet beverages and 69% consume unhealthy foods.

Malnutrition begins at pre-school period and may progress into school age. If left untreated, it may have significant negative effects on the academic performance and general well-being of SAC (Getaneh *et al.*, 2019).

Middle childhood and adolescent have historically been neglected when compared to other life stages in the nutrition and health research literature. There are very few regional or worldwide databases with nutritional information for middle childhood (5–10 years old). Many studies for this age range rely on extrapolations, such as using data from the Demographic and Health Surveys (DHS) for children aged 4 to 5 or including data of 10-year-olds to 14-year-olds within child surveys (Saavedra and Prentice, 2023).

A cross-sectional study on the nutritional status of rural school-going children in Kavre District was carried out between the ages of 4 and 16. According to the study's findings, the nutritional condition of rural school-age children in the Kavre area was found to be 30.85% underweight, 24.54% stunted, and 10.05% thin, respectively. It was found that among male children, 37.87% were underweight, 29.59% were stunted, and 11.25% were thin, whereas among female children, the results were 26.27% were underweight, 21.24% were stunted, and 9.27% were thin (Mansur *et al.*, 2017).

Despite the advocacy for health and nutrition services, there is an apparent lack of data on the exact nutritional condition of primary school children in nations in transition and those in development. The majority of studies concentrate on under-five-year-old children who suffer from malnutrition, while school-aged children are frequently excluded from health and nutrition surveys and surveillance (Best *et al.*, 2010).

Everybody needs a wide variety of foods to satisfy their needs for important nutrients and it has long been understood to be beneficial. One of the most serious issues faced by poor residents in the developing nations is to eat a varied diet (Hooshmand and Udipi, 2013).

1.3 Objectives of the study

1.3.1 General objective

To assess the nutritional status and dietary diversity of primary school children aged (5-10 years) studying in private and public schools in Kamal Rural Municipality, Jhapa.

1.3.2 Specific objectives

- To assess the nutritional status and dietary diversity of primary school children in this area.
- To find out the factors associated with nutritional status (including socio-economic status, dietary habits and child characteristics) to pinpoint key determinants among primary level students in this area.

1.4 Research questions

- What is the nutritional status of primary school children aged 5-10 years in Kamal rural municipality in Jhapa?
- What are the factors associated with nutritional status among primary school children of private and public school in Kamal rural municipality in Jhapa?

1.5 Significance of the study

The outcome from this study will be applicable to:

- Identify disparities in access to nutrition and can inform the targeted intervention to improve the health and nutritional status of primary school children.
- Provide insights into the effectiveness of the existing nutritional programs and guide future initiatives to ensure the optimal development in both types of schools.
- Encourage government bodies, educational and nutritional policy makers and other stake holders for the development of programs and policies to bridge the gaps in nutritional status and dietary diversity among students in both types of school.
- Aware and encourage community involvement in promoting healthy nutrition, emphasizing the collaboration between schools, parents, and local communities.

- Identify the range and quality of food consumption to address the potential nutritional deficiencies and excesses among primary school children in both types of school.

1.6 Conceptual framework

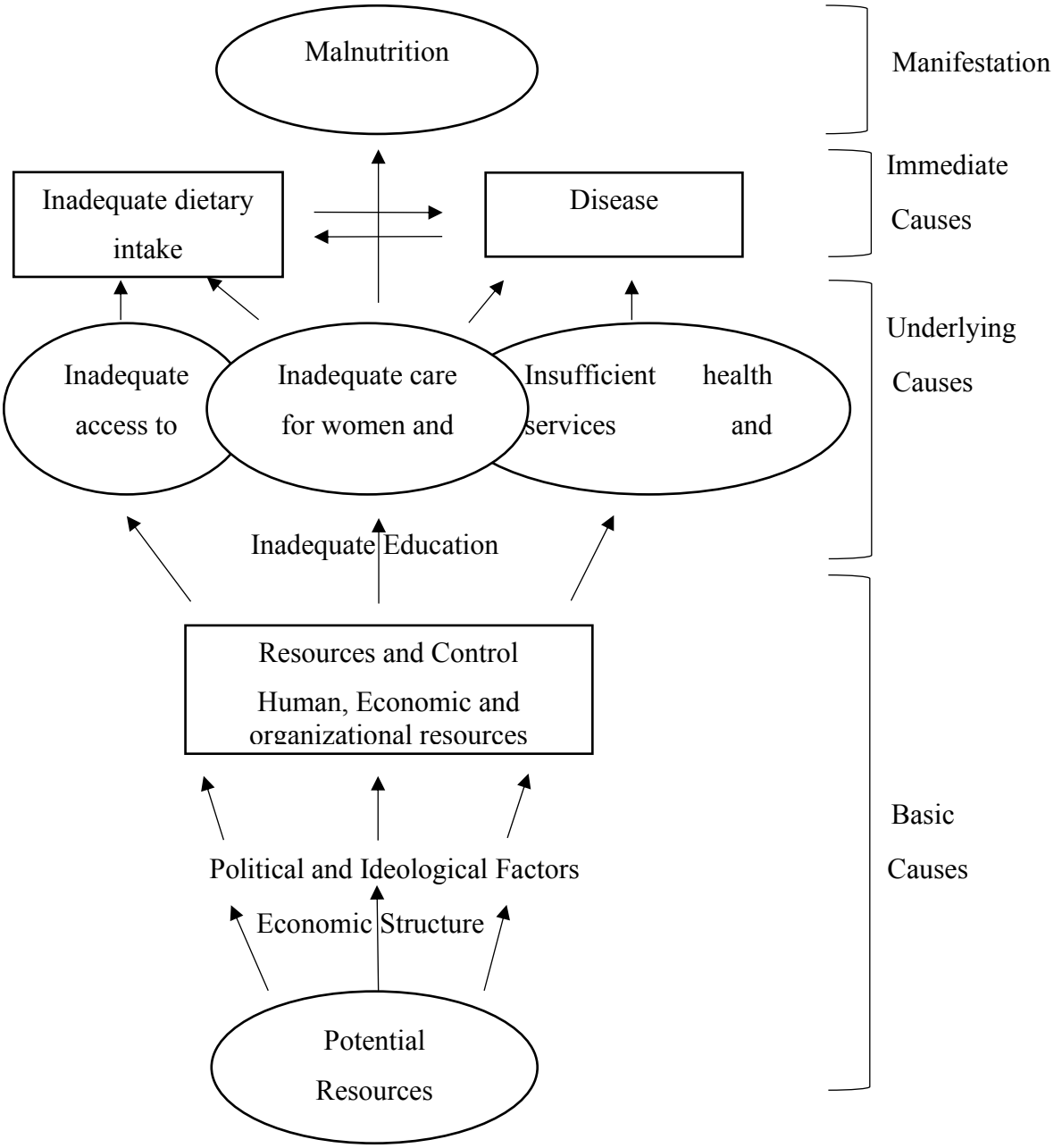

Fig 1.1: Conceptual framework on Undernutrition

(Source: UNICEF)

1.7 Limitations of the study

- Since the study being cross-sectional in nature, dietary patterns and nutritional status can be affected by seasonal variation.
- Due to limited resources, biochemical and clinical tests are excluded.

PART II

Literature review

2.1 Nutrition

The scientific discipline of nutrition examines how living things absorb and utilise nutrients for various purposes such as growth, reproduction, organ and tissue function, and energy production (Webster-Gandy *et al.*, 2020). The scientific discipline of nutrition examines how living things absorb and utilise nutrients for various purposes such as growth, reproduction, organ and tissue function, and energy production (Onís *et al.*, 1993).

2.2 Nutritional status

The state of the body with regard to food intake and utilisation is known as nutritional status. An individual's nutritional condition might range from good to poor. Eating a meal that is well-balanced and provides all the necessary nutrients to suit the body's needs is referred to as having good nutritional status. An insufficient or even excessive intake of nutrients or a poor utilisation of them to meet the body's needs are referred to as poor nutritional status (Joshi, 2015).

One of the best measures of population well-being is nutritional status. Anthropometry is particularly crucial during childhood and adolescence, even though there are other methods for assessing nutritional status, as growth can be sensitive to both excess and deficiency in nutrients, and it offers markers of both health risk and nutritional status (Mansur *et al.*, 2017).

2.3 Malnutrition

Malnutrition refers to an impairment of health resulting from deficiency, excess or imbalance of nutrients. It includes undernutrition and overnutrition (Joshi, 2015).

Numerous risk factors contribute to childhood malnutrition, and addressing these variables can significantly lower the number of cases in children. Frequent infections and limited availability to nutrient-dense diets are the two main causes of malnutrition. Interventions like deworming, food fortification, supplementation, school feeding programmes, and school-based nutrition education were implemented in response to the high incidence of diseases associated by malnutrition among children (Onís *et al.*, 1993).

2.4 Importance of nutrition in school age children

A child's consciousness and personality are developing at a crucial point during primary education, when a whole new world of insightful concepts and information become accessible to them. Children are naturally highly curious at this age, and primary education needs to support this trait (Sarma *et al.*, 2015).

Given that primary schools receive a majority of the young population and have the potential to minimize the deficiencies resulting from early childhood malnutrition in primary school students, they represent an excellent intermediate level for improving child nutrition (Pongutta *et al.*, 2022).

Children go through physical, mental, emotional, and social changes during school age, which is why it's regarded as a dynamic time of growth and development. That is, during the school-age years, the foundation for solid health and mentality is established (C *et al.*, 2022).

Unfortunately, school age nutrition has received a relatively low amount of scientific attention compared to other life stages. This is partly because of the misleading but widespread belief that early deficiencies in growth and development are irreversible. Over the past few years, voices from educational institutions, public health, and science have drawn attention to this period of life as a crucial and potentially last major window of opportunity for intervention with the objective of optimizing each person's ability to be a contributing member of society (Saavedra and Prentice, 2023).

2.5 Nutritional status indicators for children aged 5-10 years

Countries trying to assess the extent of the increasing public health crisis of childhood obesity have come to realise the necessity of a broadly applicable growth reference for older children and adolescents. The publication of the under-five growth criteria confirmed this necessity. The height-for-age and BMI-for-age tables from 2007 extend up to 19 years old, which is the WHO's upper limit for adolescence. For the benefit of nations that regularly measure only weight and would like to track growth throughout childhood, the weight-for-age charts are extended to 10 years. Because weight-for-age cannot distinguish between relative height and body mass, it is insufficient for tracking growth beyond childhood. For this reason, BMI-for-age is included here to complement height-for-age in determining

stunting (low height-for-age), overweight and obesity (high BMI-for-age), and thinness (low BMI-for-age) in school-aged children and adolescents (Onis *et al.*, 2007).The indicators for nutritional status for children aged 5-10 years are listed below:

- **Weight for age:** Weight-for-age measures a child's body weight in relation to their age on a certain day. This indicator does not identify a child as overweight or obese; rather, it determines if the child is underweight or seriously underweight. This indication is frequently employed because weight can be measured relatively easily, however it is not reliable when a child's age cannot be correctly determined, like in refugee situations. It's also important to remember that children may be underweight due to thinness, short stature (stunting), or both (WHO, 2008a).
- **Height for age:** Length/height-for-age measures the height or length obtained for the child's age at a particular visit. Children who are stunted (short) as a result of chronic undernutrition or repeated illness can be identified with the use of this indicator. It is also possible to identify children who are tall for their age; however, being tall is rarely a concern unless it is extreme and may reflect uncommon endocrine disorders (WHO, 2008a).
- **BMI for age:** An indication that is particularly helpful for screening for overweight and obesity is BMI-for-age. The weight-for-length/height chart and the BMI-for-age chart typically show results that are very similar (WHO, 2008a).

Table 2.1: Cut-off points for underweight, stunting, and thinness/obesity.

	Indicators		
Z-scores cut-offs	**Weight for age**	**Height for age**	**BMI for age**
< -3 SD	Severe underweight	Severe stunting	Severe thinness
< -2 SD	Moderate underweight	Moderate stunting	Moderate thinness
>+1 SD	-	Normal	Overweight
>+2 SD	-	Normal	Obesity

(WHO, 2019)

2.6 Forms of malnutrition in children aged 5-10 years

a. **Underweight:** It denotes weight for age less than minus two standard deviations (SD) of the WHO child growth standards median. Underweight is a composite indicator that might be difficult to interpret .However, Children who are underweight, even slightly underweight, have a higher risk of dying, while extremely underweight children have an even higher risk (WHO, 2019).
b. **Stunting:** It refers to height for age less than minus two SD of the WHO child growth standards median. Low height-for-age, or stunting, is a result of diseases and malnutrition that have been present since birth, or even earlier. Therefore, this measurement can be seen as an indicator of unfavourable environmental conditions or the persistent restriction of a child's growth potential (WHO, 2019).
c. **Overweight:** Prevalence of overweight in school-age children and adolescents is defined as the percentage of children aged 5–19 years with sex-specific BMI-for-age >+1 SD above the WHO 2007 reference median. The Global Nutrition Monitoring Framework's core set of indicators includes overweight as an intermediate outcome indicator for school-age children and adolescents (5–19 years old) (WHO, 2019).
d. **Thinness:** It refers BMI for age less than minus two SD of the WHO child growth standards median (WHO, 2019).

2.7 Assessment of nutritional status

Nutrition assessment has been defined by A.S.P.E.N. as "a comprehensive approach to diagnosing nutrition problems that uses a combination of the following: medical, nutrition, and medication histories; physical examination; anthropometric measurements; and laboratory data. Finding any particular nutrition risk or risks along with the evident presence of malnutrition is the goal of a nutrition assessment. A nutrition assessment provides the basis for a nutrition intervention (Mueller *et al.*, 2011). The nutritional status can be assessed by two methods: Direct Methods and Indirect Methods (Joshi, 2015).

1. Direct methods

(a) **Anthropometric methods:** Non-invasive quantitative measurements of the body are called anthropometric measurements. An important way to assess a child's or adult's nutritional condition is through anthropometry, according to the Centres for Disease

Control and Prevention (CDC). They are usually used in the paediatric population to assess the child's growth and developmental pattern, overall health status, and adequacy of nutrition. The core elements of anthropometry are height, weight, head circumference, body mass index (BMI), body circumferences to assess for adiposity (waist, hip, and limbs), and skinfold thickness (CD *et al.*, 2016).

(b) Biochemical methods: Malnutrition can be measured using a variety of biochemical tests, however the tests that work best in rural field conditions must be used. The requirements for collection, heating, and shaking in addition to the actual technique—which includes laboratory control using control sera—determine the accuracy of the biochemical tests (Joshi, 2015).

(c) Clinical methods: A clinical examination include evaluating the child's overall health as well as any relevant related diseases or illnesses. Evaluation of subcutaneous fat, muscle mass, and hydration can be instructive. Evidence of particular vitamin deficits may be found upon examination. One can identify certain vitamin deficiencies by looking at the hands, face, skin, and hair (Wiskin *et al.*, 2016).

(d) Dietary procedures: Diet surveys are a practical way to assess the energy intakes of groups of a population (Joshi, 2015). Ideal dietary assessment tools will be those that optimise precision, reduce workload for participants (parents, kids, teachers, and researchers), and solve or at least mitigate the issues that are particular to school-age children. A balance between quality and feasibility determines the most effective tool for dietary assessment. The 24-hour recall has the best quality-to-feasibility ratio, while the food frequency questionnaire has the highest feasibility, especially for large studies (Callahan, 2022).

2. Indirect methods

(a) Vital statistic: Malnutrition affects morbidity rates for many diseases (including tuberculosis), maternal and perinatal death rates, life expectancy, and other health statistics. These can be thought of as indirect indicators of the community's nutritional status (Joshi, 2015).

(b) Age-specific mortality rates: The incidence of pertinent types of malnutrition has been recorded using the mortality rates at particular age intervals. The infant mortality rate is said to be 30–50 times higher in underdeveloped countries between

the ages of one and four. This age group has significant nutritional needs and rapid growth, making it a sensitive time (Joshi, 2015).

(c) Morbidity and cause: It is advisable to seek out information about PEM. A comprehensive nutritional assessment of the community can be used to accomplish this. It is necessary to look for clinically recognisable syndromes such keratomalacia, nutritional marasmus, pellagra, and kwashiorkor (Joshi, 2015).

(d) Nutritionally relevant diseases: Malnutrition is the cause of morbidity and mortality in diseases like measles, TB, infectious diarrhoea, and tropical ulcers. It is crucial that death certificates specify severe malnutrition whenever it occurs in addition to the primary illness or cause of death (Joshi, 2015).

2.8 Nutritional requirement of 5-10 years old school children

Table 2.2: Nutrient requirement of children aged 5-10 years

NUTRIENTS	4-6 years	7-9 years	10-12 years	
			Boys	Girls
Energy (Kcal/d)	1360	1700	2220	2060
Protein (g/d)	15.9	23.3	31.8	32.8
CHO (g/d)	130	130	130	130
Calcium (mg/d)	550	650	850	850
Magnesium (mg/d)	155	215	270	255
Iron (mg/d)	11	15	16	28
Zinc (mg/d)	4.5	5.9	8.5	8.5
Thiamine (mg/d)	0.9	1.1	1.5	1.4
Riboflavin (mg/d)	1.3	1.6	2.1	1.9
Vitamin D (IU/d)	600	600	600	600

(Source: ICMR,2020)

2.9 Factors affecting nutritional status

Primary school children are more likely to be undernourished than preschool and secondary school children. Preschool undernutrition was substantially correlated with maternal work, having many siblings, having a high birth order, and having female children. Small-town living, having a large family, having a low monthly income, and having a working mother were all strongly associated with undernutrition in school-age children (Galgamuwa *et al.*, 2017).

Malnutrition has several different, deeply interconnected causes. Malnutrition in children is most likely to affect those who don't consume a diet sufficient in nutrients, aren't protected from frequent illnesses, and do not receive proper care. Malnutrition and ultimately maternal and child deaths are caused by a number of factors, including those related to housing, women's workload and decision-making opportunities, traditional beliefs and practices, and men's attitude toward child care (C *et al.*, 2022).

Primary acute malnutrition in children tends to occur in low- and middle-income nations and is caused by an inadequate food supply as a result of socioeconomic, political, and environmental causes. Household food insecurity poverty, low birth weight, low intrauterine growth restriction, poor nutrition for expectant mothers, inadequate supplemental feeding, frequent infectious diseases, poor water quality, poor hygiene, etc. are among the contributing causes. As a result, primary acute malnutrition is complex and primarily of social rather than biological origin. Usually occurring in the context of underlying, mostly chronic diseases like cystic fibrosis, chronic renal failure, chronic liver diseases, childhood malignancies, congenital heart disease, and neuromuscular diseases, secondary acute malnutrition is caused by abnormal nutrient loss, increased energy expenditure, or decreased food intake (Dipasquale *et al.*, 2020). Some of the factors that affect the nutritional status of primary school children aged 5-10 years includes:

a. Inadequate dietary intake: Children's eating habits and dietary intake have a big impact on how nutritious they are. One of the main causes of the rising rates of childhood malnutrition is inadequate and indiscriminate food intake (Galgamuwa *et al.*, 2017). Consuming insufficient and lack of nutritious food leaves the body deficient in energy, protein, and vitamins, which impacts growth, development, and resistance and causes a wide

range of illnesses. People then experience malnutrition and become subjected to the vicious cycle of malnutrition (Sah, 2008).

b. Immune function and infectious disease: Children's immune systems are weakened by inadequate nutritional intake, making them more susceptible to illnesses. Numerous investigations have verified that infections were frequently identified in children suffering from malnutrition. This link between infection and undernutrition creates a vicious cycle of recurrent sickness and declining nutritional condition (Galgamuwa *et al.*, 2017).

c. Socio-economic and demographic factors:

- Poverty: In lower economic levels, undernutrition is more prevalent, whereas in higher income groups, malnutrition is only found in milder forms (Bhutia, 2014). A family with a high income has the means to pay for additional health services and high-quality meals. Compared to children in higher income families, underweight children are more common in lower income categories (Galgamuwa *et al.*, 2017).
- Type and size of family: Compared to children in small households, children in large families had less access to food. The majority of young children are likely to be undernourished because larger families have a greater financial burden associated with food consumption (Galgamuwa *et al.*, 2017). Families with more children are more likely to suffer from poor nutritional status since they have to work harder to afford to eat. Poor nutritional status among several children may result from insufficient distribution of home resources (Asfaw *et al.*, 2015).
- Ethnic groups: An important factor influencing many areas of education and well-being is ethnicity. There is evidence of untouchability and caste discrimination in Nepal, as well as the impact of ethnicity on nutritional condition. Compared to non-Dalit children, a slightly larger percentage of Dalit children are underweight and stunted. Muslim and Terai caste children suffer more from malnutrition than hilly caste people (Sah, 2008). The improvement of the nutritional health status of children and adolescents from marginalised ethnic groups can be achieved through research and resource allocation towards recognising the underlying causes of health status disparities and creating interventions that are culturally relevant and have quantifiable results to address the issues (Bronner, 1996).

