

# Effect of Nutritional Status on Academic Performance of Montessori Children (6 to 9 Years)

Amrita Thapa<sup>1</sup>, Angel Pudasaini<sup>2</sup>, Laxmi Jaisee<sup>3</sup>

<sup>1,2,3</sup>Master's Student, Central Department of Home Science, Tribhuvan University, Kathmandu, Nepal

## Abstract

**Introduction:** Nutrition is a fundamental pillar of human life, health and development across the entire life span. Nutritional status is directly influenced by food intake and the occurrence of infections. Academic performance, intellectual development, and school attendance of the children and school going children is adversely affected by under nutrition. Primary school is an important stage in the development of consciousness and personality of the child (1). **Objectives:** The objective of this study was to assess the effect of nutritional status on academic performance of school going children. **Methodology:** A descriptive cross-sectional study was conducted in Budhanilkantha Municipality, Kathmandu. Anthropometric measurement was analyzed by using Gomez classification and Water low classification methods among 61 of the respondents. **Findings:** Among the total sample population, the prevalence of stunting, underweight, and wasting were 31%, 39.2%, and 36% respectively. The academic performance of the school-going children was 54.1% excellent, 39.3% good, and 6.6% satisfactory. Factors such as Age category ( $P=0.04$ ), Mostly skip meals ( $P=0.008$ ), Source of drinking water ( $P=0.006$ ), Cause of Malnutrition ( $P=0.0089$ ), Protein intake ( $P=0.004$ ) and Fat intake ( $P=0.017$ ) were found to be statistically significant with nutritional status (MUAC) of children. Factors such as, mostly skip meals ( $P=0.002$ ), meat consumed per week ( $P=0.001$ ), Source of drinking water ( $P=0.006$ ), Total calorie intake ( $P=0.019$ ) were found to be statically significant with underweight of children. Factors such as Religion ( $P=0.027$ ), Father Education ( $P=0.010$ ), Protein intake ( $P=0.033$ ), and sweet consumption ( $P=0.007$ ) were found to be statistically significant with academic performance of children. **Conclusion:** It is concluded that under nutrition (stunting and underweight) among children attending primary school is found prevalence and the academic performance of children is not associated with nutritional status.

**Keywords:** Academic Performance, Nutritional Status, School Going Children.

**Abbreviations:** MUAC=Mid-Upper Arm Circumference, PTM=Parents Teacher Meeting, SPSS=Statistical Package for Social Science, WFA= Weight For Age, HFA=Height For Age, WFH=Weight For Height, WHZ=Weight-For-Height Z-score, HAZ=Height-For-Age Z-score

**1. Introduction:** Nutrition is an essential element of human life, health, and development throughout the lifespan. The scientific study of food and its relationship to health is referred to as nutrition. It is concerned with the process through which the body uses food for energy, development, and health maintenance. The manner in which nutrients and various components in a diet engage with an organism's maintenance,

development, reproduction, health, and disease is a complex interplay. This process encompasses several stages, including food intake, absorption, assimilation, biosynthesis, catabolism, and elimination.

Adequate nutrition in school-age children is extremely important because this is the most important phase of growth. Academic performance, intellectual development, and school attendance of the children and school going children is adversely affected by under nutrition. Primary school is an important stage in the development of consciousness and personality of the child (1).

Under nutrition negatively impacts the academic performance, intellectual development, and school attendance of children and school-going individuals. On the other hand, improved school attendance and the development of perceptual and behavioral abilities were linked to an adequate diet. Under nutrition is an important global health problem that has an impact on academic performance.

The relationship between nutritional status and educational achievement among school-age children in developing countries remains to be recognized well. Stunting is regarded as the best indicator of chronic malnutrition. Stunted children perform poorly in school and have a low capacity for learning. Additionally, poor feeding habits are linked to slowed and impaired brain development.

