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Prevalence of Stunting among School Children in Sri Lanka

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***ABSTRACT*:** Stunting is a state of the children fail to grow the proper height for their age. By measuring the Height for age, it can be determined if children are stunting. Low height-for-age reflects an indication of a chronic deficiency in growth, such as prolonged illness or undernutrition. It is considered as a measure of past nutrition. The prevalence of stunting among children is a major risk in having child development in developing countries. Therefore, identifying the prevalence of stunting and its characteristics is important in the attempt of reducing the prevalence of stunting focusing the country development through well-nourished children. This study aims to identify the prevalence of stunting and its characteristics among school children in Sri Lanka based on the Nuwara-Eliya district. The primary data gathered through a sample survey was employed in this study. The sample size is 378 school children and it was selected using stratified random sampling technique. Descriptive statistics; percentages, tables, pie charts, bar charts and line charts were used in analyzing the prevalence of stunting. Gender comparison suggest that male children are more better off than female children. Children coming from urban sector are more likely to be stunted than the children from rural and estate sectors. Increasing income lowering the prevalence of stunting. It is evident that the lowest incidence of stunting is appearing among the children who learning in types 1AB schools. The highest incidence of stunting was recorded for the children belonged to poor families compared to non-poor. Mother's working group has increased the prevalence of stunting. Thus, the study suggests to be of concern with gender, living sector, type of school, income, poverty and mother's employment in targeting nutritional program to overcome the incidence of stunting.

Keywords: *Gender, Income, Mother's employment, Prevalence of stunting, School children*

I. INTRODUCTION

Stunting, wasting and underweight are three forms of undernutrition. The prevalence of stunting among children is a major risk in having child development in developing countries. Measuring stunting is a leading aspect of assessing child malnutrition. Stunting is a state of the children fail to grow the proper height for their age. The children who are too short for their age is referred as stunting. It is a result of chronic or recurrent malnutrition. An anthropometric index, Height-For-Age (HFA) is available to assess the incidence of stunting [1]. Low height-for-age is known as stunting [1]. HFA is a measure of linear growth. By measuring the Height for age, it can be determined if children are stunting. Low height-for-age reflects an indication of a chronic deficiency in growth, such as prolonged illness or undernutrition. It is considered as a measure of past nutrition. Seoane and Latham have proposed calculating height for age as stunting [2]. Stunting, where height for age (HFA) is reduced is more suggestive of chronic malnutrition with faltering of long-term growth [3] In 1977, Waterlow defined the stunting with the recommendation of using Height For Age (HFA) z-scores and SDs below the median.[4]. Later, Measurement of malnutrition in term of stunting based on HFA was continued to be used widely with successive WHO amendments. The classification in 1989 by the US National Center for Health Statistics (NCHS) was adopted by WHO as the international reference for weight and height in children [5]. It has since been used to classify children as stunting [6]. In 2006, WHO adopted a new population standard based on an international multicenter study [7]. In 2007, WHO published new standards of growth in length/height-for-age, for infants and children. This new WHO growth reference will be more effective to measure prevalence of stunting than NCHS standards [8].

According to WHO, about 144.0 million of under 5-year children worldwide have suffering from stunting [9]. In Sri Lanka too, the incidence of stunting is prevailing at a considerable level.

Table 1: Prevalence of Stunting among children by region and country in 2020

Classification	Region/Countries	Stunting %
WHO Regions	African Region	31.7
	Region of the Americas	8.9
	South-East Asia Region	30.1
	Eastern Mediterranean Region	26.2
	Europe Region	5.7
	Western Pacific Region	9.3
World Bank Income	Low income	34.6
	Middle Income	21.8
	Lower-middle income	29.1
	Upper middle income	10.8
	High income	3.4
South Asia Countries	Afghanistan	35.1
	Bangladesh	30.2
	India	30.9
	Nepal	30.4
	Bhutan	22.4
	Pakistan	36.7
	Sri Lanka	16

Source: UNICEF / WHO / World Bank Group, 2021

As given in Table 1, in WHO classification, stunting rate among children under five years is the highest (31.7%) in the African Region. For the South-East Asia region too, stunting (30.1%) recorded a high rate. Considering the income categories, the highest percentage of Stunting is perceived in low-income countries (34.6%) while showing a huge difference (34.6% - 3.4%) between low-income countries and high-income countries. Stunting prevalence rates are high in heavy-populated South Asia countries. Stunting is highest in Pakistan (36.7%) while other countries including Sri Lanka too show a considerable rate of stunting [10].