- Mother's education: The education of parents, particularly the mother, is essential for enhancing the nutritional status of the children. Children with illiterate mothers are more likely to be underweight and stunted (Chakraborty and Ghosh, 2020). A declined trend of child malnutrition is observed where the educational level of mothers increased. Mothers who are educated are better able to understand the nutritional value of food and the physical and mental development of their children (Galgamuwa *et al.*, 2017).

d. Child's characteristics

- Gender: The rates of underweight are the same for boys and girls, despite the fact that there is evidence of widespread discrimination against girls in the Terai region; however, the proportion of stunted boys is higher (Sah, 2008).
- Birth weight: Babies with low birth weights lack the nutritional reserves needed to grow to a healthy height. For these babies to accomplish normal height growth, extra nutrients are required because of their higher requirements. A short duration of breastfeeding would prevent the infant from getting enough energy, protein, and micronutrients from their diet to support appropriate height development (Esfarjani *et al.*, 2013).
- Birth order: Mothers in households with a large number of children did not have the time to care for and feed each child. Short intervals between pregnancies prevent the mother from regaining her health, which causes a low birth weight child, and frequent childbirth causes the earlier child to wean oneself from breast milk too soon (Bhutia, 2014). Birth order affects the attention of mothers to intra household activities and child care. Undernutrition was more common in children with higher birth orders (>3) than in those with lower birth orders. Programmes for family planning that encourage smaller families and longer gestational ages will lower the amount of undernourished children born to mothers with higher birth rates (Galgamuwa *et al.*, 2017).

e. Maternal characteristics: Maternal nutritional status has a direct relation to the child's nutritional status. An undernourished mother gives birth to a low birth weight baby who grows up with compromised feeding and infections to a stunted child and adolescent and carries this vicious life cycle approach by giving birth to an underweight child (Bhutia, 2014).

2.10 Causes of malnutrition in developing country

Malnutrition among school-age children in developing countries is a major global health issue that has a profound impact on the prospects and general well-being of these susceptible groups. The state of child malnutrition persists in developing nations, despite international efforts, with continuous hazards to children and adolescents and disparities in the situation. It represents a range of nutritional abnormalities that can significantly affect one's health and quality of life. Its difficulties pose a serious threat to human development generally, health, and educational achievement, making it difficult to achieve the Sustainable Development Goals (SDGs), especially those that deal with poverty reduction, education, and health (Amoadu *et al.*, 2024).

The nutritional state of an individual is determined by their dietary intake and how well their body uses those nutrients. The foundation for a child's long-term health, strength, and intellectual vibrancy is set throughout their primary school years, so nutrition is crucial. As such, it is a dynamic time for both their mental and physical development. Undernutrition is a serious global public health issue, especially in underdeveloped and developing nations (Rajak *et al.*, 2018).

Insufficiencies in any one of the three primary prerequisites for optimal nutrition—food, care, and health—lead to malnutrition in children of school age. Stunted school-age children most commonly experienced poor nutrition from an early age. Stunting in the preschool years can be lessened with the support of interventions for school-age children (Mwaniki and Makokha, 2013).

About 20–80% of students in primary schools are malnourished. Improving the general health of this age group segment requires an assessment of their nutritional state. By offering complete care for children's health and wellbeing during their school years, school health services contribute significantly to each child's development. Since education and health are closely linked, schools are among the best places to enjoy the benefits of health education. Prevention of health issues should be prioritized over treatment in health education (Shivaprakash and Joseph, 2014).

2.11 Dietary diversity

Dietary diversity is a qualitative indicator of food intake that represents household access to a variety of foods and serves as an indicator for an individual's diet's adequacy in terms of nutrients (Kennedy *et al.*, 2013). Dietary diversity can be divided into two categories: Individual Dietary Diversity (IDD) and Household Dietary Diversity (HDD). Household Dietary Diversity (HDD) is the number of food types a person consumed the day before at home. This dietary diversity is correlated with the household's socioeconomic status and does not include food that is bought and consumed outside the home. A person's individual dietary diversity (IDD) is the total number of food groups consumed by a person in the last 24 hours, whether at home or away from home. It provides insight into the nutritional value of a person's diet (Singh and Sharma, 2020).

Dietary variety instruments, also known as food variety scores or dietary diversity scores, are now regarded as the preferred method for researching dietary adequacy in developing nations. These scores take into account how many diverse foods or food types are included in the diet throughout a specific amount of time. They are useful since they can be easily collected and adjusted to a child's diet in a variety of situations. They are also connected with a number of anthropometric parameters in children. They've been employed to investigate food in both early infancy and maturity (Hooshmand and Udipi, 2013).

2.12 Measurement of dietary diversity

Depending on the purpose of the survey, the questionnaire can be employed at the individual or household level. One may collect data at the household or individual level using the Dietary Diversity Questionnaire. The goal and objectives of the survey have a role in determining the appropriate level at which to collect data. The preceding 24 hours are used as the reference period by FAO. One 24-hour recall period does not indicate a person's habitual diet. Rather, it offers an evaluation of the population's diet and can be helpful in tracking progress or focusing treatments. Other reasonable time periods for recall include the last three or seven days, or, in the case of particular items, the previous month (Kennedy *et al.*, 2013).

The Dietary Diversity Score (DDS) calculates an individual's intake of each food group during a specified time period. It is computed as the total number of food groups during a

specified time frame. According to the study, due to individual eating habits, the one- and three-day reference periods may not accurately reflect what is eaten in all subjects. Therefore, a longer reference period of seven to fifteen days may provide a more accurate assessment of dietary diversity (Singh and Sharma, 2020).

DDS is categorized into three categories, (1) Low Dietary Diversity Score (LDDS) - It is defined as the consumption of three or less than three food groups out of nine food groups. (2) Medium Dietary Diversity Score (MDDS) - It is defined as the consumption of at least four to five food groups out of nine food groups. (3) Adequate Dietary Diversity Score (ADDS) - It is defined as the consumption of six and more food groups out of nine food groups (Kennedy *et al.*, 2013).

A 24-hour dietary recall dataset was used to estimate the DDS. 16 food products were found to be recalled, and they were combined in accordance with the Food and Agriculture Organization of the United Nations/Food and Nutrition Technical Assistance Project (FAO/FANTA 2010) criteria (Sagbo and Kpodji, 2023). Nine dietary groups were established:

a. Starchy staples
b. Dark green leafy vegetables
c. Other vitamin A rich fruits and vegetables
d. Other fruits and vegetables
e. Organ meat
f. Meat and fish
g. Eggs
h. Legumes, nuts and seeds
i. Milk and milk products

2.13 Dietary diversity and nutritional status

In low- and middle-income countries, dietary diversity has been validated as an accurate indicator of dietary quality for infants and young children. Additionally, several studies have demonstrated a positive correlation between improved child growth outcomes and greater diversity of diets (Thorne-Lyman *et al.*, 2019).

It has been found that dietary diversity is highly correlated with the socioeconomic condition of the household. It has long been known that socioeconomic status affects child nutrition and health consequences. Because dietary diversity and nutritional status are closely related to household socioeconomic circumstances, interpreting relationships between them can be challenging. Families with greater incomes and resources tend to have more diverse diets (Arimond and Ruel, 2004).

A study on dietary diversity and nutritional status of urban primary school children in Iran and India concluded that children who were underweight typically scored lower than those who were overweight to a variety of food groups. The scores for pulses, dairy products, and non-vegetarian food items were positively correlated with height for age z-scores in both nations (Hooshmand and Udipi, 2013).

2.14 Disparities in nutritional status among primary school children between private and government schools

School-based comparative cross-sectional study between private and public schools was conducted in Hohoe municipality, Ghana to assess malnutrition and associated factors among kindergartens (3-5 years) and primary schools (6-12 years) students. The prevalence of stunting and thinness was found to be higher among public school students i.e. 11.6 and 7.9 % respectively whereas the prevalence of stunting and wasting among private school students were 2.8 and 1.4 % respectively. However, 9% of students attending private school and 3% of students attending public schools were overweight. The study concluded that students in both public and private schools frequently suffer from both undernutrition and overnutrition; however, overnutrition appears to be mainly caused by increased urbanisation and higher socioeconomic status. Furthermore, the study show that rural living and low socioeconomic status may hinder children's ability to obtain the most optimal nutrition possible. The study additionally supports the most significant risk factors for malnutrition, including as insufficient food intake and poor parental care (Faith *et al.*, 2016).

In Mysore city, a comparison of the nutritional status of students attending private and public primary schools was done. There were no obese children in government schools, however the proportion of underweight students was higher in government schools (32.5%) than in private schools (18.2%). Compared to government schools (0.2%), private schools had a greater percentage of overweight students (14.9%). In both government (40.2%) and

private (43.3%) schools, the prevalence of underweight students in the 6-7 years age group was high. Moreover, females were more likely to be underweight (36.3% in government and19.6% in private schools) than boys (28.8% in government schools and 16.7% in private). Private school students from higher socioeconomic classes had better nutrition than children from lower socioeconomic classes attending government schools (Nagaralu *et al.*, 2014).

In Ekiti State, Nigeria, a study titled "DIFFERENCES IN THE NUTRITIONAL STATUS OF YOUNG SCHOOL CHILDREN FROM PUBLIC AND PRIVATE OWNED PRIMARY SCHOOLS" reported that the rate of malnutrition was significantly higher in public schools than in private schools. The socioeconomic background, common food types in the area, food preparation and storage practices, and general environmental factors that may all have a role in the disparity in nutritional status between these two groups of schoolchildren. The results showed that while the majority of parents of students attending private schools had high incomes, those attending public primary schools typically have low incomes. In in another context, parents whose children attend private primary schools would be able to afford to buy their children foods that are nutrient-rich, but parents from lower-income families might not have the means to buy such foods for their children (J.A. *et al.*, 2013).

In Pyuthan Municipality, Nepal, a comparative study was conducted to evaluate the nutritional status of children aged 5 to 12 in government and private primary schools showed that the prevalence of underweight and stunting was higher in government schools (24% and 37.8% respectively) than in private schools (17% and 21% respectively); however, the prevalence of thinness and overweight was slightly higher in private schools (6% and 16% respectively) than in government schools (5.2% and 14.3% respectively). The study was aimed to investigate various factors related to the nutritional status of children. Caste/ethnicity, mother and father level of education, family annual income, and the use of folic acid, iron, and vitamin D by the mother during her pregnancy were found to be strongly correlated with the nutritional status of children attending government schools. Similarly, the nutritional status of children attending private schools was substantially correlated with factors such as gender, household size, father's education, mother's education, and the child's post-illness treatment. The total analysis concludes that socioeconomic status is a significant

underlying factor that either directly or indirectly contributes to childhood malnutrition (Bohara and Bhusal, 2017).

The study carried out to assess the nutritional status and to determine the risk factors for malnutrition among primary school children (5-11 years) attending schools of government and private sectors showed prevalence of underweight is 26.5%. It is more among government school children (66.0%) than private school children (44.0%). The prevalence of stunting is 19.2%. It is more among government school children (74.6%) than private school children (25.4%). Malnutrition was significantly more among government school children than private school children (C *et al.*, 2022).

Children attending private schools received more nutritious food than those attending government schools. Children attending government schools showed a higher percentage of wasting compared to those attending private schools (57.1% and 42.9%, respectively). The majority of students at government schools were stunted. Children attending government schools were more likely than those attending private schools to be stunted and thin (Sana *et al.*, 2017).

Indicators of chronic undernutrition, such as the HAZ evaluation, reveal that students in private schools do better than their public school's counterparts, where the rate of stunting nearly triples that of private school subjects. Although the socioeconomic condition of the parents of the students in the private schools was not included in this study, it is possible that the subjects from the private schools had a superior nutritional status than the general population. It is a common practice in the Southwest Nigeria for the rich to enrol their wards in the private schools, leaving the often time poorly funded public schools for the children of the poor. According to recent data, students from private schools that do not participate in the NHGSFP appear to have higher nutritional status than students from public schools where the program has been running for almost five years (Obembe *et al.*, 2024).

According to study by Tebeje *et al.* (2022) stunting in school-age children was independently predicted by child age, food insecurity, hand washing, and being wasted in the research area. The research area's school-age children's underweight was determined by an open waste disposal system and older child age, while wasting was significantly influenced by child age and food insufficiency.

PART III

Materials and methods

3.1 Research design

A cross-sectional descriptive study was conducted on Kamal rural municipality to assess the disparities in nutritional status and dietary diversity among primary school children between private and public schools using semi-structured interview and anthropometric measurement.

3.2 Study area

Study was done in two public and three private schools of Kamal rural municipality in Jhapa district. According to the rural municipality data, it has seven wards and covers an area of 104.59 sq.km. It lies at latitude of 26.60^0N and 87.76^0E.

3.3 Study variables

Study variables were categorized into two groups as dependent variables and independent variables.

- **Dependent variables:** The dependent variables for the study were the nutritional status of school children as indicated by underweight, stunting, thinness and overweight.
- **Independent variables:** The independent variables for the study were child characteristics (age, gender, birth order, birth weight, physical activity), socio-economic and demographic variables (head of household, ethnicity, family income, size, occupation, source of food, number of family members), environmental characteristics (water supply, toilet facility) and dietary habits (skipping of meal, food frequencies, food habit related variables (veg/non-veg), number of meals in a day, dietary diversity scores).

3.4 Target population

The targeted population was primary level school children aged 5-10 years from both private and public schools in Kamal rural municipality. Parents or caretakers were also targeted for the assessment of different factors associated with nutritional status.

3.5 Criteria for sample selection

a. **Inclusion criteria**: Students present at the day of survey, studying in either private or public school in primary level between the age of 5-10 years.

b. Exclusion criteria: All the students who were absent at the day of survey and students not under the age criteria of 5-10 years.

3.6 Sample size calculation

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

Sample Size (n) = $z^2 \times P (1-P)/d^2$ (Bohara and Bhusal, 2017)

where,

n is the sample size

Z is the statistic corresponding to level of confidence (standard value of 1.96)

P is expected prevalence

d is precision (standard value of 0.07)

Here, p was estimated on the basis of research conducted in primary school children in Pumdi Bhumdi village of Kaski district. The reason to select the data from the study is that, it is closely related to this thesis work and is the latest available research similar to this work. The result obtained from the study showed that 35.4% primary school students were underweight (Banstola and Acharya, 2015). Thus, this 35.4% was taken as the estimated prevalence of malnutrition (P) for the calculation of sample size for this study.

Now,

$n = 1.96^2 \times 0.354 \times (1 - 0.354) / (0.07)^2$

$= 179.28 \simeq 179$

In Kamal rural municipality, the total population of children between aged 5-10 years was 4792 according to census report 2080. Thus, by applying finite population sample formula, new sample size was obtained to conduct survey in the study area.

The sample size was adjusted for finite population.

New sample size (N) = n / [1+ (n - 1)/Pop]

where,

n = Sample size in infinite population

Pop = total number of population (here total number of children aged 5-9 years)

The new sample obtained was 172 from the calculation. The actual sample size was determined by adding 10% non-response rate on calculated sample size and was found to be 189. Here 189 samples so selected was divided into two halves. 95 samples from government school and 95 students from private school were selected as sample.

3.7 Sampling technique

A cross-sectional descriptive study was conducted in Kamal rural municipality, Jhapa. The selection of Kamal rural municipality was carried out using purposive sampling. Two out of seven wards were selected by simple random sampling method. From two wards two government and three private schools were selected randomly. The number of students from both private and government schools was selected on the basis of their respective proportions. Then, the students were selected from each class by using lottery method by drawing out the roll numbers of students.

3.8 Research instruments

Following instruments were used for the survey:

- Weighing balance: Weighing balance manufactured by Microlife Pvt. Ltd, with the capacity of 180 kg and having the least count of 0.1 Kg (1 piece) was used.
- Stadiometer: Stadiometer was used to measure height with a capacity of 197 cm and has the least count of 0.1 cm.
- Questionnaire: A structured and pretested set of questionnaires were used to collect information on socio-economic and demographic data, household characteristics, and child characteristics.
- Food frequency questionnaire and 24-hour dietary recall data sheet: A well designed food frequency table along with 24-hour dietary recall sheet to study the food consumption pattern, nutrient intake and dietary diversity scores of the children under study.
- Measuring cups: Standardized cups (glass and bowls) and photos of different foods were used for 24-hour dietary recall.

3.9 Pre-testing

The supervisor examined the set of questionnaires prepared. The study site was then visited and students along with their caretakers were then asked to pre-test the tool's practicality. This made it easier to understand the questions, estimate how long each set of questions would take, and see how the anthropometry standardization processes worked. To create the final set of questionnaires, all the misleading questions were removed and corrected before being administered in the actual study.

3.10 Validity and reliability of research

The data collection instruments were validated in order to determine the level to which they measure the expected results. By comparing the information our weighing balance produced with standard weights, the validity of the balance was determined. By comparing the measurement from our stadiometer with UNICEF's stadiometer, the validity of the stadiometer was determined. Prior to gathering data, a detailed analysis was conducted to see whether the questionnaires and research tools matched with the study's goals. In order to ensure validity, the questionnaire was also pre-tested before data were collected. The questionnaire's completeness, consistency, and clarity were examined every day together with the food frequency questionnaire.

3.11 Data collection techniques

Primary data was collected using a semi-structured questionnaire that included the anthropometry measurement children, general survey of the situation of the household the children belongs and dietary assessment of the primary level school children using food frequency questionnaire and 24-hour dietary recall. Parents and other caregivers of the children were interviewed in order to complete the questionnaire. Information was gathered by contacting parents directly.

Anthropometric measurements were taken with help of weighing balance and stadiometer as below:

Height: Children having braids or hair ornaments that will interfere with length/height measurements was removed before weighing to avoid delay between the measurements. The child was asked to stand on the baseboard with feet slightly apart. The back of the head, shoulder blades, buttocks, calves, and heels should all touch the vertical board. The trunk was balanced over the waist, i.e., not leaning back or forward. The mother was asked to hold the child's knees and ankles to help keep the legs straight and feet flat, with heels and calves touching the vertical board. The child's head was positioned so that a horizontal line from the ear canal to the lower border of the eye socket runs parallel to the baseboard. To keep the head in this position, the bridge between thumb and forefinger was hold over the child's chin. Still keeping the head in position, another hand was used to pull down the headboard to rest firmly on top of the head and compress the hair. The measurement was taken and the child's height was recorded in centimetres to the last completed 0.1 cm (WHO, 2008b).

Weight: The scale was placed on a flat, hard, even surface. Mother was asked to help the child remove shoes and outer clothing and the child was asked to stand still. The child was requested to stand in the middle of the scale, feet slightly apart on the footprints marked, and to remain still until the weight appears on the display. The process was repeated for three times for consistency (WHO, 2008b).

Dietary assessment: Dietary intake data was collected using 24-hour dietary recall and food frequency questionnaire. 24-h recall method was used to get exact information on the respondent's exact food intake during the previous 24-h period or preceding day. The food frequency questionnaire was used to obtain information on the type of foods usually consumed by the respondents and the frequency of consumption of those foods. Dietary

diversity score (DDS) was estimated according to a single 24-hour dietary recall and was calculated by simply counting of food groups an individual has consumed over 24 hours. Individuals consuming 3 or less than 3 food groups were having low DDS, consuming at least 5 food groups were having medium DDS and consuming 6 and more food groups were having high DDS.

3.12 Data analysis

The obtained data was analysed by the following ways:

- Firstly, the data was checked for its consistency and completeness.
- Then the data was coded and entered into the computer using statistical software (IBM SPSS) and WHO Anthroplus 1.0.4.

Descriptive analysis was used to describe the percentage and distribution of respondents by socio-economic and demographic variables, physical activity, dietary habits and patterns, child characteristics, and environmental characteristics. The nutritional status was measured with reference to WHO Standards and anthropometric indices classified according to standard deviation units (z-scores), based on the WHO criteria. From the data collected from dietary recall, gram equivalents of those foods consumed were first calculated which were converted into nutrient intake by using 'Food composition table for Nepal by DFTQC'. Energy and nutrient intake of the adolescents were compared with requirements for children aged 5-10 as provided by ICMR (2020). The chi-square test and fisher – exact test was applied to test the association between the nutrition status and its associated factors.

3.13 Ethical consideration

This research study was conducted with the permission received from the Department of Nutrition and Dietetics, Central Campus of Technology along with the approval obtained from Kamal rural municipality. Permission was obtained from the school administration. An informed consent was obtained from the parents, guardians and teachers clearly explaining the purposes and procedures before including children in the study. The privacy of the participants was safeguarded ensuring that individual data is kept confidential. No information from the study was given or disclosed to an unauthorized person external to the team implementing the study.

PART-IV

Result and discussion

A cross-sectional descriptive study was conducted to assess the nutritional status of primary school children in Kamal rural municipality, Jhapa. The results and findings of the study are expressed into several following headings. The cross tabulation between underweight, stunting, thinness/overweight and different factors influencing nutritional status of children is given in Appendix G.