Childhood malnutrition contributes significantly to the elevated child mortality rates observed in developing countries. It is linked to delayed cognitive maturation during childhood and major health issues in adulthood, which have a direct impact on individuals' quality of life. Nutritional condition serves as a critical indicator of this quality. Therefore, understanding children's nutritional state has significant implications for future generations' development.

Growth monitoring is a widely used method to evaluate the nutritional status, health, and development of individual children. Likewise, it provides the overall estimation of nutritional status and health of a population. In comparison to other health assessment methods, monitoring child growth is a cost-effective, straightforward, and non-intrusive procedure (2).

**2. Materials and Method:** -A descriptive cross-sectional study was conducted in Budhanilkantha, Municipality, Kathmandu to determine the effect of nutritional status on academic performance among school going children using structured questionnaire. A purposive sampling technique was used for the study.

The study population was 6 to 9 years school going children. The sample size was equal to the total number of children between the ages 6 to 9 years studying in Angels' Home Montessori-based preschool of. Altogether 61 sample were selected for the study.

Primary data was collected using structured questionnaire for data collection and nutritional status was assessed by anthropometric measurement (MUAC, Gomez Classification and Water low classification) and dietary method. The respondents were then interviewed face to face with the parents during Parents and teacher meeting (PTM) and care taker of school at Angels Home by using structured questionnaire. The filled questionnaire was checked for its completeness immediately at the field. Filled questionnaires were checked, edited, coded and entered to IBM SPSS (version 25).

Anthropometric measurement was analyzed by using MUAC, Gomez classification, and Water low classification method. The Chi-square test was used to test the relationship between dependent and independent variables. Academic performance was done by scoring tools.

### 3. Major findings

**Table No. 1 Socio Demographic Characteristics of the Children**

Variables	Frequency (N)	Percentage (%)
<b>Age Groups</b>		
6-7 years	35	57.4
8-9 years	26	42.6
<b>Gender</b>		
Boys	22	36.1
Girls	39	63.9
<b>Religion</b>		
Hinduism	54	88.5
Christianity	1	1.6
Buddhism	6	9.8
<b>Ethnicity</b>		
Brahmin	16	26.2
Chettri	19	31.1
Janajati	23	37.7
Dalit	1	1.6
Others	2	3.3
<b>Type of family</b>		
Joint	13	21.3
Nuclear	48	78.7

The table illustrated that most of the children (57%) were from age 6-7 years and 42% of children were from age 8- 9 years. More than half of the children (63.9%) were girls whereas 36.1% of children were boys. The majority of the respondents (88.5%) followed Hinduism as their religion and only 1.6% followed Christian. The study revealed ethnicity most of the respondent were Janajati (37.7%), and lowest range were Dalit (1.6%). In terms of family structure, 78.7% of the respondents belonged to a nuclear family, while 21.3% were joint family.

**Table 2 Distribution of food preference of children**

Variable	Frequency (N)	Percent (%)
<b>Vegetarian</b>		
No	55	90.1
Yes	6	9.8
<b>Type of vegetarian</b>		
Lacto-vegetarian	4	6.5
Lacto-ovo-vegetarian	2	3.2

**Food preference**

Homemade food	29	46.8
Fast food	15	24.59
Junk food (Packaged food)	17	27.86

Above table illustrated the food preference of school going children. Most of school going children (90.1%) were non-vegetarian. Among vegetarian children, 6.5% were lacto-vegetarian and 3.2% were lacto-ovo-vegetarian. In term of food choice, majority of children (46.8%) preferred homemade food than fast food and junk food (pre-prepared or packaged food that has low nutritional value).