Table 2: Prevalence of stunting (Hight-for- age) in Sri Lanka by districts

District	Percentage below -3 SD	Percentage below -2 SD	District	Percentage below -3SD	Percentage below -2 SD
Colombo	4.3	15.6	Killinochchi	6.6	20.9
Gampaha	2.9	12.8	Batticaloa	3.6	20.6
Kalutara	1.7	12.5	Ampara	7.2	21.9
Kandy	5.2	26	Trincomalee	3.5	15.5
Matale		14	Kurunegala	2	17.7
Nuwara Eliya	10	32.4	Puttalam	2.9	11.7
Galle	3.7	12.5	Anuradhapura	5.9	19.1
Matara	3.8	15.6	Polonnaruwa	3	11.1
Hambant	2.6	11.8	Badulla	6.5	20.6
Jaffna	1.5	13.7	Monaragala	3.5	15.9
Mannar	4.6	20.8	Rathnapura	4	17.8
Vavuniy	6.1	18.7	Kegalle	8.4	23.1
Mullativ	6	16.7			

Source: Department of Census and Statistics, 2017

According to Table 2, prevalence of stunting over all districts in Sri Lanka. Nuwara-Eliya district has recorded the highest incidence of stunting (HFA) and it is 32.4% and 10% below -2 SD and below -3 SD respectively [11]. Prevalence of stunting with reference to different phenomena are important in studying stunting and formulating strategies to overcome stunting. The research studies on prevalence of stunting are rare in Sri Lanka. This study aims to study the prevalence of stunting with reference to different phenomena among school children in the Nuwara-Eliya district, Sri Lanka. The outcome of the research will facilitate the authorities in the health sector in dropping the incidence of stunting.

II. LITERATURE REVIEW

An anthropometric index, Height-For-Age (HFA) is available to assess the incidence of stunting [1]. Low height-for-age is known as stunting [1]. Different previous studies on stunting have been conducted by many researchers in many countries. Considering gender, stunting has established different, significant, insignificant, positive and negative relationships. The Male children were more appeared to be stunted than female children [12]. In a study conducted in Bangui, gender has established a significant relationship with stunting [13]. The prevalence of stunting is increasing among the children with age is over 12 months [12]. In a study conducted in Bangui, age has established a significant relationship with stunting [13].

Increasing the number family members has more probability to have child stunting [14]. Mothers working as merchant have more likelihood to get stunting for their children than the mothers working as house wives [14]. A study conducted with 731 women with under five-year children revealed an association between stunting and mother's employment. Further, it is evident that children of not employed mothers are more likely to be stunted than the children of working mothers [15]. Considering all age categories of less than five-year children, mothers' non-education and maternal shortness have related to be stunted for their children [12]. Mothers' marital status and place of birth have revealed an association with child stunting. Mothers with BMI is less than or equal 18.5 have more risk for their children to have stunting [12]. The children whose birth order is second or third and birth interval is less than or equal to two years have more probability to be stunted [12]. Children whose mothers watching television has less likely to be stunted [12].

As found by a study conducted with 731 women with under five-year children, family income has a negative relationship with stunting [15]. Family income and malnutrition are related and observed that higher family incomes decrease malnourished percentage [11]. Also, it was found that that being a child from low income family is more likely to be malnourished [16],[17]. A study covered 86 countries, found that reducing income inequality lowered the prevalence of stunting [18]. As found by a study conducted with 731 women with under five-year children, family expenditure has a negative relationship with stunting [15]. A study covered 86 countries, found that allocating money for a social health insurance scheme reduced the stunting level [18]. With respect to poverty, it was significantly associated with stunting [19]. Children living in poorer household have more probability to be stunted [12].

Considering the children in age between 24-59 months, the prevalence of stunting appeared to be more in India, Nepal and Pakistan [12]. Further, it revealed that maternal shortness was a common reason for their children to be stunted in all 5 South Asian countries [12]. Breast feeding duration showed a considerable association with child stunting [14]. Also, bottle feeding and complementary food were related to stunting [14]. Food fortification in the household has more probability of reducing the percentage of stunted children in the household [20]. An analysis using data from the Demographic and Health Surveys of 11 countries found that the incidence of stunting is higher in rural areas than in urban areas [21].