4.1 Child characteristics

Out of 190 children surveyed, 95 were from private school and 95 were from public school. Among 95 students surveyed from private school, 47 (49.5%) were male and 48 (50.5) were female whereas, in public school, 55 (57.9%) were male and 40 (42.1%) were female. Students surveyed were categorized in two age groups as given by WHO that included early middle childhood (5-7) years and late middle childhood (8-10) years. 63.2% and 36.8% of surveyed students from private school were within an age range of (5-7) years and (8-10) years respectively. Similarly, 57.9% and 42.1% of surveyed children from public school were within an age range of (5-7) years and (8-10) years respectively. About 10.5% of children from private school and 25.3 % of children from public school were less than 2.5kg at birth whereas 89.5% of children from private school and 74.7% of children were more than 2.5kg at birth.

Among 95 students surveyed from private school, 51.6%, 43.2%, 4.2% and 1.1% were first, second, third and fourth or above child respectively. Among 95 students surveyed from public school, 49.5%, 33.7%, 11.6% and 5.3% were first, second, third and fourth or above child respectively. In private school, 24.2% had no siblings, 62.1% had one sibling, 11.6% had two siblings, 2.1% had three siblings and more. Likewise, in public school 23.2% had no siblings, 53.7% had one sibling, 18.9% had two siblings, 4.3% had three and more siblings. 23.2% students from private school and 20% from public school were engaged in physical activity for less than an hour. 76.8% from private school and 80.0% from public were engaged in physical activity for more than an hour. 86.3% from private school and 75.8% from public school students were participating in sports organized in their school whereas 13.7% in private and 24.2% in public school did not.

Table 4.1: Child's general characteristics of the studied population (n=190)

Variables	Private School		Public School	
	Frequency	Percent	Frequency	Percent
Gender of Student				
Male	47	49.5%	55	57.9%
Female	48	50.5%	40	42.1%
Age Category				
(5-7) years	60	63.2%	55	57.9%
(8-10) years	35	36.8%	40	42.1%
Birth weight of child				
Less than 2.5kg	10	10.5%	24	25.3%
2.5kg and more	85	89.5%	71	74.7%
Birth order of child				
1	49	51.6%	47	49.5%
2	41	43.2%	32	33.7%
3	4	4.2%	11	11.6%
4 or above	1	1.1%	5	5.3%
Number of siblings				
0	23	24.2%	22	23.2%
1	59	62.1%	51	53.7%
2	11	11.6%	18	18.9%
3 and more	2	2.1%	4	4.3%
Engagement in physical activity				
Less than 1 hour	22	23.2%	19	20%
More than 1 hour	73	76.8%	76	80.0%
Participation in sports organized				
Yes	82	86.3%	72	75.8%
No	13	13.7%	23	24.2%

Table 4.2: Child health characteristics of the studied population (n=190)

Variables	Private School		Public School	
	Frequency	Percent	Frequency	Percent
Exclusively breastfed				
Yes	61	64.2%	58	61.1%
No	34	35.8%	37	38.9%
Breastfeeding for two years				
Yes	84	88.4%	83	87.4%
No	11	11.6%	12	12.6%
Vitamin A and deworming tablets				
Within a month	5	5.3%	2	2.1%
Within six months	59	62.1%	56	58.9%
Within a year	14	14.7%	15	15.8%
Before 1 year	15	15.8%	20	21.1%
Not aware	2	2.1%	2	2.1%
Any recent health check-up				
Yes	27	28.4%	14	14.7%
No	68	71.6%	81	85.3%
Any recent illness or infection				
Yes	20	21.1%	23	24.2%
No	75	78.9%	72	75.8%
Child allergic to any foods				
Yes	1	1.1%	8	8.4%
No	94	98.9%	87	91.6%
Nutritional supplements				
Yes	23	24.2%	17	17.9%
No	72	75.8%	78	82.1%

Table 4.2 shows among 95 caretakers surveyed from private school, 64.2% of children were found to be exclusively breastfed for 6 months whereas 35.8% were not breastfed exclusively. Similarly, among public school children, 61.1% were exclusively breastfed whereas 38.9% were not. 84 children from private school had continued breastfeeding for 2 years whereas 11 had discontinued before the age of 2 years. 83 students from public school had breastfeeding for 2 years whereas 12 had not.

5 (5.3%) students from private school had taken vitamin A and deworming within a month, 59 (62.1%) students had taken within six months, 14 (14.7%) had within a year and 15 (15.8%) had taken before 1 year. Similarly, in public school, 2 (2.1%) had taken deworming tablets within six months whereas 56 (58.9%), 15 (15.8%) and 20 (21.1%) had within six months, within a year and before 1 year respectively. In both schools, 2.1% of surveyed caretakers were not aware about the time that their children had taken vitamin A and deworming tablets lately.

Also, 27 students from private school and 14 students from public school recently had their health check-up and 68 from private and 81 from public did not have any health check-up recently. 21.1% of students from private school and 24.2% from public school had suffered from illness and infection recently. Out of total surveyed students, only 1 student from private school and 8 students from public school had food allergy. 23 (24.2%) students from private school and 1 (17.9%) from public school were taking nutritional supplements.

4.2 Socio demographic characteristics

The table below shows the socio-demographic characteristics of the surveyed students. Most of the children from both private and public school were *Hindus*. 85 (89.5%) from private and 74 (77.9%) from public school were *Hindus*. 3 (3.2%), 4 (4.2%) and 3 (3.2%) from private and 3 (3.2%), 6 (6.3%) and 12 (12.6%) from public school were *Buddhist, Christian and Kiranti* respectively. Majority of surveyed students from private school were *Chhetri* (38%) whereas majority of students surveyed from public school were *Janajati* (24.2%). 7.4%,13.7%, 13.7%, 1.1%, 8.4% and 15.8% students from private school were *Brahmin, Janajati, Dalit, Santhal, Madhesi* and *Newar*. Likewise in public school, 10.5% were *Brahmin*, 15.8% were *Chhetri*, 12.6% were *Dalit*, 15.8% were *Santhal*, 7.4% were *Madhesi* and 13.7% were *Newar*.

Table 4.3: Socio-demographics characteristics of studied population (n=190)

Variables	Private School		Public School	
	Frequency	**Percent**	**Frequency**	**Percent**
Religion				
Hindu	85	89.5%	74	77.9%
Buddhist	3	3.2%	3	3.2%
Christian	4	4.2%	6	6.3%
Kiranti	3	3.2%	12	12.6%
Caste				
Brahmin	7	7.4%	10	10.5%
Chhetri	38	40.0%	15	15.8%
Janajati	13	13.7%	23	24.2%
Dalit	13	13.7%	12	12.6%
Santhal	1	1.1%	15	15.8%
Madhesi	8	8.4%	7	7.4%
Newar	15	15.8%	13	13.7%
Type of family				
Nuclear family	49	51.6%	57	60.0%
Joint family	46	48.4%	38	40.0%
Head of the household				
Father	23	24.2%	34	35.8%
Mother	37	38.9%	34	35.8%
Grandparents and others	35	36.8%	27	28.5%
Family members				
Below 5 members	59	62.1%	48	50.5%
5 members and above	36	37.9%	47	49.5%

Out of 95 children surveyed from private school, 49 (52.6%) were from nuclear family and 46 (48.4%) were from joint family. 57 (60.0%) whereas 57 (60%) out of 95 students surveyed from public school were from nuclear family and 62 (65.3%) were from joint family.

23 (24.2%) from private and 34 (35.8%) from public school were from family with the head being the father. Similarly, 37 (38.9%), 35 (36.8%) from private and 34 (35.8%), 27 (28.5%) from public school were from family where the head was mother and grandparents or others respectively.

59 (62.1%) from private and 48 (50.5%) from public school were from family having family members less than national average family size (4.37) whereas 36 (37.9%) from private and 47 (39.5%) from public school were from family having members more than national average.

Table 4.4: Frequency distribution of education level of parents (n=190)

Variables	Private School		Public School	
	Frequency	Percent	Frequency	Percent
Father's education level				
Primary and informal	24	25.3%	41	44.1%
Secondary	41	43.2%	29	31.2%
Higher secondary and above	28	29.5%	12	12.9%
Illiterate	2	2.1%	11	11.8%
Mother's education level				
Primary and informal	18	18.9%	46	48.4%
Secondary	45	47.4%	27	28.4%
Higher secondary and above	30	31.6%	11	11.6%
Illiterate	2	2.1%	11	11.6%

From the study, maximum number of fathers of private school children had gained secondary level education (43.2%) followed higher secondary and above with 29.5% and then after primary and informal (25.3%) and lastly 2.1 % were illiterate. Similarly, maximum number of fathers of public school's children had gained primary level and informal

education (44.1%) followed by secondary level (31.2%), higher secondary and above (12.9%) and 11.8% were illiterate. Majority of mothers of children from private school had gained secondary level education (47.4%) followed by higher secondary level and above (31.6%), primary and informal (18.9%) and 2.1% were illiterate. Likewise in public school majority of mothers had gained primary level/informal education (42.1%) followed by secondary (28.4%). 11.6% mother of public school's children had gained higher secondary and above level education and 11.6% were illiterate.

Table 4.5: Frequency distribution of economic characteristics of studied families (n=190)

Variables	Private School		Public School	
	Frequency	Percent	Frequency	Percent
Father's Occupation				
Agriculture	12	12.6%	25	26.3%
Business	10	10.5%	1	1.1%
Foreign employment	54	56.8%	31	32.6%
Daily labor and others	2	2.1%	33	34.7%
Service	17	17.9%	5	5.3%
Mother's Occupation				
Agriculture	63	66.3%	58	61.1%
Homemaker	23	24.2%	19	20.0%
Foreign employment	2	2.1%	2	2.1%
Daily labour and others	0	0.0%	3	3.2%
Service	7	7.4%	13	13.7%
Monthly income of family				
Less than 30,000	36	37.9%	47	49.5%
30,000 and more	59	62.1%	48	50.5%

Table 4.5 shows the major occupation of parents of students surveyed from which it was found that most of the fathers of children studying in private school had gone for foreign employment (56.8%) and least percentage of their fathers were daily labourers and others

(2.1%). Similarly, 12.6%, 10.5% and 17.9% were farmers, businessman and were engaged in service respectively. In public school, majority of fathers of children were daily labourers (34.7%). 32.6% had gone for foreign employment, 26.3% were farmers, 1.1%were businessman, and others, and 5.3% were engaged in service.

Likewise, the table also shows the major occupation of mothers of students studying in both private and public school. Out of 95 students surveyed from private school, majority of mothers of children were engaged in agriculture (66.3%), 24.2% were housewives, 2.1% had gone for foreign employment and 7.4% were engaged in services. Likewise, in public school, majority of mothers were engaged in agriculture (61.1%), 20% were housewives, 13.7% were engaged in services, 3.2% were daily labourers and others and 2.1% had gone for foreign employment.

This table also shows the monthly income and expenditure of families of children in both private and public school. 37.9% students from private and 49.5% from public school were belonging from family with monthly income less than 30000 whereas 62.1% from private school and 50.5% from public school were from family with monthly income 30000 and more than 30000.

4.3 Environmental condition

The table below shows that 74 (77.9%) students from private school and 67 (70.5%) from public school were from household producing their food themselves while 21 (22.1%) from private school and 28 (29.5%) from public school were from household purchasing their food from market. 84 (88.4%) students from private and 70 (73.7%) from public school had kitchen garden in their house whereas 11 (11.6%) from private and 25(26.3%) from public school did not have kitchen garden in their house.

Majority of children from both private and public school were having tube well as the main source of water which was found to be 72.6% and 83.2% respectively.16 (16.8%) students from private school and 12 (12.6%) students from public school had water tap as source of drinking water and 10 (10.5%) from private school and 4 (4.2%) from public school had both tube well and water tap as water source. 75 (78.9%) students from private school and 62 (65.3%) students from public school were having purified water whereas 20 (21.1%) from private and 33 (34.7%) from public school didn’t purify water. 93(97.9%)

students from private school and 91 (95.8%) students from public school were having iodized salt and 2 (2.1%) students from private and 4 (4.2%) students from public school were not having iodized salt. All the household surveyed from private school and public school had access to toilet facility.

Table 4.6: Frequency distribution of environmental characters of studied families (n=190)

Variables	Private School		Public School	
	Frequency	Percent	Frequency	Percent
Main source of food in family				
Own production	74	77.9%	67	70.5%
Purchased from market	21	22.1%	28	29.5%
Kitchen garden in house				
Yes	84	88.4%	70	73.7%
No	11	11.6%	25	26.3%
Source of drinking water in family				
Tube well	69	72.6%	79	83.2%
Water tap	16	16.8%	12	12.6%
Both	10	10.5%	4	4.2%
Water purification				
Yes	75	78.9%	62	65.3%
No	20	21.1%	33	34.7%
Use of iodized salt				
Yes	93	97.9%	91	95.8%
No	2	2.1%	4	4.2%
Toilet facility in house				
Yes	95	100.0%	95	100.0%
No	0	0.0%	0	0.0%

4.4 Awareness on malnutrition

Table 4.7: Frequency distribution on knowledge of caretakers (n= 190)

Variables	Private School		Public School	
	Frequency	Percent	Frequency	Percent
Know about malnutrition?				
Yes	58	61.1%	40	42.1%
No	37	38.9%	55	57.9%
If yes, what causes malnutrition				
Imbalance of nutrients	2	2.1%	0	0.0%
Lack of food	44	46.3%	31	32.6%
Lack of food and unhygienic food practice	3	3.2%	2	2.1%
Over eating	1	1.1%	0	0.0%
Unhygienic food practices	8	8.4%	7	7.4%

The table shows the knowledge of respondents regarding malnutrition which shows that 58 (61.1%) students from private school and 40 (42.1%) from public school were from family whose members were known about malnutrition whereas 37 (38.9%) respondents from private school and 55 (57.9%) respondents from public school were not aware about malnutrition. Similarly, majority of respondents from both private and public school responded that lack of food could be the cause of malnutrition whereas the 2.1% from private school responded malnutrition could be caused due to imbalance of nutrients, 3.2% from private and 2.1% from public responded lack of food and unhygienic food practices both could be the reason for malnutrition, 1.1% respondents from private school mentioned overeating was the cause for malnutrition and 8.4% of respondents from private school and 7.4% of respondent from public school responded that unhygienic food practices were the cause for malnutrition.

4.5 Dietary habits and behaviour

This table shows the number of meals and snacks that students consumed in a day. 4 (4.2%) students from private school and 2 (2.1%) students from public school were consuming only

1 meal in a day whereas 91 (95.8%) from private and 93 (97.9%) from public were consuming two meals per day. Likewise, majority of students from both private and public school were consuming three snacks per day that accounted for 64 (67.4%) students in private school and 73 (76.8%) students in public school. 18 (18.9%) students from private and 20 (21.1%) students from public school were consuming two snacks a day and 13 (13.7%) students from private and 2 (2.1%) students from public school were consuming only one snack per day.

Table 4.8: Frequency distribution of meals consumed by surveyed students (n=190)

	Private School		**Public School**	
Variables	**Frequency**	**Percent**	**Frequency**	**Percent**
Meals consumed in a day				
1	4	4.2%	2	2.1%
2	91	95.8%	93	97.9%
Snacks consumed in a day				
1	13	13.7%	2	2.1%
2	18	18.9%	20	21.1%
3	64	67.4%	73	76.8%

Table 4.9 shows that out of 95 students surveyed from each private and public school, only 5 (5.3%) from private school and 4 (4.2%) students from public school were vegetarian whereas 90 (4.7%) students from private and 91 (95.8%) from public school were non-vegetarian. 35 (36.8%) students from private and 25 (26.3%) from public school skipped meal but 60 (63.2%) students from private and 70 (73.7%) from public school were not skipping any meal. Majority of students from both private and public schools skipped breakfast that represented 28.4% in private and 14.7% in public school. 8 (8.4%) students from private and 11 (11.6%) students from public school skipped other meals that was either snacks or lunch or dinner. A study by Koabar *et al.* (2018) 94.2% of the studied sample skipping meals with 50.8% skipping breakfast. A study conducted in Baden-Württemberg, Germany reported that 13.1% of primary school students were skipping breakfast (Kesztyüs *et al.*, 2017).

26 (27.4%) students from private school and 11 (11.6%) were skipping their meal for five days and more whereas 7 (7.3%), 2 (2.1%) students from private and 12 (12.6%), 2 (2.1%) students from public school were skipping meals for three to four days a week and for once to twice a week respectively. 90 (94.7%) students from private school and 1 (1.1%) student from public school were consuming home based meal at lunch break and 5 (5.3%) students from private and 94 (98.9%) students from public school were consuming snacks from cafeteria at lunch break.

Table 4.9: Frequency distribution of dietary habits of surveyed students (n=190)

Variables	Private School		Public School	
	Frequency	**Percent**	**Frequency**	**Percent**
Are you a vegetarian?				
Yes	5	5.3%	4	4.2%
No	90	94.7%	91	95.8%
Skipping meal				
Yes	35	36.8%	25	26.3%
No	60	63.2%	70	73.7%
Type of meal skipped				
Breakfast	27	28.4%	14	14.7%
Others	8	8.4%	11	11.6%
Frequency of skipped meal				
Once or twice a week	2	2.1%	2	2.1%
Three to four times a week	7	7.3%	12	12.6%
Five or more days	26	27.4%	11	11.6%
Consumption at lunch break				
Home based meal	90	94.7%	1	1.1%
Snacks from cafeteria	5	5.3%	94	98.9%

4.6 Dietary diversity score

Table 4.10: Frequency distribution of IDDS categories of studied children (n=190)

IDDS categories	Private School		Public School	
	Frequency	Percent	Frequency	Percent
Low	30	31.6%	44	46.3%
Medium	58	61.1%	50	52.6%
High	7	7.4%	1	1.1%

30(31.6%) students from private and 44(46.3%) students from public school had low dietary diversity score (3 and less). 58(61.1%) from private and 50(52.6%) from public school had medium dietary diversity score (5 and less) and 7(7.4%) from private and 1(1.1%) from public school had high DDS (6 and more). A study by Kalagi *et al.* (2024) reported the majority of children from both urban and rural areas (64% and 69.7%, respectively) had moderately diverse diets. 6.9% from urban and 4.8% from rural had good dietary diversity.

Table 4.11: Average and dispersion of DDS of studied population (n=190)

	Private School			Government School		
	Minimum	Maximum	Mean ± SD	Minimum	Maximum	Mean ± SD
DDS	2	7	4.08 ± 0.996	1	6	3.66 ± 1.017

The mean dietary diversity among children in private school was found to be 4.08 ± 0.996 with the minimum of 2 and maximum of 7. Likewise, the average dietary diversity score of children in public school was 3.66 ± 1.017 with minimum of 1 and maximum of 6. Children attending public primary schools had a mean (±SD) DDS intake of 4.27 (±1.47) (Ouedraogo *et al.*, 2024).

4.7 Consumption of food groups

Out of 95 students surveyed from private school all students were having cereals daily. Likewise in public school, all 95 surveyed students were having cereals daily.

Table 4.12: Frequency of weekly consumption of different food groups (n=190)

Variables	Private School				Public School			
	Daily	3-4 times a week	Once a week or less	Never	Daily	3-4 times a week	Once a week or less	Never
Pulses and Legumes	76	18	0	1	61	30	3	1
	80.0%	18.9%	0.0%	1.1%	64.2%	31.6%	3.2%	1.1%
Milk and milk products	61	21	10	3	31	22	28	14
	64.2%	22.2%	10.5%	3.2%	32.6%	23.2%	29.5%	14.7%
Green leafy vegetables	8	43	23	21	11	39	29	16
	8.4%	45.3%	24.2%	22.1%	11.6%	41.1%	30.5%	16.8%
Other vegetables	8	52	16	19	16	62	6	11
	8.4%	54.7%	16.8%	20.0%	16.8%	65.3%	6.3%	11.6%
Fruits	21	30	43	1	0	16	78	1
	22.1%	31.6%	45.3%	1.1%	0.0%	16.8%	82.1%	1.1%
Egg, meat and fish	5	52	33	5	7	44	40	4
	5.3%	54.7%	34.7%	5.3%	7.4%	46.3%	42.1%	4.2%
Tea and coffee	60	7	8	20	79	6	1	9
	63.2%	7.4%	8.4%	21.1%	83.2%	6.3%	1.1%	9.5%
Fast food, packaged foods	37	32	24	2	38	26	31	0
	38.9%	33.7%	25.3%	2.1%	40.0%	27.4%	32.6%	0.0%
Carbonated beverages	3	23	68	1	2	11	69	13
	3.2%	24.2%	71.6%	1.1%	2.1%	11.6%	72.6%	13.7%

76 (80%) of students from private and 61 (64.2%) of students from public school were consuming pulses and legumes daily whereas 18 (18.9%) from private and 30 (31.2%) from public were consuming 3-4 times a week. 3 (3.2%) students from public school were consuming pulses and legumes once a week and 1 (1.1%) student from both type of school were not consuming pulses and legumes at all.

The consumption of milk and milk products was more common in private school as compared to that of public school. 61 (64.2%) students from private school and 31 (32.64%) from public school were consuming milk and milk products on a regular basis whereas 3 (3.2%) from private and 14 (14.7%) from public school did not consume milk and milk products at all. 21 (22.1%) from private and 22 (23.2%) from public school were consuming milk and milk products for 3-4 times a week and 10 (10.5%) from private and 28 (29.5%) from public were consuming milk and milk products once a week or less.