**Table 3 Frequency of food consumption from different food groups of children**

Variables		Frequency (N)	Percent (%)	Amount
<b>Cereals and grains</b>	Twice a day	9	14.75	40-200gm
	3 times a day	32	52.45	
	More than 3 times a day	20	32.78	
<b>Pulses and legumes</b>	Twice a day	49	80.3	30-80gm
	3 times a day	7	8.1	
	3-4 times a week	4	6.55	
	Once a week	1	1.6	
<b>Vegetables</b>	Twice a day	47	77.04	100-500gm
	3 times a day	11	18.03	
	3-4 times a week	2	3.2	
	Never	1	41.5	
<b>Meat, Meat products, fish and egg</b>	Daily	7	8.1	20-250gm
	3-4 times a week	21	34.4	
	Once a week	27	47.26	
	Never	6	9.8	

<b>Milk</b>	Daily	33	54.09	100-
	3-4 times a week	16	26.22	450ml
	Once a week	7	8.1	
	Occasionally	3	4.91	
	Never	2	3.2	
<b>Fruits</b>	Daily	38	62.3	100-
	3-4 times a week	17	27.86	300gm
	Once a week	4	6.55	
	Occasionally	1	1.6	

This table shows the frequency of consumption of various food items among school-going children. Most of the children (52.45%) consumed cereals and grains thrice a day and only 14.75% of children consumed cereals and grains twice a day. In terms of pulses, the majority of children (80.3%) consumed them twice a day and only 1.6% of children consumed them once a week. Similarly, in terms of vegetables, 77.04% of children consumed twice a day, and only 3.2% of children consumed 3-4 times a week. Similarly, regarding consumption of meat and meat products, most of the children (47.26%) consumed meat once a week and only 9.8% of children never consumed meat. Likewise, consumption of milk, most of the children (54.09%) drink daily and only 3.2% of children never drink milk. Likewise, in terms of fruits, 62.3% of children consumed once a day and only 1.6% of children consumed occasionally.

**Table 4 Dietary intake of the children**

Variable intake	Frequency (N)	Percent (%)	Average
<b>Total calorie intake (Kcal)</b>			
Adequate (1700)	6	9.8	1616.286Kcal
Higher than recommended (1701-2100)	25	41	
Lower than recommended (920-1699)	30	49.2	
<b>Carbohydrate intake(gm)</b>			
Higher than recommended (130-360)	61	100	288.36gm
<b>Fat Intake (gm)</b>			
Higher than recommended (31-40)	43	70.5	
Lower than recommended (17-29.9)	16	26.2	36.73gm
Adequate (30)	2	3.3	
<b>Protein Intake (gm)</b>			
Higher than recommended	46	75.4	

(23.4-35)

Lower than recommended (19-23.2)	14	22.9	33.069gm
Adequate (23.3)	1	1.6	

The above table illustrated the dietary intake of school-going children. The calorie intake of school going children, 49.2% of children consumed lower than recommended and 41% consumed higher than recommended and 9.8% consumed adequate amounts of calorie. Similarly, the carbohydrate intake, all children consumed higher than recommended. Likewise, fat Intake, 70.5% of children consumed higher than recommended, 26.2 % consumed lower than recommended, and 3.3 % consumed adequate amounts of fat. The study revealed that in protein intake, 75.4% of children consumed higher than recommended, 22.9% consumed lower than recommended and 1.6% of children consumed adequate amounts of protein.

**Table 5 Nutritional status (MUAC) of children According to Gender**

Gender	Boys		Girls	
	Frequency (N)	Percent (%)	Frequency (N)	Percent (%)
Malnourished (Below 12.5) cm	3	4.91	2	3.27
Normal (Above 12.5-26) cm	36	59.01	20	32.78

According to WHO, MUAC less than 12.5cm indicate the severe acute malnutrition (SAM) and MUAC between 12.5 -26.5cm illustrate that child is well nourished. The study reveals that nutritional status of school going children according to MUAC, 32.78% of girls and 59.01% of boys had normal nutritional status. Similarly, 3.27% of girls and 4.91% of boys were malnourished.