Following Fig. 1 shows the proposed conceptual frame work which developed based on the literature for the stunting and related phenomena.

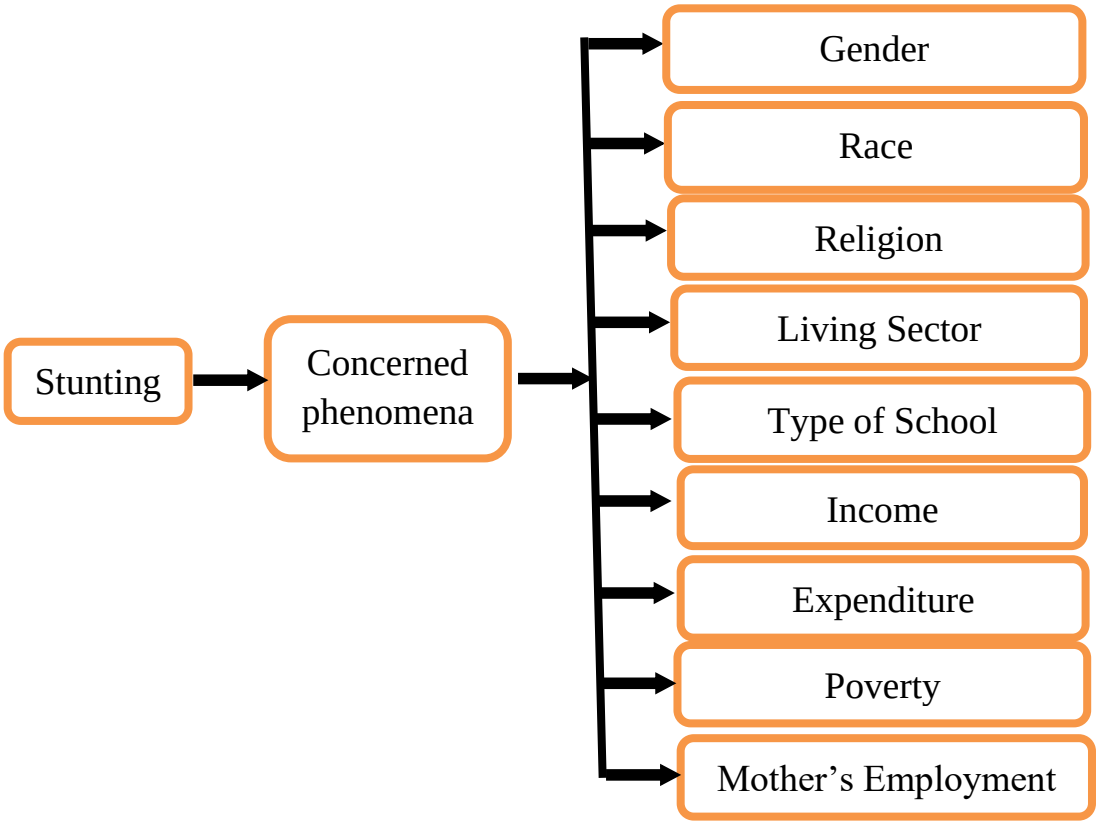

Figure 1: Conceptual framework
Source: Developed by the researcher, 2023

III. METHODOLOGY

Quantitative research approach was applied in this study. The type of data used in this study was the primary data. The primary data were collected using a structured questionnaire as the main data collection method. The sample was selected from grade 6 school children of government schools in the Nuwara Eliya district, Sri Lanka using multi-stage stratified random sampling technique.

At the first stage, Nuwara Eliya district was selected from 25 districts in Sri Lanka as the study area purposely due to high prevalence of child stunting. Three types of government schools, i.e., type 1AB schools, type 1C schools, Type 2 schoolswhich hold grade 6 classes were considered as strata. Three schools from each type were selected randomly at the second stage. The final sampling units are grade six school children. The sample size was 378 and it was decided based on the Morgan table. Finally, sampling units were selected from grade 6 classes of the selected schools. Proportional allocation was utilized in deciding the number of male and female children. To ensure the randomness, the lottery method and random number table were adopted to select the schools from each type of school and final units (children) respectively. Considering the accuracy and consistency, the information was gathered from the parents of the selected 378 grade six school children. The ethical approval to conduct the research was obtained from ethics review committee, University of Kelaniya, Sri Lanka and agreed not to reveal individual identity of both children and schools.