8 (8.4%) from private school and 11 (11.6%) from public school were consuming green leafy vegetables for daily, 43 (45.3%) from private and 39 (41.1%) from public school were consuming green leafy vegetable for 3-4 times a week, 23 (24.2%) from private and 29 (30.5%) from public school were consuming green leafy vegetable once a week or less and 21 (22.1%) from private and 16 (16.8%) from public school did not consume green leafy vegetable at all.

The consumption pattern of other vegetables in table shows that in private school, 8 (8.4%), 52 (54.7%) and 16 (16.8%) and students consumed other vegetables daily, 3-4 times a week and once in a week or less. Likewise, 16 (16.8%), 62 (65.3%) and 6 (6.3%) students from public school were consuming other vegetables daily, 3-4 times a week and once a week or less. 19 (20.0%) students from private and 11 (11.6%) students from public school did not consume others vegetables at all.

The pattern for food consumption shows that students in private school were consuming fruits more frequent as compared to that of students in public school. In private school, 21 (22.1%), 30 (31.6%) and 43 (45.3%) were consuming fruits daily, 3-4 times a week and once in a week or less respectively. In public school, none students were found having fruits daily beside that 16 (16.8%) and 78 (82.1%) students were found consuming fruits for 3-4 times a week and once a week or less. 1 (1.1%) student from both type of school did not consume fruits at all.

The pattern of consumption of egg, meat and fish showed that 5 (5.3%) from private and 7 (7.4%) from public school consumed egg, meat and fish daily. 52 (54.7%), 33 (34.7%), 5 (5.3%) from private school and 44 (46.3%), 40 (42.1%), 4 (4.2%) from public school consumed egg, meat and fish for 3-4 times a week, once a week or less and never respectively.

The table showed that students from public school were taking tea and coffee more frequently as compared to that of private school with 83.2% of students consuming tea and coffee daily which is only about 63.2% in private school. More students from private school were avoiding coffee and tea as compared to that of public school. 20 (21.1%) students from private school and 9 (9.5%) from public school did not consume tea and coffee at all. 7 (7.4%) and 8 (8.4%) from private school and 6 (6.3%) and 1 (1.1%) from public school were consuming tea and coffee for 3-4 times a week and once a week or less respectively.

The pattern of consumption of fast foods and packaged foods shows that 37 (38.9%) students from private and 38 (40.0%) from public school were consuming fast foods and packaged foods daily. 32 (33.7%) from private and 26 (27.4%) were consuming for 3-4 times a week. 24 (25.3%) from private and 31 (32.6%) from public school were found having fast foods and packaged foods at least once a week or less. 2 (2.1%) students from private school did not consume fast foods and packaged foods at all.

The consumption of carbonated beverages was found more common among private school students as compared to that of public school's students with private school having only 1 (1.1%) student who did not consume carbonate beverages at all while public school had 13 (13.7%) students who did not consume carbonated beverages. 3 (3.2%) from private school and 2 (2.1%) from public school were found consuming carbonated beverages daily. Likewise, 23 (24.2%) and 68 (71.6%) from private school and 11 (11.6%) and 69 (72.6%), 53 (55.8%) from public school were found consuming carbonated beverages for 3-4 times a week and once a week or less respectively.

4.8 Dietary Intakes

The participants' dietary intakes were categorized as below RDA and above RDA based on a comparison with the ICMR (2020) RDAs, as shown in the table. 24.2% from private school and 23.2% from government school were consuming calorie above EAR. In both private and

public school, 98.9% students were having protein intake above RDA levels. 40.0% from private school and 50.5% from public school were consuming visible fats below EAR. Likewise, from private school 89.47% and 96.84% students from public school were consuming carbohydrates above the RDA. When intake and requirement were compared, it was discovered that the children' energy intake was significantly lower than the requirement. The predominant diet of every child in this study was rice and most of children ate roots and tubers on a daily basis, which is a good source of CHO due to which there was no evidence of CHO deficiency (Patsa and Banerjee, 2019).

Table 4.13: Adequacy of nutrient intake

Variables	**Private School**		**Public School**	
	Frequency	**Percent**	**Frequency**	**Percent**
Adequacy of calorie intake				
Above EAR	23	24.2%	22	23.2%
Below EAR	72	75.8%	73	76.8%
Adequacy of protein intake				
Above RDA	94	98.9%	94	98.9%
Below RDA	1	1.1%	1	1.1%
Adequacy of visible fat intake				
Above EAR	57	60.0%	47	49.5%
Below EAR	38	40.0%	48	50.5%
Adequacy of carbohydrate intake				
Above RDA	85	89.47%	92	96.84%
Below RDA	10	10.53%	3	3.16%

Table 4.14 shows the mean intake of macronutrients among private and public school. The average calorie intake of students in private school of age group 5-7 years was 1264.6 ± 331.5 whereas in government school the average energy intake of 5-7 years children was 1261.3 ± 263.6. The average intake of children aged 8-10 years in private and public school

were 1437.3 ± 337.1 and 1402 ± 325.9 respectively. The average protein intake of children aged 5-7 years in private and public school were 39.5 ± 10.2 and 39.0 ± 8.6. Children aged 8-10 years had average protein intake of 42.9 ± 10.9 and 44.3 ± 10.3 in private and public school respectively. An average visible fat intake among 5-7 years children in private and public school were 28.1 ± 7.4 and 28.1 ± 5.9 whereas among 8-10 years the intake was 36.5 ± 9.5 in private and 32.0 ± 7.6 in public school.

Likewise, the average carbohydrate intake of children aged 5-7 years in private and public school's students were found to be 194.2 ± 56.2 and 187.9 ± 64.6 respectively. An average carbohydrate intake among 8-10 years were found to be 224.1 ± 63 in private and 217 ± 73.5 in public school. The mean energy, protein, fat and CHO intake of children aged 6-9 years was 1878 ± 1079.5, 56.9 ± 72.3, 84.8 ± 152.9 and 302.6 ± 319.2 respectively (Ayogu, 2019). In an overall, the mean intake of macronutrients among primary school students studying in private school was higher as compared to those studying in public school.

Table 4.14: Mean macronutrients intake of surveyed population (n=190)

	Private School		**Public School**	
Nutrients	**5-7 years**	**8-10 years**	**5-7 years**	**8-10 years**
Calorie (kcal)	1264.6 ± 331.5	1437.2 ± 337.1	1261.3 ± 263.6	1402.7 ± 325.9
Protein (g)	39.5 ± 10.2	42.9 ± 10.9	39.0 ± 8.6	44.3 ± 10.3
Visible fat (g)	28.1 ± 7.4	36.5 ± 9.5	28.1 ± 5.9	32.0 ± 7.6
Carbohydrate (g)	194.2 ± 56.2	224.1 ± 63.0	187.9 ± 64.6	217.3 ± 73.5

4.9 Prevalence and distribution of malnutrition

The total prevalence of underweight among primary school students was found to be 39.10% that was higher than the prevalence of underweight in study by Shivaprakash and Joseph (2014) that reported the prevalence of underweight was 30.3%. The overall prevalence of stunting was found to be 25.20% which was similar to study by Mansur *et al.* (2017) in Kavre district that stated the prevalence of stunting in school children was 24.54%. The prevalence of thinness and overweight was found to be 30.60% and 17.90% in which the prevalence of thinness was lower as compared to study conducted by Vastrad *et al.* (2023) the reported the prevalence of thinness was 43% whereas the prevalence of obesity was

higher than study by Bohara and Bhusal (2017) that reported the prevalence of obesity was 14.8%.

This graph shows the comparison of prevalence of underweight, stunting, thinness and overweight among primary school children between private and public school in Kamal rural municipality, Jhapa. More proportion of children were underweighted in public school as compared to that of private school. There was a significant disparity in the percentage of underweight students in different schools: 45.5% of students in government schools and just 9.5% of private school students are underweight (Khan *et al.*, 2016).

Likewise, more proportion of children were stunted in public school (14.7%) than that of private school (10.5%). This is in accordance to study conducted in Zagazig city, Egypt. The result from study found that more than half of public school pupils (52.7%) complained of being short in stature which was compared to 27.4% of children in private schools and this difference was statistically significant(Tork, 2013).

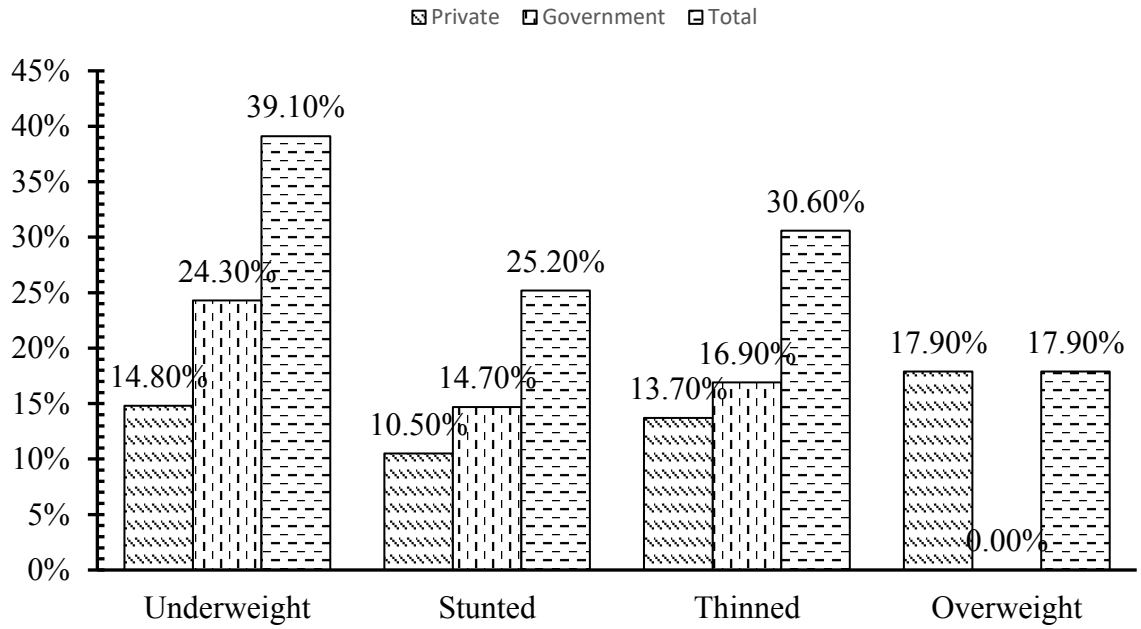

Fig 4.1: Prevalence of malnutrition

The proportion of thinned students were higher in public school (16.90%) whereas in private school it was 13.70%. This is in accordance to the study that reported there was a higher rate of underweight (24%) in students attending government schools compared to students attending private schools (17%) (Bohara and Bhusal, 2017). When comparing

students from private schools to those in public schools, the percentage of thinned children was higher in public school (18.7%)than that of private school (7.5%) (Tork, 2013).

Overweight was found prevalent only in private school that constitutes 17.90% of studied children. This in in accordance to study conducted by Khan *et al.* (2021) that reported in government schools, there were only 3% of overweight students and none of the obese students. Compared to that, the prevalence of overweight and obesity was found to be 30% and 14% in private schools. Similar findings were reported by P *et al.* (2016) of the students in the government school, 56% (Normal=98) had normal BMIs. Overweight or obesity was not prevalent. However, 44% of students were underweight in government school. The study carried in Nigeria concluded that children from higher social classes had the highest percentage of obese children. Moreover, every child that was obese attended private schools (Olasinde *et al.*, 2020).

On overall, more proportion of students in public school were found to be underweighted, stunted and thinned as compared to that of private school whereas the study found no incidence of overweight in public school while 17.90% of students from private school were overweight. This result is supported by study conducted in Ghana. The study's main conclusions were the following: Compared to students attending private schools, a greater percentage of underweight, stunted, and thin students attended public schools. In comparison to students who attend private schools, those who attend public schools were also far more likely to become underweight and thin (Faith *et al.*, 2016). Undernutrition was more common in students attending government schools, while obesity and overweight were more common in students attending private schools. Children attending government schools were more likely than those attending private schools to be stunted and thin (Sana *et al.*, 2017).

4.10 Age-wise distribution of malnutrition

In private school, 10 students of age group 5-7 years and 4 students within age range of 8-10 years were found underweight. Likewise, in public school, 15 students within age group of 5-7 years and 8 students within age group of 8-10 years were underweight.

In both type of school, the prevalence of underweight was found to be more common among age group of 5-7 years. This is in accordance to result of study conducted in Uttarakhand where the prevalence of underweight was higher among 6 years (71.4%) and 7

(61.1%) years old children than that of 8 years and above (Limbu and Arya, 2018). Underweight prevalence was high among 6-7 year of age group in both government and private school (Nagaralu *et al.*, 2014). Severely underweight children were high among the age group of 6-7 years (14.28%) than that of 8-9 years (5.61%) in the study conducted by Singh *et al.* (2014).

Table 4.15: Prevalence of malnutrition according to age group (n=190)

	Private School			**Public School**		
Nutritional Status	**5-7 years**	**8-10 years**	**Total**	**5-7 years**	**8-10 years**	**Total**
WAZ						
Underweight	10 (10.5%)	4 (4.2%)	14 (14.7%)	15 (15.8%)	8 (8.4%)	23 (24.2%)
Normal	50 (52.6%)	31 (32.6%)	81 (85.2%)	40 (42.1%)	32 (33.7%)	72 (75.8%)
HAZ						
Stunted	6 (6.3%)	4 (4.2%)	10 (10.5%)	8 (8.4%)	6 (6.3%)	14 (14.7%)
Normal	54 (56.8%)	31 (32.6%)	85 (89.4%)	47 (49.5%)	34 (35.8%)	81 (85.3%)
BAZ						
Thinned	9 (9.5%)	4 (4.2%)	13 (13.7%)	10 (10.5%)	6 (6.3%)	16 (16.8%)
Normal	43 (45.3%)	22 (23.2%)	65 (68.5%)	45 (47.4%)	34 (35.8%)	79 (83.2%)
Overweight	8 (8.4%)	9 (9.5%)	17 (17.9%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Table 4.15 shows the age-wise distribution of stunting among private and public school's students. In private school, higher proportion of students within age group 5-7 years were stunted (6.3%) as compared to students within age group of 8-10 years (4.2%). The

prevalence of stunting in public school was more within an age group of 5-7 years (8.4%) as compared to age group of 8-10 years (6.3%).

In overall the prevalence of stunting was found more in public school and private school among an age group of 5-7 years. This result coincided with findings from study of Uttarakhand that reported 55.43 percent of children between the ages of 6 and 8 and 47.8 percent of children between the ages of 9 and 10 were stunted. This might be because older children can express their dietary preferences, which promotes food intake among older children (Limbu and Arya, 2018).

Table 4.15 shows age-wise distribution of thinness among private and public school's students. In private school, proportion of thinned students were higher in an age group of 5-7 years (9.5%). Similarly, the prevalence of thinness in public school was more among age group 5-7 years (10.5%). The higher prevalence of thinned students was found in age group of 5-7 years in both public and private school. This findings was similar to study conducted in Tamil Nadu that indicated compared to children older than seven years old, children under seven years old had a higher frequency of thinness (55.45%) (Jasmine Sharmila *et al.*, 2020).

The prevalence of overweight was found only in private school with more proportion of students being overweighted within an age group of 8-10 years (9.5%). This was in accordance to study conducted by (Aljawayan *et al.*, 2022) that stated the rate of overweight was 8% at the age group 9 - 11 years and decreased with age.

4.13 Gender-wise distribution of malnutrition

Table 4.16 shows gender-wise distribution of malnutrition among private and public school's students. In both private and public school, more males as compared to females were underweight. In private school, 8.4% males and 6.3% females were underweighted whereas in public school 14.7% males and 9.5% females were underweight. In overall, the prevalence of underweight was higher among males in both type of school. The prevalence of underweight was more in males than females in both type of school which is supported by study conducted in Pumdi Bhumdi village where the rate of underweight is higher among boys (38.05%) than among girls (32.68%) (Banstola and Acharya, 2015). The proportion of underweight was higher among boys (7.7%) as compared to girls (7.2%) in the study conducted by Mwaniki and Makokha (2013).

Table 4.16: Prevalence of malnutrition according to gender (n=190)

	Private School			Public School		
	Male	**Female**	**Total**	**Male**	**Female**	**Total**
WAZ						
Underweight	8	6	14	14	9	23
	(8.4%)	(6.3%)	(14.7%)	(14.7%)	(9.5%)	(24.2%)
Normal	39	42	81	41	31	72
	(41.1%)	(44.2%)	(85.3%)	(43.2%)	(32.6%)	(75.8%)
HAZ						
Stunted	7	3	10	13	1	14
	(7.4%)	(3.2%)	(10.6%)	(13.7%)	(1.1%)	(14.8%)
Normal	40	45	85	42	39	81
	(42.1%)	(47.4%)	(89.5%)	(44.2%)	(41.1%)	(85.3%)
BAZ						
Thinned	9	4	13	12	4	16
	(9.5%)	(4.2%)	(13.7%)	(12.6%)	(4.2%)	(16.8%)
Normal	31	34	65	43	36	79
	(32.6%)	(35.8%)	(68.4%)	(45.3%)	(37.9%)	(83.2%)
Overweight	7	10	17	0	0	0
	(7.4%)	(10.5%)	(17.9%)	(0.0%)	(0.0%)	(0.0%)

In private school, more males (7.4%) were stunted as compared to females (3.2%). Likewise, in public school, more male (13.7%) were stunted than female (1.1%). Comparing between public and private school, more males from public school (13.7%) were stunted than males from private school (7.4%). But more female (3.2%) from private school were stunted than female from public school (1.1%). In overall, more males than females were found stunted in both private and public school. This result coincides with results from study in Ethiopia that stated stunted students comprised 12% of female students in public primary schools, compared to 19% of male students (Bantie *et al.*, 2021). A study conducted in

North-east Ethiopia found that stunting was found to be more common in boys (56.3%) than in girls (43.8%) (Bazie *et al.*, 2021).

The prevalence of thinness was more among boys in both private and public school. In private school, 9.5% male and 4.2% female were thinned whereas in public school, 12.6% male and 4.2% females were thinned. On comparing, more male from public school were thinned (12.7%) than from private school (9.5%). In both school the prevalence of thinness among female was found to be (4.2%). More males than females were thinned in both schools. This result is supported by study conducted to assess prevalence and factors associated with stunting and thinness among school age children in rural primary schools that reported more than half of 55 (51.4%) of the thin children were males (Sisay *et al.*, 2022). A cross-sectional study on children studying in urban schools of Western Maharashtra found that the prevalence of thinness was more among boys of age 5-9 years (14.8%) compared to that of girls (12.3%) (Tyagi *et al.*, 2023). The prevalence of overweight in private school was found to be more among females (10.5%) than that of males (7.4%). This is supported by study conducted in Karnataka, India that reported females were more overweight than males with prevalence of 13.6% and 11.3% (V. *et al.*, 2022).

The overall prevalence of undernutrition: underweight, stunting and thinness was high among boys in both type of school whereas the prevalence of overweight was higher among girls. Stunting, wasting, and underweight were found to be more common in boys than in girls, indicating a disparity in gender. Boys were more likely than females to suffer from malnutrition. Numerous studies have also demonstrated that undernourishment is more common in male children than in female children. Though the exact reason for the gender disparity in undernutrition is uncertain, some research has revealed that males are more susceptible than females to environmental stressors during play, such as diseases and exposure to chemicals and air pollution (Pal *et al.*, 2021).

4.16 Nutritional status comparison with WHO standard

Distribution of underweight, stunting, thinness and overweight among primary school children of Kamal rural municipality, Jhapa based on WHO standard are shown in the Figure 4.2, 4.3 and 4.4 respectively.