**Table 6 Distribution of malnutrition according to gender**

Gender	Boys	Girls	
		Frequency (N)	Percent (%)
<b>WFA</b>			
1 <sup>st</sup> Degree (76-90%)	7	11.47	21.31
2 <sup>nd</sup> Degree (61-75%)	1	1.63	4.91
Normal (above 90%)	14	22.95	37.7

<b>HFA</b>				
Mild (90-95%)	7	11.47	8	13.11
Moderate (85-90%)	2	3.27	2	3.27
Normal (above 90%)	13	21.3	29	47.54
<b>WFH</b>				
Mild (80-90%)	5	8.1	11	21.31
Moderate (70-80%)	3	4.9	3	4.91
Normal (above 90%)	14	22.95	25	40.9

This table demonstrated the gender-wise distribution of malnutrition. According to weight for age (Underweight), 22.95% of boys had normal nutritional status and 13.1% of boys were found to be underweight. Similarly, in girls 37.7% had normal nutritional status and 26.2% were found to be underweight.

According to height for age (stunting), 21.3% of boys had normal nutritional status and 14.74% of boy children were found to be stunted. Likewise, in girls 47.54% had normal nutritional status and 16.3% were found to be stunted.

According to weight for height (wasting), 22.95% of boys had normal nutritional status and 13% of boys were found to be wasted. Likewise, in girls 40.9% had normal nutritional status and 26.2% were found to be wasted.

**Table 7 Distribution of academic performance of the children**

Variable	Frequency (N)	Percent (%)
<b>Result of child</b>		
Outstanding	33	54.1
Good	24	39.3
Satisfactory	4	6.6
<b>Sequential thinking, reasoning problem solving</b>		
Outstanding	19	31.1
Excellent	13	21.3
Very good	18	29.5
Good	11	18

Above table shows the academic performance of the school-going children. According to base on the report card school-going children, the majority of children (54.1%) had an outstanding result and a smaller number of children (6.6%) had a satisfactory result. Likewise, the most of children (31.1%) had an outstanding result and only 18% of children had good result. Children had good result in sequential thinking and reasoning problem-solving skills.

**Table 8 Distribution of extracurricular activities of children**

Variable	Frequency (N)	Percent (%)
<b>Art and Craft</b>		
Outstanding	13	21.3
Excellent	14	23
Very good	23	37.7
Good	11	18
<b>Physical exercise</b>		
Outstanding	16	26.2
Excellent	13	21.3
Very good	19	31.1
Good	13	21.3
<b>Music and dance</b>		
Outstanding	16	26.2
Excellent	16	26.2
Very good	17	27.9
Good	12	19.7

According to base on report card of school going children, in term of art and craft, 37.7% of children had a very good performance and 18% had a good performance. In physical activities, 31.1% of children had a very good performance. Similarly, 27.9% of children had very good performance in in music and dance.

**Table 9 Distribution of Academic performance of the Children According to Gender**

Gender	Boys		Girls	
	Frequency (N)	Percent (%)	Frequency (N)	Percent (%)
<b>Academic Performance</b>				
Outstanding	9	14.75	24	39.34
Good	8	13.11	13	21.3
Satisfactory	5	8.19	2	3.27

This table illustrates about the academic performance of school going children were 36.1% of boys and 63.9% of girls. Similarly, 14.75% of boys had outstanding performance, good and only 8.19% of boys had satisfactory performance. Likewise, 39.34% of girls had outstanding performance, and only 3.27% of girls had satisfactory performance.



**Table 10 (a) Factors association between nutritional status (MUAC) and sociodemographic characteristics**

Variables	Malnourished	Normal	Chi-square	P-value
<b>Age Group</b>				
6-7 years	5	30	4.046 <sup>a</sup>	0.04*
8-9 years	0	26		