The incidence of child stunting and its classifications were based on global standards: <−3 z score, <−2 z score, and ≥−2 z score [22]. Stunting was measured using Hight For Age (HFA) Z score. The index was calculated using the following formula.

The formula to obtain HFA z score is

$$HFA\ z\ score = \frac{M_o - M_e}{SD_e} \quad (1)$$

Where,
$M_o = ObservedHeightofanindividualinagivenage$
$M_e = MedianHeightofthereferencepopulationinagivenage$
$SD_o = Standareddeviationofthereferencepopulationinagivenage$

Table 3: Classification of stunting for Height-For-Age z-score

Height-for-age z-score	Classification
-2 ≤ Z-score	Well nourished
Z-score < - 2	Stunted
Z-score < - 3	Severely stunted

Source: Namakin et al., 2014

Children with HFA z score below −2 SD of the median of reference population were considered as stunted and others are not stunted. The other variables used in this study are gender, race, religion, living sector, type of school, income, expenditure, poverty and mother's employment. Gender, race, religion, living sector, type of school, poverty and mother's employment were used as categorical variables. The families entitled for Samurdhi was considered as poor while others are as non-poor. Income and expenditure are total monthly family income and expenditure and they were continuous variables. However, they were categorized in the analysis. Descriptive statistics, percentages, tables, bar chats, pie charts were applied in this study to investigate the relationship between stunting and other factors. The analysis tools are descriptive statistics i.e. parentages and the graphical approach. The characteristics considered to investigate the relationship with stunting are gender, race, religion, living sector, type of school, income, expenditure, poverty and mother's employment

IV. RESULT AND DISCUSSION

4.1 Sample Distribution

A sample of 378 school children drawn from the grade 6 school children in government schools in the Nuwara-Eliya district, Sri Lanka was analyzed in this study. The sample distribution with respect to the gender, race, religion, living sector, type of school, income expenditure, mother's employability and poverty is presented in the table 4.

Table 4: Sample distribution

Characteristic type	Demographic characteristics	Categories	Number of children	Percentage (%)	Total
Qualitative	**Gender**	Male	207	55	378
		Female	171	45	
	Race	Sinhala	271	72	378
		Tamil	93	24	
		Muslim	7	2	
		Burger	7	2	
	Religion	Buddhist	263	70	378
		Hindu	81	21	
		Islamic	7	2	
		Catholic	27	7	
	Living Sector	Rural	258	68	378
		Urban	80	21	
		Estate	40	11	
	Type of school	Type 1AB	141	37	378
		Type 1C	140	37	
		Type 2	97	26	
	Poverty	Poor	69	18	378
		Non-poor	309	82	
		Government	26	7	378

	Mother's employment	Private	50	13		
		Self-Employment	14	4		
		Others	12	3		
		Never Employed	276	73		
	Demographic characteristics		**Minimum**	**Maximum**	**Variance**	**Mean**
Quantitative	**Income**		2500	84500	112467468	30545
	Expenditure		3000	60000	122514668	25932

Source: Sample survey data analysis, 2023

As shown in the Table 4, male representation (55%) of the sample is higher than the female representation (45%). Considering the race, the highest, 72% of the sample consists with Sinhalese while the lowest with Muslims band Burgers (2%). Regarding the religion, the highest percentage (70%) of the sample was recorded form Buddhist religion group. The lowest percentage (2%) of the sample was represented by Islamic children. Considering the residential sector, the majority of the children (68%) in the sample have lived in the rural sector while the least percentage of children have come from the estate sector. The urban sector representation in the sample was 21% recording the second place. Type 1AB and type 1C schools have similar representation (37%) in the sample while least representation was by type 2 schools (26%). The percentage of children from poor families is 18 and non-poor families is 82. Mothers of the majority of the children (73%) are never employed. Mothers of only 20% of the children are involved in government or private sector jobs. The percentages of the children whose mothers are employed in self-employment and other employment are 4% and 3% respectively. Concerning the income and expenditure, the maximum income and expenditure of the children's families are 84500 rupees and 60000 rupees per month respectively. The minimum income and expenditure of the children's families are 2500 rupees and 3000 rupees per month respectively.