- **Weight for age**

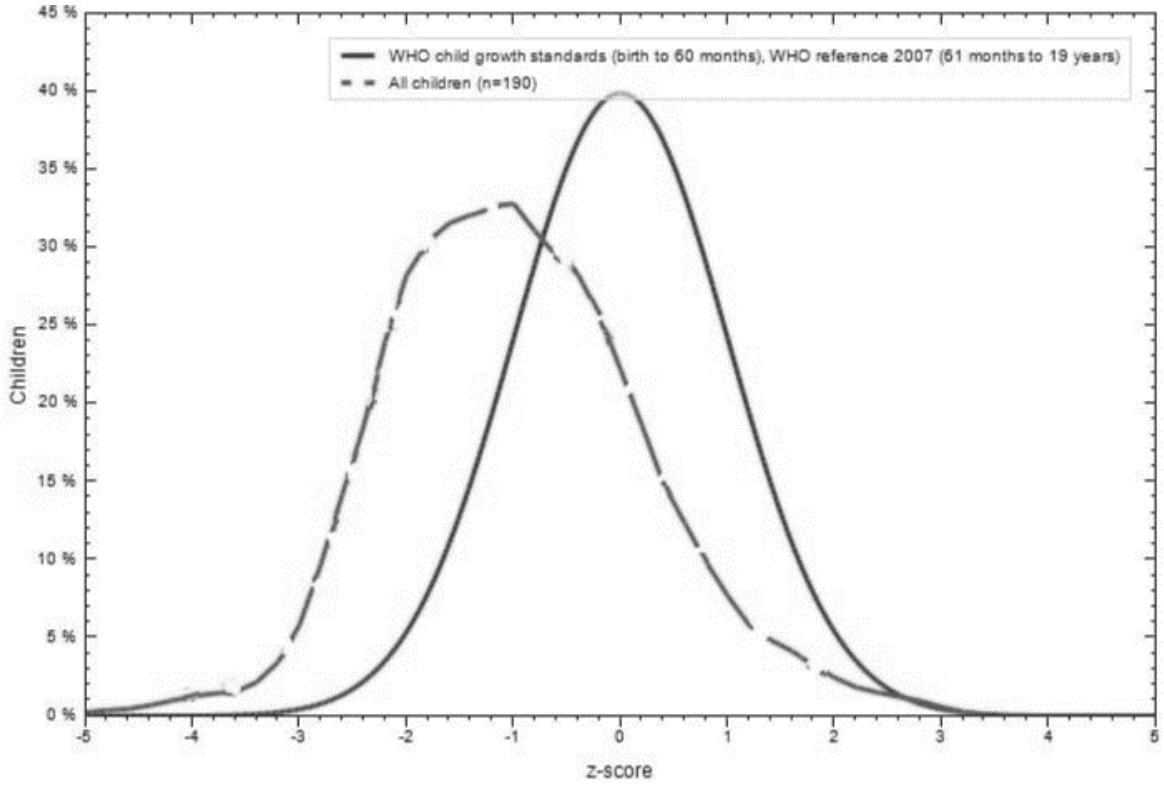

Fig 4.2: Distribution of WAZ

The curve in the figure 4.2 is skewed to the left side of WHO standard reference curve. It is because mean, median and mode of weight for age z-score of the survey children was found to be -0.9664, -1.0100 and -2.12 which is less than the reference to WHO standard. Most of the studied children have their weight for age z-score less than zero though few of them have z-score more than zero indicating majority of samples are underweight.

- **Height for age**

The curve in the figure is skewed to the left side of WHO standard curve. It is because mean, median and mode of height for age z-score of survey children was found to be -0.83, -0.82 and -0.28 5 respectively which are lesser than the average of WHO reference curve i.e. zero. Higher number of subjects have their height for age z – score less than zero but still very few subjects have z-score more than zero. This indicates majority of the subjects had shorter stature.

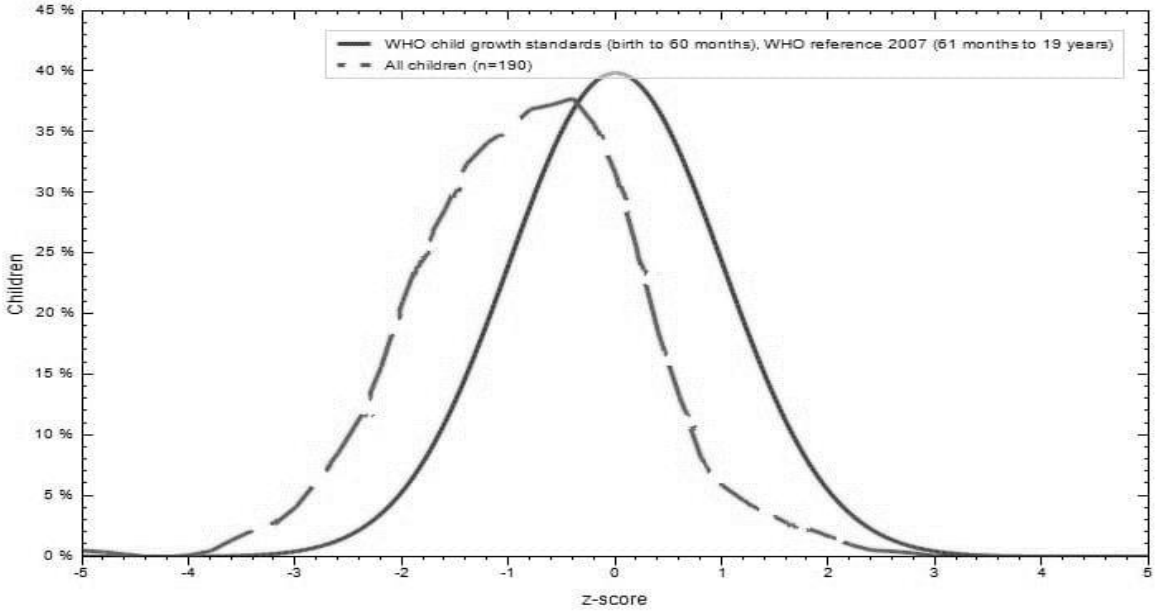

Fig 4.3: Distribution of HAZ

- **BMI for age**

The curve in the figure is skewed to the left side of WHO standard reference curve. It is because mean, median and mode of BMI for age z-score of the survey children was found to be-0.6940, -0.6850 and -0.31which is less than the reference to WHO standard. Most of the studied children have their BMI for age z-score less than zero though few of them have z-score more than zero indicating majority of samples are thinned.

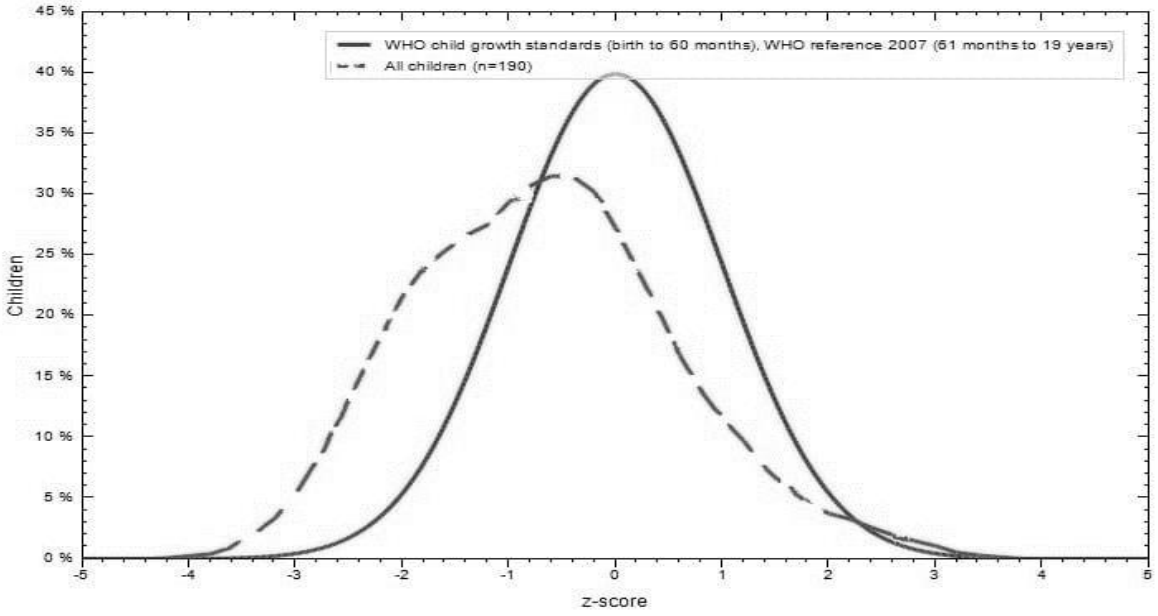

Fig 4.4: Distribution of BAZ

4.17 Factors associated with malnutrition

Chi-square and fisher's exact test were used to find factors associated with underweight, stunting, thinness and overweight of primary school students in both types of school. Father's education level, mother's education level, mother's occupation and frequency of consumption of fruits were found to have a significant association with underweight among children in private school whereas birth weight of child, birth order of child, knowledge of caretakers on malnutrition and frequency of consumption of tea and coffee were found to be statistically significant with underweight among children in public school.

There were no significant association of variables found with stunting in private school whereas gender of students was significantly associated with stunting in public school children.

Various factors such as monthly expenditure in food, frequency of consumption of other vegetables and carbonate beverages and number of meals in a day were found to have statistical association with thinness among private school students. Factors like birth order of child, knowledge of caretakers on malnutrition, presence of kitchen garden in house and caste/ethnicity of children were found associated with thinness in public school.

4.17.1 Factors associated with underweight among private school

An association between underweight and father's education level was observed in this study (p-value: 0.031). This study shows the risk of underweight increases among private school students whose fathers were illiterate (100.0%). An association between mother's education level and the prevalence of underweight shows that the prevalence of underweight was higher among children whose mothers were illiterate (100.0%). This result is in accordance to study from West Bengal India stated that the children whose mothers could only read and write and illiterate were the most at risk of being underweight (39.02%), followed by the children whose mothers had only completed primary school (34.73%) as opposed to secondary school (23.88%) (Pal *et al.*, 2021). According to the current study, children whose mothers have never attended a formal education were more likely to be stunted and underweight as compared to children whose mothers had formal education (Wolde *et al.*, 2015).

Table 4.17: Factors associated with underweight in private school(n=95)

Factors	Normal	Underweight	Chi – square	p-value
Father's education				
Secondary and below	56 (86.2%)	9 (13.8%)	7.375_f	$*0.031_f$
Above secondary	25 (89.3%)	3 (10.7%)		
Illiterate	0 (0.0%)	2 (100.0%)		
Mother's education				
Secondary and below	53 (84.1%)	10 (15.9%)	8.603_f	$*0.011_f$
Above secondary	28 (93.3%)	2 (6.7%)		
Illiterate/informal	0 (0.0%)	2 (100.0%)		
Mother's occupation				
Agriculture	50 (79.4%)	13 (20.6%)	6.310_f	$*0.033_f$
Homemaker	23 (100.0%)	0 (0.0%)		
Others	8 (88.9%)	1 (11.1%)		
Consumption of fruits				
Daily	21 (100.0%)	0 (0.0%)	7.770_f	$*0.015_f$
3-4 times a week	27 (90.0%)	3 (10.0%)		
Once in a week and less	33 (75.0%)	11 (25.0%)		

*Statistically significant (p-value<0.05)
$(p\text{-value})_f$ denotes fisher exact test was used .

In the context of private schools' children, the prevalence of underweight were significantly high (50%) among children whose fathers' education was primary/illiterate as compared to those with at least secondary level (11%) education. In the same way, the prevalence of underweight and stunting were significantly high (34.9% and 30.2%, respectively) among children whose mother's education was primary/illiterate as compared to those with at least secondary level (3.6% and 12.3%, respectively) education (Bohara and Bhusal, 2017).

This study shows significant association between mother's occupation and prevalence of underweight. Underweight children from private school whose mothers involved in

agriculture (20.6%). The percentage of underweight children whose mothers were businesswomen was greater (8.3%), than that of children whose mothers were housewives (5.7%), and the percentage of underweight children whose parents were teachers and traders (1.1% each) (Opara DC and KA, 2014). Children whose mothers were laborers or cultivators had 1.55 times higher risk of being underweight than children whose mothers were housewives (Pal *et al.*, 2021).

A significant association was found between the consumption of fruits and underweight status of primary school children in private school. The study shows that the risk of underweight increases with low consumption of fruits. As children who consumed fruits daily were not found underweight whereas children consuming fruits once in a week and less were found underweighted. This findings was similar from study conducted in Hohoe municipality, Ghana where only 6.9% surveyed students were underweight who were consuming fruits for more than 3 times a week whereas 10.2% of surveyed students were underweight who were consuming fruits for less than 3 times a week (Faith *et al.*, 2016).

4.17.2 Factors associated with underweight among public school

An association was found among nutritional status and birth weight of child in public school students (p-value:0.021). Most of children weighing less than 2.5kg at birth were found underweight. The prevalence of underweight was 41.7% among those who were weighted less than 2.5kg at birth and the prevalence was 18.3% among those who weighted 2.5kg and more at birth. This result was in accordance to study conducted by M and Hr (2021) that reported a highly significant correlation between birth weight groups and underweight level was discovered using chi-square analysis ($\alpha 2 = 1.61$ at $P<0.0001$). The LBW children were shown to be at risk for underweight. Based on the weight for age classification, the majority of LBW children (40.8%) were found to be underweight in the mild category, followed by 37.8% in the moderate category, and 4.1% in the severe category. In contrast, 32.7% of NBW children were found to be underweight at the mild (26.6%) and moderate (6.0%) levels. A study conducted to assess the factors influencing the nutritional status of primary school children in the Estate sector demonstrates that there is a chance of being underweight as the LBW rises (Nalaka *et al.*, 2018).

Table 4.18: Factors associated with underweight in public school (n=95)

Factors	Normal	Underweight	Chi-square	P-value
Birth weight of child				
Less than 2.5kg	14 (58.3%)	10 (41.7%)	5.333	*0.021
2.5kg and more	58 (81.7%)	13 (18.3%)		
Knowledge about malnutrition				
Yes	35 (87.5%)	5 (12.5%)	5.164	*0.023
No	37 (67.3%)	18 (32.7%)		
Birth order				
2 and less	64 (81.0%)	15 (19.0%)		*0.021_f
More than 2	8 (50.0%)	8 (50.0%)		
Consumption of tea and coffee				
Daily	56 (70.9%)	23 (29.1%)		
3-4 times a week	6 (100.0%)	0 (0.0%)	5.602_f	*0.044_f
Once in a week and less	10 (100.0%)	0 (0.0%)		

*Statistically significant (p-value<0.05)
$(p\text{-value})_f$ denotes fisher exact test was used

Likewise, an association between knowledge about malnutrition of caretakers and prevalence of underweight among government school students were also observed. The prevalence of underweight was higher among those children whose caretakers had no knowledge about malnutrition (32.7%). This finding was similar to the results of findings from study conducted in public primary schools in urban and rural areas in Ekiti state Nigeria that revealed that underweight in primary school students in rural communities is statistically highly associated with caregivers' inadequate knowledge about malnutrition ($p = 0.010$). The results of this study showed that good nutritional status is linked to caregivers who have a good understanding of malnutrition and nutritional status, while malnutrition is linked to caregivers who have a poor understanding (Sanni *et al.*, 2024).

Birth order of a child was also found to be associated with underweight among government school students with pvalue:0.021. This is in accordance to study conducted to assess undernutrition and associated risk factors among school age children in Addis Ababa, Ethiopia that concluded that 30.9% of the 459 children were undernourished (underweight = 15.9%). There was a significant correlation found between having a birth order greater than two and an elevated risk for underweight. The higher prevalence of underweight among children with higher birth orders (greater than two) compared to other children might be explained by the possibility that most Ethiopian parents give less attention, care and resource to older children when they give birth to new ones (Degarege *et al.*, 2015).

Similarly, a significant association was observed between the consumption of coffee and the prevalence of underweight which is in accordance to study conducted in west Ethiopia that showed those who consumed coffee in primary school were 2.25 times more likely to be underweight. The prevalence of underweight was more among those who consumed coffee (9.5%) (Shama *et al.*, 2023).

4.17.3 Factors associated with stunting among public school

Table 4.19: Factors associated with stunting in public school(n=95)

Factors	Normal	Stunted	Chi-square	P-value
Gender of Student				
Male	42 (76.4%)	13 (23.6%)	8.234	*0.004
Female	39 (97.5%)	1 (2.5%)		

*Statistically significant (p-value<0.05)

While studying about the factors associated with stunting among public school children, an association was found among gender and nutritional status of children. This study shows that the prevalence of stunting was higher in males (23.6%) than females (2.5%). A similar trend of stunting has been documented in the study conducted in rural school going children in Kavre district where the prevalence of stunting was higher among males (29.59%) than female children (21.24%) which was statistically significant with p-value<0.05 (Mansur *et al.*, 2017).

Another study conducted in Southern Ethiopia also stated that stunting was more common in males than in females. This may be the case because males are more susceptible to the effects of chronic undernutrition than females are due to the fact that males' growth and development are more influenced by nutritional stress and environmental factors, including common childhood diseases (Tariku *et al.*, 2018).

4.17.4 Factors associated with thinness/overweight among private school

While studying the factors associated with thinness/overweight among private schools of Kamal rural municipality, following factors as shown in table 4.20 were found associated that includes source of drinking water, consumption of carbonated beverages, total meals consumed in a day and practice of extended breastfeeding for 2 years.

An association was found among the prevalence of thinness/overweight among private school students and source of drinking water in family. The proportion of thinned students were high among families having tube well as the source of drinking water whereas the proportion of overweight children were high among those drinking water from water tap. this is in accordance to study conducted in India that reported children who have access to piped water are less likely to be considered "thin" or "severely thin," with a ∼1% drop in the likelihood of being considered normal weight, compared to those who do not. Furthermore, according to the results, children who have access to piped water are more likely to become overweight and obese, however the effect is not very strong (Liu *et al.*, 2015).

Likewise, this study shows that children who consume carbonated beverages daily has higher risk of thinness and overweight. None of the students were found to have normal nutrition status among those who were consuming carbonated beverages daily. This result is coincided with findings from the study in Serbia that discovered a positive association between drinking soft drinks and being thin. The likelihood of being thinned was equally higher if the child's intake of soft beverages was reported to be more than once per week. Unhealthy eating habits may be linked to less frequent nutrient-rich food consumption, which may result in thinness and other types of malnutrition (Bozic *et al.*, 2021). There was a higher likelihood of underweight in children who drank carbonated beverages (Kamanga *et al.*, 2024). Compared to children who rarely or never drink fizzy drinks, children who drink them on some days and most days had 3.36 and 2.39 times the likelihood of being fat, respectively. A statistical significance was observed in these

differences. Even after adjusting for the other factors that were found to be important obesity predictors, children who drank fizzy drinks regularly had a 2.84 times higher chance of being obese than children who drank them rarely or never at all (Ganle *et al.*, 2019).

Table 4.20: Factors associated with thinness/overweight in private school(n=95)

Factors	Normal	Thinned	Overweight	Chi-square	P-value
Source of drinking water					
Tube well	48 (69.6%)	11 (15.9%)	10 (14.5%)		
Water tap	8 (50.0%)	1 (6.2%)	7 (43.8%)	8.637_f	$*0.044_f$
Both	9 (90.0%)	1 (10.0%)	0 (0.0%)		
Consumption of carbonated beverages					
Daily	0 (33.3%)	2 (66.7%)	1 (33.3%)		
3-4 times a week	18 (78.3%)	0 (0.0%)	5 (21.7%)	12.017_f	$*0.008_f$
Once a week and less	47 (68.4%)	11 (15.9%)	11 (15.9%)		
Meals in a day					
3 and less	4 (28.6%)	5 (35.7%)	5 (35.7%)	11.935_f	$*0.001_f$
More than 3	61 (75.3%)	8 (9.9%)	12 (14.8%)		
Extended breastfeeding upto 2 years					
Yes	59 (70.2%)	13 (15.5%)	12 (14.3%)	5.922_f	$*0.039_f$
No	6 (54.5%)	0 (0.0%)	5 (45.5%)		

*Statistically significant (p-value<0.05)

$(p\text{-value})_f$ denotes fisher exact test was used

A significant association was observed between meals per day and prevalence of thinness and overweight in private school students. Both thinness and overweight were found higher among children who were consuming less than 3 meals a day. This study was coincided with findings from the study in Ethiopia that concluded in comparison to children whose meal

frequency was four or above, the chance of thinness was 2.67 times (AOR: 2.67; 95% CI: 1.11, 6.46) greater among children whose meal frequency was two or fewer (Sisay *et al.*, 2022). The study carried out in Arar city found the significant association between overweight and number of daily meals with p-value 0.046 that reported 84% of overweighted children reported were consuming less than 3 meals a day (Alenazi *et al.*, 2021).

A significant association was found between duration of extended breastfeeding and prevalence of thinness and overweight in private primary school. The prevalence of thinness was higher among those who were breastfed for 2 years whereas the prevalence of overweight was higher among those who were not. This is in accordance to study that reported the duration of breastfeeding and nutritional status were found to be significantly correlated. Strong correlations were discovered, indicating that children who were breastfed for fewer than six months had increased chances of being obese (OR=1.26, 95% CI 1.04-1.54) or overweight (OR=1.21, 95% CI 1.02-1.43). According to these findings, breastfeeding duration may be regarded as one of the most important indicators of a child's nutritional status in school age (Lang Morović and Musić Milanović, 2019).

4.17.5 Factors associated with thinness among public school

The factors that were significantly associated with thinness among public school students were knowledge about malnutrition, presence of kitchen garden in house and caste that is shown in table 4.21.

Birth order of child was found significantly associated with the prevalence of thinness among government school children. The prevalence was high among children with birth order more than 2(37.5%). This result is supported by study conducted in China that reported a higher birth order significantly increases the ORs for thinness. Prenatal weight and birthweight are two examples of child- and family-related characteristics that may have changed as a result of an increase in pregnancies and an increase in household size. When these variables were taken into account, the correlation between thinness and birth order persisted. Compared to their younger siblings, firstborn children were typically born with lower birthweights, but they also tended to be more susceptible to conditions that could promote growth (Tingting *et al.*, 2020).