**Table 10(b) Factors association between nutritional status (MUAC) and dietary intake**

Variables	Malnourished	Normal	Chi-square	P-value
<b>Mostly skip meals</b>				
No	2	36	11.773 <sup>a</sup>	0.008*
Breakfast	0	1		
Evening Snack	2	19		
Dinner	1	0		
<b>Protein Intake</b>				
Adequate	0	1	11.199 <sup>a</sup>	0.004*
Higher than recommended	1	46		
Lower than recommended	4	9		
<b>Fat Intake</b>				
Adequate	0	2	8.152 <sup>a</sup>	0.017*
Higher than recommended	1	42		
Lower than recommended	4	12		

\*Statically significant (P<0.05)

This table illustrates the factors associated with the nutritional status (MUAC) school-going children. Factor such as Age group (P=0.04), Mostly skip meal (P=0.008), Protein intake (P=0.004), and Fat intake (P=0.017) were found to be statically significant with nutritional status of children.

**Table 11 (a) Factors association between underweight and socio-demographic characteristic**

Variables	1 <sup>st</sup> degree	2 <sup>nd</sup> Degree	Normal	Chi-square value	P-value	
<b>Mostly skip meal</b>	No skipping	12	0	26	20.467 <sup>a</sup>	0.002*
	Breakfast	0	0	1		

Evening snack	8	3	10
Dinner	0	1	0

**Table 11 (b) Factors association between underweight (WFA) and dietary intake**

Variables	1 <sup>st</sup> degree	2 <sup>nd</sup> degree	Normal	Chi-Square	P-Value
<b>Meat consumed per week</b>	Daily	1	0	6	21.707 <sup>a</sup> 0.001*
	3-4 times a week	2	1	18	
	Once a week	9	5	13	
	Never	1	0	0	
<b>Total calorie</b>	Adequate	1	0	5	11.780 <sup>a</sup> 0.019*
	Higher than recommended	5	0	20	
	Lower than recommended	15	1	14	

This table illustrates the factors associated with nutritional status (underweight) of school going children. Factor such as, mostly skip meals (P=0.002), Meat consumed per week (P=0.001) and total calories (P=0.019) were found to be statistically significant with underweight children.

**Table 13(b) Factors association between wasting and dietary habits**

Variables	Mild	Moderate	Normal	Chi-Square	P-value
<b>Mostly skipping meal</b>	No skipping	10	1	27	14.331 <sup>a</sup> 0.026*
	Breakfast	0	0	1	
	Evening Snack	6	4	11	
	Dinner	0	1	0	
<b>Meat consumed per week</b>	Daily	1	0	6	23.071 <sup>a</sup> 0.001*
	3-4 times a week	2	1	18	
	Once a week	9	5	13	
	Never	1	0	0	

This table illustrates the factors associated with the nutritional status (Wasting) of school-going children. Factors such as mostly skip meals (P=0.026), and meat consumed per week (P=0.01) were found to be statistically significant with wasting of children.

**Table 14 (a) Factors associated between academic performance and socio-demographic characteristics**

Variables		Outstanding	Good	Satisfactory	Chi-Square	P-value
<b>Religion</b>	Hinduism	32	18	4	10.920 <sup>a</sup>	0.027*
	Christianity	1	0	0		
	Buddhism	0	6	0		
<b>Father education</b>	Primary	0	1	1	16.693 <sup>a</sup>	0.010*
	Secondary	5	5	2		
	Higher Secondary	12	14	1		
	Above HS	16	4	0		

**Table 14 (b) Factors associated between academic performance and dietary intake**

Variables		Outstanding	Good	Satisfactory	Chi-square	P-value
<b>Sweet consumed</b>	Everyday	3	9	3	17.663 <sup>a</sup>	0.007*
	Twice a week	6	4	0		
	Thrice a week	12	10	1		
	Once a week	12	1	0		
<b>Protein intake</b>	Adequate	1	0	0	10.486 <sup>a</sup>	0.033*
	Higher than recommended	28	1	2		
	Lower than recommended	4	8	1		
<b>Total Calorie Intake</b>	Adequate	4	2	0	14.131 <sup>a</sup>	0.028*
	Higher than recommended	18	7	0		
	Lower than recommended	15	14	1		

This table illustrates that the factors associated with academic performance of school going children. Factors such as Religion (P=0.027), Father Education (P=0.010), Protein intake (P=0.033), Eat sweet (P=0.007) and total calorie intake (P=0.028) were found to be statistically significant with Academic performance of children.