4.2 Prevalence of Stunting

The incidence of stunting plays the key role in this study. The sample of 378 school children drawn from the grade 6 school children in government schools in the Nuwara-Eliya district, Sri Lanka was analyzed to identify the incidence of child stunting with respect to different characteristics. Stunting were measured using the index, HFA (Height For Age) z score. The children with z scores less than −2 for HFA were defined as stunted and others are as not stunted.The percentages of stunted children computed for the sample is given in the table 5.

Table 5: Prevalence of Stunting in the sample

Stunting	**Number of children**	**Percentage (%)**	**Total**
Suffering from Stunting	87	23	
Not Suffering from Stunting	291	77	
Total	378	100	378

Source: Sample survey data analysis, 2023

Table 5 indicates the percentages of children suffering from stunting and not suffering from stunting in the study area. It is evident that the percentage of children suffering from stunting is 23%. The stunted percentage, 23% found in this study are lower than the stunted percentages 32.4% (for under-five year children) provided by the Department of Census and Statistics [11] which were measured through the HFA z score for the Nuwara-Eliya district.

4.2.1 Prevalence of stunting with respect to Gender

Fig.2 shows that the incidence of child stunting with respect to the children being a male or female.

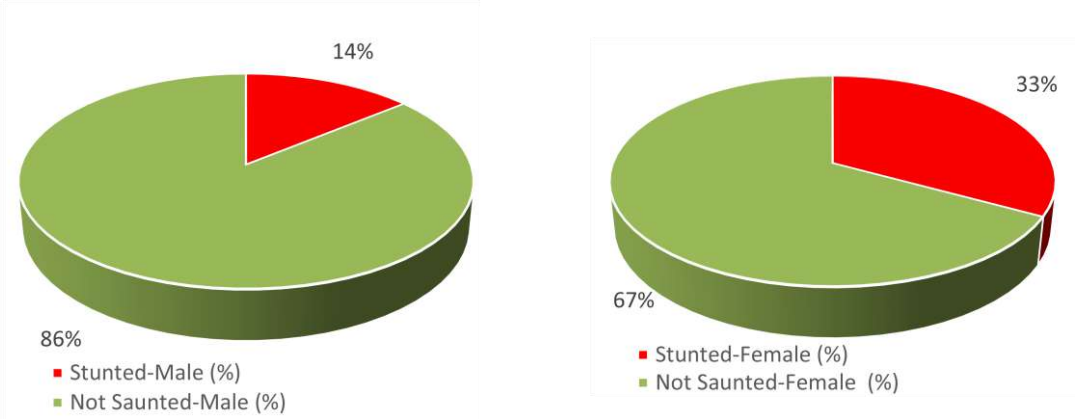

Figure 2: Child Stunting by Gender
Source: Researcher's finding using sample survey data analysis, 2023

The female children are more likely to expose to malnutrition than the male children. It reveals that 33% of the females and 14% of the males of the sample are suffering stunting. Based on the demographic and health survey report by DCS, 2017, the percentages of stunting (National) among under five-year children for males is 17.9% [11]. However, the prevalence of stunting found in this study using the sample drawn from Nuwara-Eliya district for males (14%) is lesser than the results (17.9%) for male (under five-year children) for overall-Sri Lanka computed by DCS, 2017 [11]. According to the DCS, 2017, the percentages stunting (National) among under-five year children for females are 16.6% [11]. Regarding female, the results of this study using the sample drawn from Nuwara-Eliya district (33%) is higher than that for overall Sri Lanka (16.6%) (under five-year children) provided by DCS, 2017 [11].