Table 4.21: Factors associated with thinness in public school(n=95)

Factors	Normal	Thinned	Chi-square	P-value
Birth order				
2 and less	69 (87.3%)	10 (12.7%)		*0.026$_f$
More than 2	10 (62.5%)	6 (37.5%)		
Knowledge on malnutrition				
Yes	37 (92.5%)	3 (7.5%)	4.305	*0.038
No	42 (76.4%)	13 (23.6%)		
Kitchen garden in house				
Yes	62 (88.6%)	8 (11.4%)		*0.028$_f$
No	17 (68.0%)	8 (32.0%)		
Caste				
Brahmin/Chhetri	22 (88.0%)	3 (12.0%)	9.533	*0.009
Janajati	34 (94.4%)	2 (5.6%)		
Dalit and others	23 (67.6%)	11 (32.4%)		

*Statistically significant (p-value<0.05)

(p-value)$_f$ denotes fisher exact test was used

A significant association between knowledge of caretakers on malnutrition and thinness showed that the prevalence of thinness was more among those children whose caretakers were not aware about malnutrition. This is in accordance to study from Babiya VDC, Sunsari, that reported children whose mothers were unaware of malnutrition had a 60.9% prevalence of thinness, whereas children whose mothers were aware of the condition had a 14.6% prevalence. This makes sense because mothers who are aware of malnutrition are more likely to provide their children with enough food and close attention, which helps reduce childhood thinness to some level (Koirala, 2019).

Likewise, the prevalence of thinness was higher among those children whose family did not have kitchen garden in house. More students from public school belonging to household that did not have kitchen garden were found thinned (32.0%) which coincides with the result

from study conducted in Kaski district of Nepal where the study revealed a significant association between the availability of kitchen garden and body mass index with p-value<0.05 (Puri and Adhikari, 2019).

The prevalence of thinness was higher among children belonging dalit and others (Santhal, Madhesi) group (32.4%). This result is in accordance to study in Kathmandu that reported significant association between ethnicity and thinness. With comparison to the reference value, families belonging to the Madhesi ethnic group had a 3·3 higher chance of wasting by BMI-for-age (95% CI (1·5, 7·3), P = 0·003). This result was expected as national surveys have shown that ethnic groupings in Nepal differ with respect to the use of health services and health outcomes, with underprivileged groups—like the Madhesi group—performing significantly worse than more privileged ones (Chapagain et al., 2023).

Part V

Conclusion and recommendations

5.1 Conclusions

This study was conducted with an objective to assess the disparity in nutritional status of primary school children in private and public schools in Kamal rural municipality, Jhapa. Followings were the conclusions drawn from the study:

a. The prevalence of underweight, stunting and thinness among primary school students was tend to be higher in public school (24.30%, 14.7% and 16.9%) than private school (14.80%, 10.50% and 13.7%) respectively.
b. Obesity prevalence was observed only among students from private school.
c. The mean dietary diversity score of private school children was found to be 4.08 ± 0.996 and public school was found to be 3.66 ± 1.017.
d. Parent's education level, mother's occupation, frequency of consumption of fruits and frequency of consumption of tea and coffee were found associated with underweight in private school's students and factors such as birth weight of the child, knowledge about malnutrition and birth order of child were found significantly associated with nutritional status of public school's students.
e. There were no factors found to be significantly associated with stunting among private school's students whereas gender of students was found to be strongly associated with prevalence of stunting among public school students with male becoming more stunted as compared to females.
f. Frequency of carbonated beverages consumption, source of drinking water, number of meals in a day were found associated with thinness/obesity among private school students and birth order of child, knowledge about malnutrition, presence of kitchen garden in house and caste/ethnicity of child were found associated with thinness among public school students.

5.2 Recommendations

The following recommendations could be carried out in order reduce the burden of malnutrition among primary school students in the survey region based on the study's findings:

a. Depending on the level of malnutrition found in this study, a community-based nutrition program should be set up to address the issue at the local level.
b. A study to evaluate the effectiveness of school-based nutrition programs and their impact on reducing malnutrition and assessing how teacher training in nutrition education can influence children's dietary habits and health outcomes can be carried out.
c. This kind of survey has to be conducted on a regular basis to help stakeholders create plans and policies for improving nutritional status. Use of community-based participatory research methods to involve local stakeholders in identifying and addressing malnutrition issues can be thoughtful.
d. Additionally, biochemical testing and clinical examination can be used to validate the information gathered from anthropometry and household surveys.

PART VI

Summary

Malnutrition in primary school children is a significant global issue with wide-ranging impacts on health, development, and learning. Stunting (low height for age), thinness (low BMI for age), overweight (high BMI for age) and underweight (low weight for age) caused due to various factors can impair brain development, poor academic performance and increase risk of infections, chronic illnesses, and developmental delays.

The cross-sectional study was conducted to find out the disparities in nutritional status among primary school students studying in private and public schools in Kamal rural municipality in Jhapa. Weight for age, height for age and BMI for age were the anthropometric indicators used in the study. Along with anthropometric measurements, household, children and socio-economic characteristics of children were assessed through structured questionnaire. The data analysis was performed using Excel 2021 and IBM SPSS version 20. Out of 190 students (95 from each type of school), more students were found underweight, stunted and thinned in public school than that of private school. Only students studying in private school were found overweight. The prevalence of underweight, stunting and thinness were 24.3%, 14.7% and 16.9% in public school and 14.8%, 10.5% and 13.7% in private school. 17.9% students were found overweight in private school. The mean dietary diversity score of private school students (4.08 ± 0.996) was slightly higher than public school students (3.66 ± 1.017).

Factors like parent's educational level, mother's occupation, frequency of fruit consumption, monthly expenditure of family, total meals consumed in a day, frequency of consumption of carbonated beverages were found associated with malnutrition among private school children whereas birth weight, birth order, knowledge on malnutrition, frequency of consumption of tea and coffee, gender, ethnicity were found associated with malnutrition among public school students.

The prevalence of malnutrition among children aged 5-10 years can vary significantly between private and public schools due to differences in resources, socioeconomic factors, and access to services. Addressing malnutrition in children aged 5-10 years requires multi-faceted approach with education, healthcare, community support, and policy changes.

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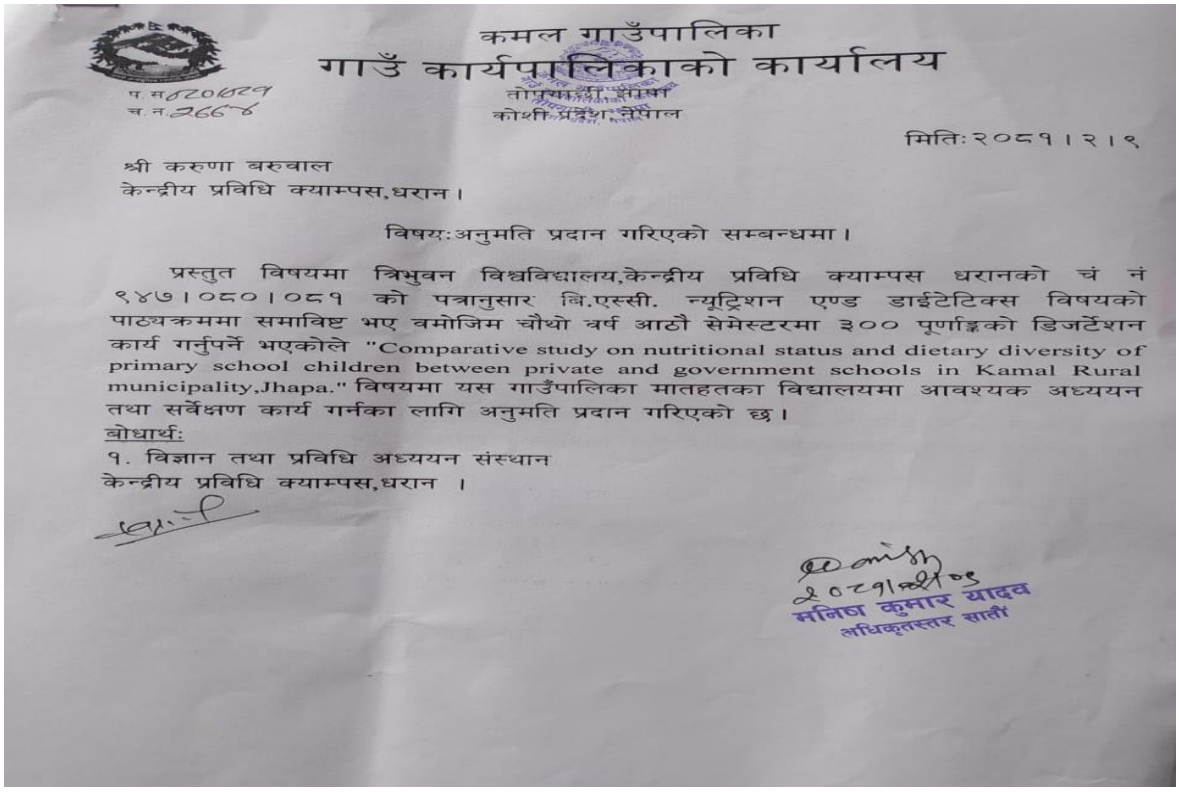
Appendices

Appendix A Approval letter from Kamal rural municipality



कमल गाउँपालिका
गाउँ कार्यपालिकाको कार्यालय
कोशी प्रदेश, नेपाल

प.स.८२०७८१
च.न.२६६७

मितिः २०८१।२।९

श्री करुणा बरुवाल
केन्द्रीय प्रविधि क्याम्पस,धरान।

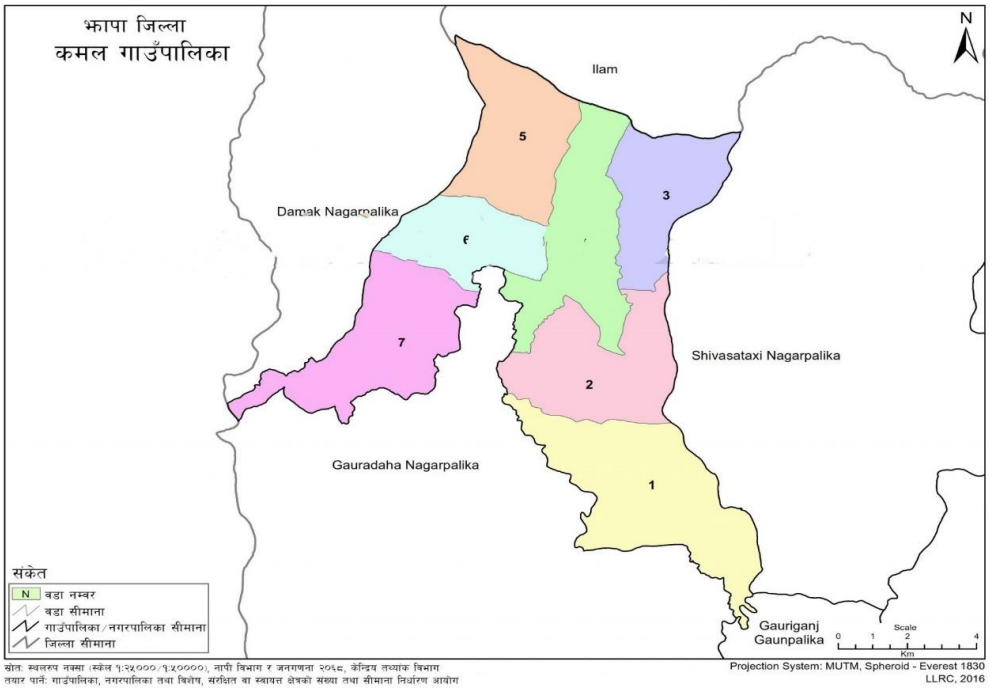
विषयः अनुमति प्रदान गरिएको सम्बन्धमा।

प्रस्तुत विषयमा त्रिभुवन विश्वविद्यालय,केन्द्रीय प्रविधि क्याम्पस धरानको चं नं ९४७।०८०।०८१ को पत्रानुसार बि.एस्सी. न्यूट्रिशन एण्ड डाईटेटिक्स विषयको पाठ्यक्रममा समाविष्ट भए बमोजिम चौथो वर्ष आठौ सेमेस्टरमा ३०० पूर्णाङ्कको डिजर्टेशन कार्य गर्नुपर्ने भएकोले "Comparative study on nutritional status and dietary diversity of primary school children between private and government schools in Kamal Rural municipality,Jhapa." विषयमा यस गाउँपालिका मातहतका विद्यालयमा आवश्यक अध्ययन तथा सर्वेक्षण कार्य गर्नका लागि अनुमति प्रदान गरिएको छ।

बोधार्थः
१. विज्ञान तथा प्रविधि अध्ययन संस्थान
केन्द्रीय प्रविधि क्याम्पस,धरान ।

२०८१।२।९
मनिष कुमार यादव
अधिकृतस्तर सातौं

Appendix B Survey site



Appendix C Consent form from principal

Namaste!

I, Ms. Karuna Baruwal, an undergraduate student of Nutrition and Dietetics in Central Campus of Technology, Dharan; am going to conduct dissertation work in Kamal rural municipality for the degree of Bachelor of Science in in Nutrition and Dietetics.

The topic for the study is "NUTRITIONAL STATUS AND DIETARY DIVERSITY OF PRIMARY SCHOOL CHILDREN IN PRIVATE AND PUBLIC SCHOOLS OF KAMAL RURAL MUNICIPALITY, JHAPA"

Under this study, nutritional status and dietary pattern of students studying in primary school level will be surveyed. The purpose of this study is to evaluate and compare the nutritional status and dietary diversity of children attending private and public schools. The results will contribute to better understanding and addressing nutritional disparities in educational settings.

I am seeking permission to involve students from your school in this study. Students may undergo basic nutritional assessments. All data will be collected in a manner that ensures confidentiality and the entire process is expected to take approximately 5-10 minutes and will be scheduled to minimize disruption to the school day.

Participation in this study is entirely voluntary. Your student participation is not mandatory, and they may withdraw from the study at any time without any consequences.

By signing this form, you give permission for your students to participate in this study. You acknowledge that you have read and understood the information provided and that you are aware of your right to withdraw your child from the study at any time.

I, [Principal's name], have read and understood the information provided about this study. I consent to my students participating in this research project.

Signature: _____ Date: _____

Appendix D Consent form from parents

Namaste!

I, Ms. Karuna Baruwal, an undergraduate student of Nutrition and Dietetics in Central Campus of Technology, Dharan; am going to conduct dissertation work in Kamal rural municipality for the degree of Bachelor of Science in in Nutrition and Dietetics.

The topic for the study is "NUTRITIONAL STATUS AND DIETARY DIVERSITY OF PRIMARY SCHOOL CHILDREN IN PRIVATE AND PUBLIC SCHOOLS OF KAMAL RURAL MUNICIPALITY, JHAPA"

Under this study, nutritional assessment of students studying in primary level in public and private school will be performed All information collected in this study will be kept strictly confidential. Your child's identity will not be revealed in any publication or presentation resulting from this study.

Participation in this study is entirely voluntary. You may choose not to allow your child to participate or to withdraw your child from the study at any time without any penalty or loss of benefits to which you are otherwise entitled. By signing this form, you give permission for your child to participate in this study

I have read and understood the information provided above. I have had the opportunity to ask questions and all my questions have been answered to my satisfaction. I voluntarily agree to allow my child to participate in this study.

Child's Name: _____

Parent/Guardian's Name: _____

Parent/Guardian's Signature: _____

Researcher's Signature: _____

Date: _____

Appendix E Survey Questionnaire

Department of Nutrition and Dietetics

Dharan-14, Hattisar

Questionnaire for assessing nutritional status and dietary diversity

Section I: General Information

Date of interview:

School Code No:	Student Code No:
Kamal Rural Municipality	Ward No:
School's Name	
Type of School: a. Private school b. Government school	Class:
Name of Student:	Gender: Male/Female
Birth date:	Age:
Respondent: a. Father b. Mother c. Grandparents d. Others _____	
Religion: a. Hindu b. Muslim c. Buddhist c. Christian d. Others _____	
Caste: a. Brahmin b. Chhetri c. Janajati d. Dalit d. Others _____	

Section II: Anthropometric Information

	Reading 1	**Reading 2**	**Reading 3**	**Mean reading**
Height:				
Weight:				

BMI:

Section III: Details of the child

1. What was the birth weight of the child?
   a. Less than 2.5 kg b. More than 2.5 kg
2. What is the birth order of the child? _____
3. Number of siblings from same mother:
   Brother: Sister:
4. Did you exclusively breastfeed your child for 6 months?
   a. Yes b. No
5. Did you feed breastmilk to your child up to 2 years?
   a. Yes b. No
6. Did you give Vitamin A and deworming tablet to your child?
   a. Yes b. No

   If yes, when did you give?
   a. Within a month b. Within six months
   c. Within a year d. Before one year
   e. Not aware
7. Has the child undergone any recent health check-ups?
   a. Yes b. No
8. Has the child experienced any recent illness or infections?
   a. Yes b. No

   If yes, please specify _____
9. Is your child taking any nutritional supplements or medications?
   a. Yes b. No
10. How many hours of physical activity does the child engage in on a typical school day?

    _____
11. Does your child participate in any organized sports or physical education classes in the school?
    a. Yes b. No
12. Is the child allergic to any specific types of foods?
    a. Yes b. No

    If yes, please specify _____

Section IV: Household Characteristics

13. Type of family:

a. Nuclear family b. Joint family

14. Number of family members: _____

Number of male members: Number of female members:

15. Head of the household:
    a. Father b. Mother
    c. Grandparents d. Others

16. Father's occupation
    a. Service b. Agriculture
    c. Business d. Foreign employee
    e. Daily labour f. Others

17. Mother's occupation
    a. Home maker b. Agriculture
    c. Service d. Business
    e. Daily labour f. Others

18. Father's education level
    a. Primary b. Secondary
    c. Higher secondary d. Graduate
    e. Illiterate f. Informal

19. Mother's education level
    a. Primary b. Secondary
    c. Higher secondary d. Graduate
    e. Illiterate f. Informal

20. Family's monthly income _____

21. Main source of food for household
    a. Own production b. Purchased from market
    c. Others

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

23. Main source of drinking water in the family
    a. Tube well b. Water tap
    c. Well d. River
    e. Others _____

24. Do you used iodized salt?
    a. Yes b. No

25. Is the water purified?
    a. Yes b. No
26. Toilet facility in the house
    a. Yes b. No
27. Do you know about malnutrition?
    a. Yes b. No
28. If yes, what is the main cause for malnutrition?
    a. Lack of food b. Unhygienic food practices
    c. Superstition d. Others

Section V: Meal Habits and Dietary Intake

29. How many meals do your child eat in a day?
    Meals: _____
    Snacks: _____
30. Is your child a vegetarian?
    a. Yes b. No
31. Does your child skip any meal?
    a. Yes b. No
32. If yes, which meal does he/she skip?
    a. Breakfast b. Lunch
    c. Dinner
33. How often does he/she skip this meal?
    a. Once-twice a week b. Three-four times a week
    c. Five or more days
34. Reason for skipping meal?