#### 4. Discussion

The main objective of this study was to investigate the relationship between the nutritional status of school-going children and their academic performance. Schooling is a tool for individual and social change, enhancing the probability of general well-being. Primary school is an important stage in the development of children's consciousness and personalities. Children are extremely inquisitive at this age, and primary

education must encourage this tendency among children. Nutrition is an endogenous component that influences children's learning ability and skills at school.

In the present study, the prevalence of stunting, underweight, and wasting was found to be 31%, 39.2%, and 36% respectively. These findings were notably higher compared to previous studies conducted in Brazil (14.9% stunted and 9.7% wasted) (3), Kenya (24% stunted, 14.9% underweight, 9.7% wasted) (4), Nicaragua (5% wasted) (5), and eastern Ethiopia (8.9% stunted) (6). The observed discrepancies could be attributed to socio-demographic variables, differences in the sampling areas, and variations in the study periods.

The present study also revealed that father education levels was a significant factor in academic performance among school-going children. In the present study there was also observed differences in parental educational achievements between both sexes. The educational performance of girls' children was higher than that of boy's where 39.34% of girls had outstanding performance and only 14.75% of boy's had outstanding performance. This is in line with the findings of the Vietnam study (7).

In terms of factors, the current study found that age and monthly income had no statistically significant relationship with academic performance among school-aged children. This finding was consistent with a systematic review and meta-analysis showed that found a high relationship between academic achievement and socioeconomic level, including age (8). Poor academic achievement in children was statistically associated with a family's socioeconomic situation (9).

However, the majority of the variables in this study, such as father education, sweet consumption, and protein intake, 46 were statistically significant with academic achievement. Similarly, previous research in Southeast Ethiopia (10) found a positive relationship between the family's minimum wealth-indexed score and poor academic performance. This might be because a well-balanced food intake is necessary for proper biological functioning, affecting complex brain activities such as cognitive processes associated with academic achievement (11).

Moreover, macronutrient and micronutrient deficits are a major issue in developing countries. As a result, this barrier has either a direct or indirect impact on the children's future. Improved nutritional status has been shown to positive and direct impact on children's academic performance. According to the current study, dietary status is not a statistically significant determinant for good academic performance among school-aged children. This finding is consistent with findings from studies conducted in northwest Ethiopia (11), which found that children with high WHZ and HAZ scores had good academic performance as compared to their counterparts. According to the available research, childhood malnutrition is linked to a variety of socioeconomic and environmental factors, including poverty, parents' education/occupation, and access to health care services.

Low nutrition levels in children have serious long-term and short-term effects on their physical and mental growth. Deficiencies in one or more of the three key requirements for optimal nutrition, namely food, care, and health, contribute to malnutrition among school-aged children. Children who experience stunting during their school years have often faced inadequate nutrition since infancy. Implementing interventions specifically for school-aged children can complement existing efforts aimed at reducing stunting levels during the preschool years. Children's consumption of food with insufficient calories and from fewer than four food groups was a key predictor of malnutrition. Breakfast contributed to the total amount of energy consumed during the day.

## 5. Limitation

- As the study was conducted with limited resources, biochemical and clinical assessments is not included.
- This study covers only the children of 6 to 9 years

## 6. Conclusion

It is concluded that under nutrition (stunting and underweight) among children attending primary school is found prevalence and the academic performance of children is not associated with nutritional status. Father education, and economic status were found to be statistically significant with academic performance.

## 7. Acknowledgement

The authors of this study express deep sense of gratitude to Angels Home Montessori preschool and all the respondents without whom this study would have been incomplete and for providing their valuable time, participation and cooperation to carry out this research.

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