4.2.2 Prevalence of stunting with respect to Race

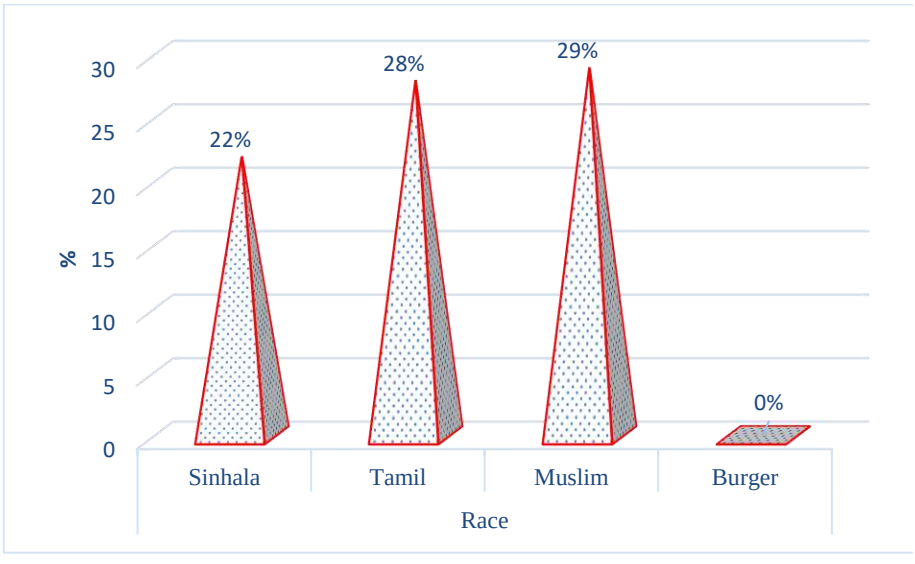

Figure 3: Child Stunting by Race
Source: Researcher's finding using sample survey data analysis, 2023

According to the Fig.3, the highest prevalence of stunting is seen among Muslim children recording that 29% of Muslim children are stunted. The stunting is appeared the lowest among Burger children with a 0%. Further, a

considerable percent of both Tamil (28%) and Sinhala (22%) children are suffering from stunting. However, a vast difference in malnutrition between Tamil and Muslim children is not evident.

4.2.3 Prevalence of stunting with respect to Religion

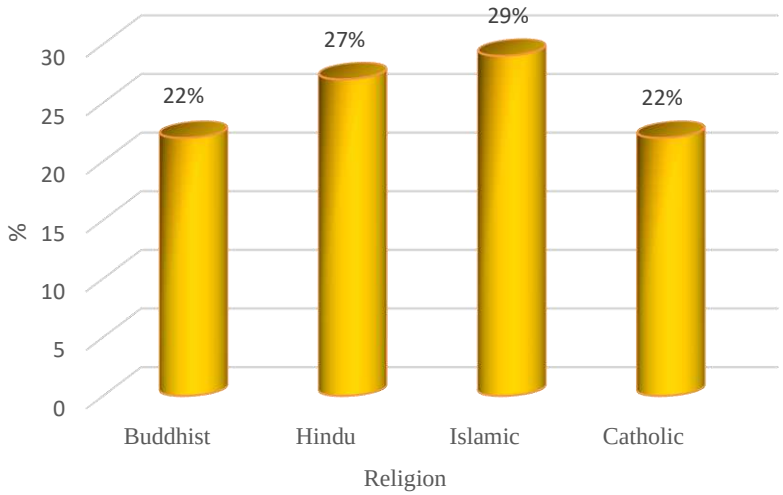

Figure 4: Child Stunting by Religion
Source: Researcher's finding using sample survey data analysis, 2023

Fig. 4 highlights that the 29% of Islamic children are stunted recording the highest while 27% of Hindu children are stunted recoding the second place. The percentage of having malnutrition is similar for the two religion groups of Buddhism and Catholic (22%). However, the above figure clearly shows that a considerable percent of children seems to have stunting for all religion groups without a big difference.

4.2.4 Prevalence of stunting with respect to Living sector

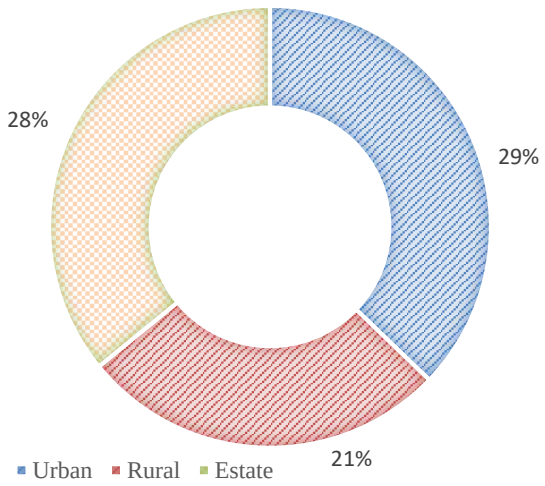

Figure 5: Child Stunting by Living sector
Source: Researcher's finding using sample survey data analysis, 2023