    _____
35. What do your child consume at lunch break?
    a. Home-based meal b. Snacks from cafeteria
    c. Packaged foods d. Others _____
36. If consuming snacks from cafeteria, what are the common snacks consumed:

    _____

24-hour dietary recall

	Food items	Portion	Amount
Breakfast (6:00-8:00 am)			
Lunch (9:00-10:00 am)			
Snacks (1:00-2:00 pm)			
Evening snacks (4:00-5:00 pm)			
Dinner (7:00-8:00 pm)			

Food frequency Questionnaire

Food Groups	Daily	3-4 times a week	Once in a week or less	Never	Remarks
Cereals					
Pulses and legumes					
Milk and milk products					
Green leafy vegetables					
Other vegetables					
Fruits					
Egg, meat and fish					
Tea/coffee					
Fast foods/Packaged foods					
Carbonated beverages					

Appendix F Photo gallery

a. Filling questionnaire

b. Measuring weight

c. Standardized cup used for diet assessment

Appendix G Relationship of study variables with malnutrition

Relation of study variable with Underweight

	Private School				Public School			
	Normal	**Underweight**	**Chi-square**	**P-value**	**Normal**	**Underweight**	**Chi-square**	**P-value**
Religion								
Hindu	72(84.7%)	13(15.3%)		1.000$_f$	55(74.3%)	19(25.7%)	0.392	0.583
Others	9(90.0%)	1(10.0%)			17(81.0%)	4(19.0%)		
Vegetarian								
Yes	3(60.0%)	2(40.0%)		0.156$_f$	3(75.0%)	1(25.0%)		1.000$_f$
No	78(86.7%)	12(13.3%)			69(75.8%)	22(24.2%)		
Meals in a day								
3 and less	11(78.6%)	3(21.4%)		0.428$_f$	2(66.7%)	1(33.3%)		0.569$_f$
More than 3	70(86.4%)	11(13.6%)			70(76.1%)	22(23.9%)		
Caste								
Brahmin/Chhetri	37(82.2%)	8(17.8%)			21(84.0%)	4(16.0%)		
Janajati	24(85.7%)	4(14.3%)	0.793$_f$	0.653$_f$	29(80.6%)	7(19.4%)	3.640	0.162
Dalit and others	20(90.9%)	2(9.1%)			22(64.7%)	12(35.3%)		
Father's education								
Secondary and below	56(86.2%)	9(13.8%)			55(78.6%)	15(21.4%)		
Above secondary	25(89.3%)	3(10.7%)	7.375$_f$	*0.031$_f$	9(75.0%)	3(25.0%)	1.428$_f$	0.511$_f$
Illiterate	0(0.0%)	2(100.0%)			7(63.3%)	4(36.4%)		
Mother's education								
Secondary and below	53(84.1%)	10(15.9%)	8.603$_f$	*0.011$_f$	57(78.1%)	16(21.9%)	2.995$_f$	0.259$_f$
Above secondary	28(93.3%)	2(6.7%)			9(81.8%)	2(18.2%)		
Illiterate	0(0.0%)	2(100.0%)			6(54.5%)	5(45.5%)		

	Private school				Public School			
	Normal	**Underweight**	**Chi-square**	**P-value**	**Normal**	**Underweight**	**Chi-square**	**P-value**
Father's occupation								
Agriculture	9(75.0%)	3(25.0%)	2.007$_f$	0.416$_f$	20(80.0%)	5(20.0%)	5.129	0.077
Foreign employment	48(88.9%)	6(11.1%)			27(87.1%)	4(12.9%)		
Others	24(82.8%)	5(17.2%)			21(63.6%)	12(36.4%)		
Mother's occupation								
Agriculture	50(79.4%)	13(20.6%)	6.310$_f$	0.033$_f$	45(77.6%)	13(22.4%)	0.440$_f$	0.839$_f$
Homemaker	23(100.0%)	0(0.0%)			14(73.7%)	5(26.3%)		
Others	8(88.9%)	1(11.1%)			13(72.2%)	5(27.8%)		
Physical activity								
Less than 1 hour	20(90.9%)	2(9.1%)		0.510$_f$	17(89.5%)	2(10.5%)		0.145$_f$
More than 1 hour	61(83.6%)	12(16.4%)			55(72.4%)	21(27.6%)		
Gender of Student								
Male	39 (83.0%)	8(17.0%)	0.386	0.534	41(74.5%)	14 (25.5%)	0.110	0.740
Female	42 (87.5%)	6(12.5%)			31(77.5%)	9(22.5%)		
Birth weight of child								
Less than 2.5kg	9(90.0%)	1(10.0%)		1.000$_f$	14 (58.3%)	10 (41.7%)	5.333	*0.021
2.5kg and more	72 (84.7%)	13 (15.3%)			58 (81.7%)	13 (18.3%)		
Knowledge on malnutrition								
Yes	51 (87.9%)	7 (12.1%)	0.844	0.358	35 (87.5%)	5 (12.5%)	5.164	*0.023
No	30 (81.1%)	7 (18.9%)			37 (67.3%)	18(32.7%)		
Type of family								
Nuclear family	42(85.7%)	7(14.3%)	0.016	0.898	42(73.7%)	15(26.3%)	0.344	0.557
Joint family	39(84.8%)	7(15.2%)			30(78.9%)	8(21.1%)		

	Private school				Public School			
	Normal	**Underweight**	**Chi-square**	**P-value**	**Normal**	**Underweight**	**Chi-square**	**P-value**
Water purification								
Yes	63(84.0%)	12(16.0%)		0.727_f	47(75.8%)	15(24.2%)	0.000	0.996
No	18(90.0%)	2(10.0%)			25(75.8%)	8(24.2%)		
Iodized salt								
Yes	79(84.9%)	14(15.1%)	0.353	1.000	69(75.8%)	22(24.2%)	0.001	1.000
No	2(100.0%)	0(0.0%)			3(75.0%)	1(25.0%)		
Skipping meal								
Yes	30(85.7%)	5(14.3%)	0.009	0.925	19(76.0%)	6(24.0%)	0.001	0.977
No	51(85%)	9(15%)			53(75.7%)	17(24.3%)		
Meal they skip								
Breakfast	22(81.5%)	5(18.5%)		0.315_f	12(85.7%)	2(14.3%)		0.350_f
Others	8(100%)	0(0.0%)			7(63.6%)	4(36.4%)		
Age category								
(5-7) years	50(83.3%)	10(16.7%)	0.483	0.487	40(72.7%)	15(27.3%)	0.668	0.414
(8-10) years	31(88.6%)	41(1.4%)			32(80.0%)	8(20.0%)		
Exclusively breastfed								
Yes	53(86.9%)	8(13.1%)	0.357	0.550	45(77.6%)	13(22.4%)	0.262	0.609
No	28(82.4%)	6(17.6%)			27(73.0%)	10(27.0%)		
Breastfeeding upto 2 years								
Yes	71(84.5%)	13(15.5%)		1.000_f	64(77.1%)	19(22.9%)		0.476_f
No	10(90.9%)	1(9.1%)			8(66.7%)	4(33.3%)		
Family members								
Above average	49(83.1%)	10(16.9%)	0.606	0.436	33(68.8%)	15(31.2%)	2.620	0.106
Below average	32(88.9%)	4(11.1%)			39(83.0%)	8(17.0%)		

	Private school				Public School			
	Normal	**Underweight**	**Chi-square**	**P-value**	**Normal**	**Underweight**	**Chi-square**	**P-value**
Recent health check-up								
Yes	22(81.5%)	5(18.5%)		0.531$_f$	12(85.7%)	2(14.3%)		0.506$_f$
No	59(86.8%)	9(13.2%)			60(74.1%)	21(25.9%)		
Recent illness or infection								
Yes	16(80.0%)	4(20.0%)		0.484$_f$	17(73.9%)	6(26.1%)	0.058	0.809
No	65(86.7%)	10(13.3%)			55(76.4%)	17(23.6%)		
Nutritional supplements								
Yes	19(82.6%)	4(17.4%)		0.738$_f$	11(64.7%)	6(35.3%)		0.347$_f$
No	62(86.1%)	10(13.9%)			61(78.2%)	17(21.8%)		
Participation in sports organized								
Yes	70(85.4%)	12(14.6%)		1.000$_f$	54(75.0%)	18(25.0%)	0.101	0.751
No	11(84.6%)	2(15.4%)			18(78.3%)	5(21.7%)		
Food allergy								
Yes	1(100.0%)	0(0.0%)		1.000$_f$	4(50.0%)	4(50.0%)		0.094$_f$
No	80(85.1%)	14(14.9%)			68(78.2%)	19(21.8%)		
Main source of food								
Own production	62(83.8%)	12(16.2%)		0.728$_f$	50(74.6%)	17(25.4%)	0.167	0.682
Purchased from market	19(90.5%)	2(9.5%)			22(78.6%)	6(21.4%)		
Kitchen garden								
Yes	71(84.5%)	13(15.5%)		1.000$_f$	53(75.7%)	17(24.3%)	0.001	0.977
No	10(90.9%)	1(9.1%)			19(76.0%)	6(24.0%)		

	Private school				Public School			
	Normal	**Underweight**	**Chi-square**	**P-value**	**Normal**	**Underweight**	**Chi-square**	**P-value**
Dietary diversity score								
Low	25(83.3%)	5(16.7%)			33(75.0%)	11(25.0%)		
Medium	49(84.5%)	9(15.5%)	0.820$_f$	0.807$_f$	38(76.0%)	12(24.0%)	0.467$_f$	1.000$_f$
High	7(100.0%)	0(0.0%)			1(100.0%)	0(0.0%)		
Source of drinking water								
Tube well	60(87.0%)	9(13.0%)			57(72.2%)	22(27.8%)		
Water tap	1487.5%	212.5%	2.159$_f$	0.355$_f$	11(91.7%)	1(8.3%)	2.671$_f$	0.219$_f$
Both	7(70.0%)	3(30.0%)			4(100.0%)	0(0.0%)		
Pulses and legumes								
Daily	65(85.5%)	11(14.5%)			49(80.3%)	12(19.7%)		
2-3 times a week	15(83.3%)	3(16.7%)	0.757$_f$	0.768$_f$	20(66.7%)	10(33.3%)	2.250$_f$	0.312$_f$
Once a week and less	1(100.0%)	0(0.0%)			3(75.0%)	1(25.0%)		
Milk and milk products								
Daily	52(85.2%)	9(14.8%)			23(74.2%)	8(25.8%)		
2-3 times a week	19(90.5%)	2(9.5%)	1.260$_f$	0.520$_f$	16(72.7%)	6(27.3%)	0.333	0.847
Once a week and less	10(76.9%)	3(23.1%)			3378.6%	9(21.4%)		
Green leafy vegetables								
Daily	8(100.0%)	0(0.0%)			9(81.8%)	2(18.2%)		
2-3 times a week	37(86.0%)	6(14.0%)	1.819	0.403	29(74.4%)	10(25.6%)	0.263	0.894
Once a week and less	36(81.8%)	8(18.2%)			34(75.6%)	11(24.4%)		
Other vegetables								
Daily	7(87.5%)	1(12.5%)			12(75.0%)	4(25.0%)		
2-3 times a week	46(88.5%)	6(11.5%)	1.227	0.542	47(75.8%)	15(24.2%)	0.105$_f$	1.000$_f$
Once a week and less	28(80.0%)	7(20.0%)			13(76.5%)	4(23.5%)		

	Private school				Public School			
	Normal	**Underweight**	**Chi-square**	**P-value**	**Normal**	**Underweight**	**Chi-square**	**P-value**
Fruits								
Daily	21(100.0%)	0(0.0%)						
2-3 times a week	27(90.0%)	3(10.0%)	7.770$_f$	*0.015$_f$	15(93.8%)	1(6.2%)		0.107$_f$
Once a week and less	33(75.0%)	11(25.0%)			57(72.2%)	22(27.8%)		
Egg, meat and fish								
Daily	5(100.0%)	0(0.0%)			5(71.4%)	2(28.6%)		
2-3 times a week	46(88.5%)	6(11.5%)	1.872$_f$	0.356$_f$	34(77.3%)	10(22.7%)	0.140	0.932
Once a week and less	30(78.9%)	8(21.1%)			33(75.0%)	11(25.0%)		
Tea and coffee								
Daily	54(90.0%)	6(10.0%)			56(70.9%)	23(29.1%)		
2-3 times a week	4(66.7%)	2(33.3%)	9.733$_f$	*0.006$_f$	6(100.0%)	0(0.0%)	5.602$_f$	*0.044$_f$
Once a week and less	23(79.3%)	6(20.7%)			10(100.0%)	0(0.0%)		
FF and Packaged foods								
Daily	33(89.2%)	4(10.8%)			30(78.9%)	8(21.1%)		
2-3 times a week	26(81.2%)	6(18.8%)	0.949$_f$	0.667$_f$	20(76.9%)	6(23.1%)	0.618	0.734
Once a week and less	22(84.6%)	4(15.4%)			22(71.0%)	9(29.0%)		
Carbonated beverages								
Daily	3(100.0%)	0(0.0%)			1(50.0%)	1(50.0%)		
2-3 times a week	23(100.0%)	0(0.0%)	6.327$_f$	*0.040$_f$	10(90.9%)	1(9.1%)	2.339$_f$	0.299$_f$
Once a week and less	55(79.7%)	14(20.3%)			61(74.4%)	21(25.6%)		

	Private school				Public School			
	Normal	**Underweight**	**Chi-square**	**P-value**	**Normal**	**Underweight**	**Chi-square**	**P-value**
Adequacy of energy								
Above EAR	21(91.3%)	2(8.7%)			15(68.2%)	7(31.8%)	0.903	0.342
Below EAR	60(83.3%)	12(16.7%)		0.506$_f$	57(78.1%)	16(21.9%)		
Adequacy of protein								
Above RDA	80(85.1%)	14(14.9%)			71(75.5%)	23(24.5%)		1.000$_f$
Below RDA	1(100.0%)	0(0.0%)		1.000$_f$	1(100.0%)	0(0.0%)		
Adequacy of visible fats								
Above EAR	51(89.5%)	6(10.5%)			35(74.5%)	12(25.5%)	0.089	0.766
Below EAR	30(78.9%)	8(21.1%)	2.011	0.156	37(77.1%)	11(22.9%)		
Adequacy of CHO								
Above RDA	73(85.9%)	12(14.1%)			70(76.1%)	22(23.9%)		
Below RDA	8(80.0%)	2(20.0%)		0.639$_f$	2(66.7%)	1(33.3%)		0.569$_f$

Relation of study variable with Stunting

	Private school				Public School			
	Normal	**Stunted**	**Chi-square**	**P-value**	**Normal**	**Stunted**	**Chi-square**	**P-value**
Religion								
Hindu	76(89.4%)	9(10.6%)		1.000$_f$	65(87.8%)	9(12.2%)		0.292$_f$
Others	9(90.0%)	1(10.0%)			16(76.2%)	5(23.8%)		
Vegetarian								
Yes	5(100.0%)	0(0.0%)		1.000$_f$	4(100.0%)	0(0.0%)		1.000$_f$
No	80(88.9%)	10(11.1%)			77(84.6%)	14(15.4%)		

	Private school				Public School			
	Normal	**Stunted**	**Chi-square**	**P-value**	**Normal**	**Stunted**	**Chi-square**	**P-value**
Meals in a day								
3 and less	14(100.0%)	0(0.0%)		0.349$_f$	3(100.0%)	0(0.0%)		1.000$_f$
More than 3	71(87.7%)	10(12.3%)			78(84.8%)	14(15.2%)		
Caste								
Brahmin/Chhetri	38(84.4%)	7(15.6%)	1.948$_f$	0.426$_f$	21(84.0%)	4(16.0%)	1.613	0.446
Janajati	26(92.9%)	2(7.1%)			29(80.6%)	7(19.4%)		
Dalit and others	21(95.5%)	1(4.5%)			31(91.2%)	3(8.8%)		
Father's education								
Secondary and below	60(92.3%)	5(7.7%)	2.447$_f$	0.330$_f$	59(84.3%)	11(15.7%)	0.520$_f$	0.797$_f$
Above secondary	23(82.1%)	5(17.9%)			11(91.7%)	1(8.3%)		
Illiterate	2(100.0%)	0(0.0%)			9(81.8%)	2(18.2%)		
Mother's education								
Secondary and below	57(90.5%)	6(9.5%)	0.748$_f$	0.778$_f$	61(83.6%)	12(16.4%)	1.953$_f$	0.478$_f$
Above secondary	26(86.7%)	4(13.3%)			9(81.8%)	2(18.2%)		
Illiterate	2(100.0%)	0(0.0%)			11(100.0%)	0(0.0%)		
Father's occupation								
Agriculture	11(91.7%)	1(8.3%)	0.596$_f$	0.888$_f$	20(80.0%)	5(20.0%)	1.479$_f$	0.462$_f$
Foreign employment	49(90.7%)	5(9.3%)			27(87.1%)	4(12.9%)		
Others	25(86.2%)	4(13.8%)			30(90.9%)	3(9.1%)		
Mother's occupation								
Agriculture	55(87.3%)	8(12.7%)	1.195$_f$	0.574$_f$	50(86.2%)	8(13.8%)	1.160$_f$	0.654$_f$
Homemaker	22(95.7%)	1(4.3%)			17(89.5%)	2(10.5%)		
Others	8(88.9%)	1(11.1%)			14(77.8%)	4(22.2%)		

	Private School				Public School			
	Normal	**Stunted**	**Chi-square**	**P-value**	**Normal**	**Stunted**	**Chi-square**	**P-value**
Physical activity								
Less than 1 hour	20(90.9%)	2(9.1%)		1.000$_f$	17(89.5%)	2(10.5%)		0.728$_f$
More than 1 hour	65(89.0%)	8(11.0%)			64(84.2%)	12(15.8%)		
Gender of Student								
Male	40(85.1%)	7(14.9%)		0.199$_f$	42(76.4%)	13(23.6%)	8.234	*0.004
Female	45(93.8%)	3(6.2%)			39(97.5%)	1(2.5%)		
Birth weight of child								
Less than 2.5kg	9(90.0%)	1(10.0%)		1.000$_f$	20(83.3%)	4(16.7%)		0.746$_f$
2.5kg and more	76(89.4%)	9(10.6%)			61(85.9%)	10(14.1%)		
Knowledge on malnutrition								
Yes	52(89.7%)	6(10.3%)		1.000$_f$	36(90%)	4(10%)	1.234	0.267
No	33(89.2%)	4(10.8%)			45(81.8%)	10(18.2%)		
Type of family								
Nuclear family	45(91.8%)	4(8.2%)		0.516$_f$	49(86.0%)	8(14.0%)	0.056	0.813
Joint family	40(87.0%)	6(13.0%)			32(84.2%)	6(15.8%)		
Water purification								
Yes	66(88.0%)	9(12.0%)		0.683$_f$	55(88.7%)	7(11.3%)		0.230$_f$
No	19(95.0%)	1(5.0%)			26(78.8%)	7(21.2%)		
Iodized salt								
Yes	83(89.2%)	10(10.8%)		1.000$_f$	78(85.7%)	13(14.3%)		0.477$_f$
No	2(100.0%)	0(0.0%)			3(75.0%)	1(25.0%)		
Skipping meal								
Yes	32(91.4%)	3(8.6%)		0.741$_f$	24(96.0%)	1(4.0%)		0.104$_f$
No	53(88.3%)	7(11.7%)			57(81.4%)	13(18.6%)		

	Private School				Public School			
	Normal	**Stunted**	**Chi-square**	**P-value**	**Normal**	**Stunted**	**Chi-square**	**P-value**
Meal they skip								
Breakfast	24(88.9%)	3(11.1%)		1.000$_f$	14(100.0%)	0(0.0%)		0.440$_f$
Others	8(100.0%)	0(0.0%)			10(90.0%)	1(10.1%)		
Age Category								
(5-7) years	54(90.0%)	6(10.0%)		1.000$_f$	47(85.5%)	8(14.5%)	0.004	0.951
(8-10) years	31(88.6%)	4(11.4%)			34(85.0%)	6(15.0%)		
Exclusively breastfed								
Yes	52(85.2%)	9(14.8%)		0.090$_f$	51(87.9%)	7(12.1%)	0.844	0.358
No	33(97.1%)	1(2.9%)			30(81.1%)	7(18.9%)		
Breastfeeding upto 2 years								
Yes	74(88.1%)	10(11.9%)		0.599$_f$	72(86.7%)	11(13.3%)		0.377$_f$
No	11(100.0%)	0(0.0%)			9(75.0%)	3(25.0%)		
Family members								
Above average	52(88.1%)	7(11.9%)		0.737$_f$	40(83.3%)	8(16.7%)	0.288	0.592
Below average	33(91.7%)	3(8.3%)			41(87.2%)	6(12.8%)		
Recent health check-up								
Yes	24(88.9%)	3(11.1%)		1.000$_f$	12(85.7%)	2(14.3%)		1.000$_f$
No	61(89.7%)	7(10.3%)			69(85.2%)	12(14.8%)		
Recent illness or infection								
Yes	18(90.0%)	2(10.0%)		1.000$_f$	19(82.6%)	4(17.4%)		0.738$_f$
No	67(89.3%)	8(10.7%)			62(86.1%)	10(13.9%)		
Nutritional supplements								
Yes	19(82.6%)	4(17.4%)		0.248$_f$	15(88.2%)	2(11.8%)		1.000$_f$
No	66(91.7%)	6(8.3%)			66(84.6%)	12(15.4%)		

	Private School				Public School			
	Normal	**Stunted**	**Chi-square**	**P-value**	**Normal**	**Stunted**	**Chi-square**	**P-value**
Participation in sports organized								
Yes	75(91.5%)	7(8.5%)		0.136$_f$	62(86.1%)	10(13.9%)		0.738$_f$
No	10(76.9%)	3(23.1%)			19(82.6%)	4(17.4%)		
Food allergy								
Yes	1(100.0%)	0(0.0%)		1.000$_f$	6(75.0%)	2(25.0%)		0.335$_f$
No	84(89.4%)	10(10.6%)			75(86.2%)	12(13.8%)		
Main source of food								
Own production	64(86.5%)	10(13.5%)		0.111$_f$	56(83.6%)	11(16.4%)		0.752$_f$
Purchased from market	21(100.0%)	0(0.0%)			25(89.3%)	3(10.7%)		
Kitchen garden								
Yes	75(89.3%)	9(10.7%)		1.000$_f$	60(85.7%)	10(14.3%)		1.000$_f$
No	10(90.9%)	1(9.1%)			21(84.0%)	4(16.0%)		
Dietary diversity score								
Low	26(86.7%)	4(13.3%)			36(81.8%)	8(18.2%)		
Medium	52(89.7%)	6(10.3%)	0.614$_f$	0.765$_f$	44(88.0%)	6(12.0%)	1.294$_f$	0.627$_f$
High	7(100.0%)	0(0.0%)			1(100.0%)	0(0.0%)		
Source of drinking water								
Tube well	64(92.8%)	5(7.2%)			66(83.5%)	13(16.5%)		
Water tap	14(87.5%)	2(12.5%)	4.562$_f$	0.064$_f$	11(91.7%)	1(8.3%)	0.515$_f$	0.835$_f$
Both	7(70.0%)	3(30.0%)			4(100.0%)	0(0.0%)		
Pulses and legumes								
Daily	66(86.8%)	10(13.2%)			53(86.9%)	8(13.1%)		
2-3 times a week	18(100.0%)	0(0.0%)	3.101$_f$	0.284$_f$	24(80.0%)	6(20.0%)	1.046$_f$	0.665$_f$
Once a week and less	1(100.0%)	0(0.0%)			4(100.0%)	0(0.0%)		

	Private School				Public School			
	Normal	**Stunted**	**Chi-square**	**P-value**	**Normal**	**Stunted**	**Chi-square**	**P-value**
Milk and milk products								
Daily	54(88.5%)	7(11.5%)	0.159$_f$	1.000$_f$	23(74.2%)	8(25.8%)	3.978$_f$	0.128$_f$
2-3 times a week	19(90.5%)	2(9.5%)			20(90.9%)	2(9.1%)		
Once a week and less	12(92.3%)	1(7.7%)			38(90.5%)	4(9.5%)		
Green leafy vegetables								
Daily	7(87.5%)	1(12.5%)	3.173$_f$	0.178$_f$	10(90.9%)	1(9.1%)	1.894	0.436
2-3 times a week	41(95.3%)	2(4.7%)			35(89.7%)	4(10.3%)		
Once a week and less	37(84.1%)	7(15.9%)			36(80.0%)	9(20.0%)		
Other vegetables								
Daily	8(100.0%)	0(0.0%)	0.983$_f$	0.595$_f$	13(81.2%)	3(18.8%)	0.459$_f$	0.833$_f$
2-3 times a week	47(90.4%)	5(9.6%)			53(85.5%)	9(14.5%)		
Once a week and less	30(85.7%)	5(14.3%)			15(88.2%)	2(11.8%)		
Fruits								
Daily	20(95.2%)	1(4.8%)	1.015$_f$	0.571$_f$				1.000$_f$
2-3 times a week	27(90.0%)	3(10.0%)			14(87.5%)	2(12.5%)		
Once a week and less	38(86.4%)	6(13.6%)			67(84.8%)	12(15.2%)		
Egg, meat and fish								
Daily	5(100.0%)	0(0.0%)			6(85.7%)	1(14.3%)		
2-3 times a week	45(86.5%)	7(13.5%)	0.789$_f$	0.722$_f$	37(84.1%)	7(15.9%)	0.092	1.000
Once a week and less	35(92.1%)	3(7.9%)			38(86.4%)	6(13.6%)		
Tea and coffee								
Daily	53(88.3%)	7(11.7%)			66(83.5%)	13(16.5%)	1.678$_f$	0.488$_f$
2-3 times a week	6(100.0%)	0(0.0%)	0.287$_f$	1.000$_f$	5(83.3%)	1(16.7%)		
Once a week and less	26(89.7%)	3(10.3%)			1(100.0%)	0(0.0%)		

	Private School				Public School			
	Normal	**Stunted**	**Chi-square**	**P-value**	**Normal**	**Stunted**	**Chi-square**	**P-value**
Fast food and packaged food								
Daily	32(86.5%)	5(13.5%)			33(86.8%)	5(13.2%)		
2-3 times a week	28(87.5%)	4(12.5%)	1.690$_f$	0.486$_f$	23(88.5%)	3(11.5%)	0.812$_f$	0.713$_f$
Once a week and less	25(96.2%)	1(3.8%)			25(80.6%)	6(19.4%)		
Carbonated beverages								
Daily	3(100.0%)	0(0.0%)			1(50.0%)	1(50.0%)	2.363$_f$	0.316$_f$
2-3 times a week	21(91.3%)	2(8.7%)	0.262$_f$	1.000$_f$	10(90.9%)	1(9.1%)		
Once a week and less	61(88.4%)	8(11.6%)			70(85.4%)	12(14.6%)		
Adequacy of energy								
Above EAR	20(87.0%)	3(13.0%)		0.700$_f$	17(77.3%)	5(22.7%)		0.302$_f$
Below EAR	65(90.3%)	7(9.7%)			64(87.7%)	9(12.3%)		
Adequacy of protein								
Above RDA	84(89.4%)	10(10.6%)			80(85.1%)	14(14.9%)		1.000$_f$
Below RDA	1(100.0%)	0(0.0%)		1.000$_f$	19100.0%)	0(0.0%)		
Adequacy of visible fat								
Above EAR	52(91.2%)	5(8.8%)		0.514$_f$	38(80.9%)	9(19.1%)	1.441	0.230
Below EAR	33(86.8%)	5(13.2%)			43(89.6%)	5(10.4%)		
Adequacy of CHO								
Above RDA	77(90.6%)	8(9.4%)		0.283$_f$	78(84.8%)	14(15.2%)		1.000$_f$
Below RDA	8(80.0%)	2(20.0%)			3(100.0%)	0(0.0%)		

Relation of study variable with Thinness

	Private school					Public School			
	Normal	**Thinned**	**Overweight**	**Chi-square**	**P-value**	**Normal**	**Thinned**	**Chi-square**	**P-value**
Religion									
Hindu	58(68.2%)	13(15.3%)	14(16.5%)	2.152$_f$	0.396$_f$	60(81.1%)	14(18.9%)		0.510$_f$
Others	7(70.0%)	0(0.0%)	3(30.0%			19(90.5%)	2(9.5%)		
Vegetarian									
Yes	3(60.0%)	2(40.0%)	0(0.0%)	2.970$_f$	0.174$_f$	4(100.0%)	0(0.0%)		1.000$_f$
No	62(68.9%)	11(12.2%)	17(18.9%)			75(82.4%)	16(17.6%)		
Meals in a day									
3 and less	4(28.6%)	5(35.7%)	5(35.7%)	11.935$_f$	*0.001$_f$	3(100.0%)	0(0.0%)		1.000$_f$
More than 3	61(75.3%)	8(9.9%)	12(14.8%)			76(82.6%)	16(17.4%)		
Caste									
Brahmin/Chhetri	36(80.0%)	5(11.1%)	4(8.9%)	7.559$_f$	0.103$_f$	22(88.0%)	3(12.0%)		
Janajati	15(53.6%)	4(14.3%)	9(32.1%)			34(94.4%)	2(5.6%)	9.533	*0.009
Dalit and others	14(63.6%)	4(18.2%)	4(18.2%)			23(67.6%)	11(32.4%)		
Father's education									
Secondary and below	43(66.2%)	10(15.4%)	12(18.5%)	3.485$_f$	0.439$_f$	60(85.7%)	10(14.3%)		
Above secondary	21(75.0%)	2(7.1%)	5(17.9%)			9(75.0%)	3(25.0%)	1.306$_f$	0.563$_f$
Illiterate/informal/absent	1(50.0%)	1(50.0%)	0(0.0%)			9(81.8%)	2(18.2%)		
Mother's education									
Secondary and below	41(65.1%)	11(17.5%)	11(17.5%)	2.520$_f$	0.645$_f$	62(84.9%)	11(15.1%)		
Above secondary	22(75.9%)	2(6.7%)	6(20.7%)			9(81.8%)	2(18.2%)	1.400$_f$	1.000$_f$
Illiterate	2(100.0%)	0(0.0%)	0(0.0%)			8(72.7%)	3(27.3%)		

	Private school					Public School			
	Normal	Thinned	Overweight	Chi-square	P-value	Normal	Thinned	Chi-square	P-value
Father's occupation									
Agriculture	8(83.3%)	2(16.7%)	2(16.7%)	1.362$_f$	0.869$_f$	24(96.0%)	1(4.0%)	4.371	0.112
Foreign employment	37(68.5%)	6(11.1%)	11(20.4%)			25(80.6%)	6(19.4%)		
Others	20(68.4%)	5(17.2%)	4(13.8%)			25(75.8%)	8(24.2%)		
Mother's occupation									
Agriculture	45(71.4%)	8(12.7%)	10(15.9%)	2.313$_f$	0.696$_f$	49(84.5%)	9(15.5%)	0.507$_f$	0.864$_f$
Homemaker	14(60.9%)	3(13.0%)	6(26.1%)			15(78.9%)	4(21.1%)		
Others	7(77.8%)	2(22.2%)	2(22.2%)			15(83.3%)	3(16.7%)		
Physical activity									
Less than 1 hour	15(68.2%)	3(13.6%)	4(18.2%)	0.115$_f$	1.000$_f$	17(89.5%)	2(10.5%)		0.514$_f$
More than 1 hour	50(68.5%)	10(13.7%)	13(17.8%)			62(81.6%)	14(18.4%)		
Gender									
Male	31(66.0%)	9(19.1%)	7(14.9%)	2.581	0.275	43(78.2%)	12(21.8%)	2.309	0.129
Female	34(70.8%)	4(8.3%)	10(20.8%)			36(90.0%)	4(10.0%)		
Birth weight of child									
Less than 2.5kg	6(60.0%)	3(30.0%)	1(10.0%)	2.481$_f$	0.264$_f$	18(75%)	6(25%)	1.526	0.223$_f$
2.5kg and more	59(69.4%)	10(11.8%)	16(18.8%)			61(85.9%)	10(14.1%)		
Knowledge on malnutrition									
Yes	40(69.0%)	9(15.5%)	9(15.5%)	0.843	0.656	37(92.5%)	3(7.5%)	4.305	*0.038
No	25(67.6%)	4(10.8%)	8(21.6%)			42(76.4%)	13(23.6%)		
Type of family									
Nuclear family	32(65.3%)	7(14.3%)	10(20.4%)	0.528	0.768	47(82.5%)	10(17.5%)	0.050	0.823
Joint family	33(71.7%)	6(13.0%)	7(15.2%)			32(84.2%)	6(15.8%)		

	Private school					Public School			
	Normal	**Thinned**	**Overweight**	**Chi-square**	**P-value**	**Normal**	**Thinned**	**Chi-square**	**P-value**
Water purification									
Yes	53(70.7%)	10(13.3%)	12(16.0%)	1.252$_f$	0.595$_f$	54(87.1%)	8(12.9%)	1.977	0.160
No	12(60.0%)	3(15.0%)	5(25.0%)			25(75.8%)	8(24.2%)		
Iodized salt									
Yes	64(68.8%)	12(12.9%)	17(18.3%)	2.399$_f$	0.287$_f$	75(82.4%)	16(17.6%)	0.846	1.000$_f$
No	1(50.0%)	1(50.0%)	0(0.0%)			4(100.0%)	0(0.0%)		
Skipping meal									
Yes	21(60.0%)	6(17.1%)	8(22.9%)	1.821	0.402 $_f$	21(84.0%)	4(16.0%)	0.017	1.000$_f$
No	44(73.3%)	7(11.7%)	7(11.7%)			58(82.9%)	12(17.1%)		
Meal they skip									
Breakfast	14(51.9%)	6(22.2%)	7(25.9%)	2.896$_f$	0.247$_f$	11(78.6%)	3(21.4%)		0.604$_f$
Others	7(87.5%)	0(0.0%)	1(12.5%)			10(90.9%)	1(9.1%)		
Age Category									
(5-7) years	43(71.1%)	9(15.0%)	8(13.3%)	2.350	0.309	45(81.8%)	10(18.2%)	0.167	0.682
(8-10) years	22(88.6%)	4(11.4%)	9(25.7%)			34(85.0%)	6(15.0%)		
Exclusively breastfed									
Yes	45(73.8%)	6(9.8%)	10(16.4%)	2.772	0.250	46(79.3%)	12(20.7%)	1.574	0.210
No	20(58.8%)	7(20.6%)	7(20.6%)			33(89.2%)	4(10.8%)		
Breastfeeding upto 2 years									
Yes	59(70.2%)	13(15.5%)	12(14.3%)	5.922$_f$	*0.039$_f$	68(81.9%)	15(18.1%)	0.710	0.684$_f$
No	6(54.5%)	0(0.0%)	5(45.5%)			11(91.7%)	1(8.3%)		
Family members									
Above average	41(69.5%)	10(16.9%)	8(13.6%)	2.874	0.238	37(77.1%)	11(22.9%)	2.556	0.110
Below average	24(66.7%)	3(8.3%)	9(25.0%)			42(89.4%)	5(10.6%)		

	Private school					Public School			
	Normal	**Thinned**	**Overweight**	**Chi-square**	**P-value**	**Normal**	**Thinned**	**Chi-square**	**P-value**
Recent health check-up									
Yes	15(55.6%)	5(18.5%)	7(25.9%)	3.090_f	0.238_f	13(92.9%)	1(7.1%)		0.452_f
No	50(73.5%)	8(11.8%)	10(14.7%)			66(81.5%)	15(18.5%)		
Recent illness or infection									
Yes	13(65.0%)	5(25.0%)	2(10.0%)	3.068_f	0.216_f	20(87.0%)	3(13.0%)		0.753_f
No	52(69.3%)	8(10.7%)	15(20.0%)			59(81.9%)	13(18.1%)		
Nutritional supplements									
Yes	18(78.3%)	3(13.0%)	2(8.7%)	1.731_f	0.471_f	12(70.6%)	5(29.4%)		0.154_f
No	47(65.3%)	10(13.9%)	15(20.8%)			67(85.9%)	11(14.1%)		
Participation in sports organized									
Yes	56(68.3%)	12(14.6%)	14(17.1%)	0.605_f	0.812_f	61(84.7%)	11(15.3%)		0.526_f
No	9(69.2%)	1(7.7%)	3(23.1%)			18(78.3%)	5(21.7%)		
Food allergy									
Yes	1(100.0%)	0(0.0%)	0(0.0%)	1.193_f	1.000_f	7(87.5%)	1(12.5%)		1.000_f
No	64(68.1%)	13(13.8%)	17(18.1%)			72(82.8%)	15(17.2%)		
Main source of food									
Own production	51(68.9%)	11(14.9%)	12(16.2%)	0.890	0.698_f	55(82.1%)	12(17.9%)		0.771_f
Purchased from market	14(66.7%)	2(9.5%)	5(23.8%)			24(85.7%)	4(14.3%)		
Kitchen garden									
Yes	56(66.7%)	13(15.5%)	15(17.9%)	1.640	0.480_f	62(88.6%)	8(11.4%)		$*0.028_f$
No	9(81.8%)	0(0.0%)	2(18.2%)			17(68.0%)	8(32.0%)		
Dietary diversity score									
Low	21(70.0%)	5(16.7%)	4(13.3%)			36(81.8%)	8(18.2%)		
Medium	39(67.2%)	8(13.8%)	11(19.0%)	1.800_f	0.812_f	42(84.0%)	8(16.0%)	0.629_f	0.826_f
High	5(71.4%)	0(0.0%)	2(28.6%)			1(100.0%)	0(0.0%)		

	Private school					Public School			
	Normal	**Thinned**	**Overweight**	**Chi-square**	**P-value**	**Normal**	**Thinned**	**Chi-square**	**P-value**
Source of drinking water									
Tube well	48(69.6%)	11(15.9%)	10(14.5%)	8.637$_f$	*0.044$_f$	63(79.7%)	16(20.3%)	3.053$_f$	0.267$_f$
Water tap	8(50.0%)	1(6.2%)	7(43.8%)			12(100.0%)	0(0.0%)		
Both	9(90.0%)	1(10.0%)	0(0.0%)			4 (100.0%)	0(0.0%)		
Pulses and legumes									
Daily	51(67.1%)	10(13.2%)	15(19.7%)	5.071$_f$	0.300$_f$	51(83.6%)	10(16.4%)	0.557$_f$	0.892$_f$
2-3 times a week	14(77.8%)	2(11.1%)	2(11.1%)			24(80.0%)	6(20.0%)		
Once a week and less	0(0.0%)	1(100.0%)	1(100.0%)			4(100.0%)	0(0.0%)		
Milk and milk products									
Daily	44(72.1%)	7(11.5%)	10(16.4%)	3.939$_f$	0.409$_f$	28(90.3%)	3(9.7%)	1.826	0.401
2-3 times a week	15(71.4%)	3(14.3%)	3(14.3%)			17(77.3%)	5(22.7%)		
Once a week and less	6(46.2%)	3(23.1%)	4(30.8%)			34(81.0%)	8(19.0%)		
Green leafy vegetables									
Daily	6(75.0%)	0(0.0%)	2(25.0%)	1.449$_f$	0.879$_f$	11(100.0%)	0(0.0%)	3.217	0.200
2-3 times a week	29(67.4%)	7(16.3%)	7(16.3%)			33(84.6%)	6(15.4%)		
Once a week and less	30(68.2%)	6(13.6%)	6(13.6%)			35(77.8%)	10(22.2%)		
Other vegetables									
Daily	4(50.0%)	2(25.0%)	2(25.0%)	7.301$_f$	0.093$_f$	16(100.0%)	0(0.0%)	4.429$_f$	0.128$_f$
2-3 times a week	39(75.0%)	3(5.8%)	10(19.2%)			50(80.6%)	12(19.4%)		
Once a week and less	27(62.9%)	8(22.9%)	5(14.3%)			13(76.5%)	4(23.5%)		
Fruits									
Daily	15(71.4%)	1(4.8%)	5(23.8%)	2.820$_f$	0.605$_f$				1.000$_f$
2-3 times a week	22(73.3%)	4(13.3%)	4(13.3%)			14(87.5%)	2(12.5%)		
Once a week and less	28(63.6%)	8(18.2%)	8(18.2%)			65(82.3%)	14(17.7%)		

	Private school					Public School			
	Normal	**Thinned**	**Overweight**	**Chi-square**	**P-value**	**Normal**	**Thinned**	**Chi-square**	**P-value**
Egg, meat and fish									
Daily	2(40.0%)	0(0.0%)	3(60.0%)	4.866$_f$	0.245$_f$	6(85.7%)	1(14.3%)	0.116	0.943
2-3 times a week	37(71.2%)	7(13.5%)	7(13.5%)			37(84.1%)	7(15.9%)		
Once a week and less	26(68.4%)	6(15.8%)	6(15.8%)			36(81.8%)	8(18.2%)		
Tea and coffee									
Daily	44(73.3%)	7(11.7%)	9(15.0%)	3.785$_f$	0.384$_f$	64(81.0%)	15(19.0%)	0.998$_f$	0.634$_f$
2-3 times a week	3(50.0%)	2(33.3%)	1(16.7%)			6(100.0%)	0(0.0%)		
Once a week and less	18(62.1%)	4(13.8%)	7(24.1%)			9(90.0%)	1(10.0%)		
Fast food and packaged food									
Daily	26(70.3%)	5(13.5%)	6(16.2%)	0.495$_f$	0.989$_f$	31(81.6%)	7(18.4%)	1.925	0.382
2-3 times a week	21(65.6%)	5(15.6%)	6(18.8%)			20(76.9%)	6(23.1%)		
Once a week and less	18(69.2%)	3(11.5%)	5(19.2%)			28(90.3%)	3(9.7%)		
Carbonated beverages									
Daily	0(33.3%)	2(66.7%)	1(33.3%)	12.017$_f$	*0.008$_f$	2(100.0%)	0(0.0%)	0.544$_f$	0.781$_f$
2-3 times a week	18(78.3%)	0(0.0%)	5(21.7%)			10(90.9%)	1(9.1%)		
Once a week and less	47(68.4%)	11(15.9%)	11(15.9%)			67(81.7%)	15(18.3%)		
Adequacy of energy									
Above EAR	18(78.3%)	2(8.7%)	3(13.0%)	1.110$_f$	0.576$_f$	19(86.4%)	3(13.6%)		0.756$_f$
Below EAR	47(65.3%)	11(15.3%)	14(19.4%)			60(82.2%)	13(17.8%)		
Adequacy of protein									
Above RDA	64(68.1%)	13(13.8%)	17(18.1%)	1.193$_f$	1.000$_f$	78(83.0%)	16(17.0%)		1.000$_f$
Below RDA	1(100.0%)	0(0.0%)	0(0.0%)			1(100.0%)	0(0.0%)		

	Private school					Public School			
	Normal	**Thinned**	**Overweight**	**Chi-square**	**P-value**	**Normal**	**Thinned**	**Chi-square**	**P-value**
Adequacy of visible fat									
Above EAR	40(70.2%)	6(10.5%)	11(19.3%)	1.259	0.533	41(87.2%)	6(12.8%)	1.104	0.293
Below EAR	25(65.8%)	7(18.4%)	6(15.8%)			38(79.2%)	10(20.8%)		
Adequacy of CHO									
Above RDA	58(68.2%)	11(12.9%)	16(18.8%)	0.817_f	0.768_f	77(83.7%)	15(16.3%)	0.429_f	
Below RDA	7(70.0%)	2(20.0%)	1(10.0%)			2(66.7%)	1(33.3%)		