Considering the residential sector, the majority of the children (68%) in the sample have lived in the rural sector while the least percentage of children have come from the estate sector. The urban sector representation in the sample was 21% recording the second place. Fig. 5 discloses that the stunting has appeared to be the highest (29%)

among the children who live in the urban sector. The lowest percentage of child stunting (21%) is seen among the children who have come from the rural sector. However, there is not a vast difference in the prevalence of stunting between the children live in urban sector (29%) and estate sector (28%).

4.2.5 Prevalence of stunting with respect to Income and Expenditure

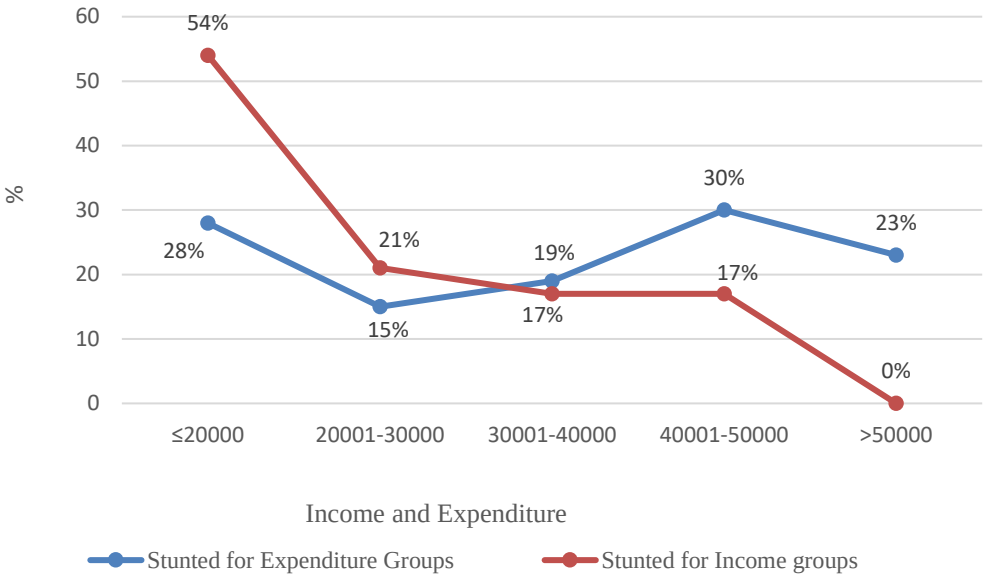

Figure 6: Child stunting by income groups and expenditure groups
Source: Researcher's finding using sample survey data analysis, 2023

As shown in the fig. 6, percentages of children suffering from stunting decrease with the increase of income. The highest percentage of stunting was recorded (54%) for the lowest income group (≤20000) while the lowest percentage of stunting (0%) is seen for the highest income group (>50000). Being a child from higher income family decreases the prevalence of stunting compare with a child from low income family. Similarly, a previous study conducted with 731 women with under five-year children found that family income has a negative relationship with stunting [15].Family income and malnutrition are related and observed that higher family incomes decrease malnourished percentage [11].A study covered 86 countries, found that reducing income inequality lowered the prevalence of stunting [18].Considering the expenditure groups, the two groups that show the highest stunting are 40001-50000 (30%) and ≤20000 (28%).As found by a study conducted with 731 women with under five-year children, family expenditure has a negative relationship with stunting [15]. A study covered 86 countries, found that allocating money for a social health insurance scheme reduced the stunting level [18].

4.2.6 Prevalence of stunting with respect to type of school, poverty and mother's employability

Below Table 6 provides prevalence of stunting with respect to type, poverty and mother's employability in the study area.

Table 6: Prevalence of stunting with respect to Type of school, Poverty and Mother's employment

Characteristics	**Categories**	**Stunting**		**All (%)**
		Yes (%)	No (%)	
Type of School	Type 1AB	22	78	37
	Type 1C	23	77	37
	Type 2	25	75	26
Poverty	Poor	64	36	18
	Non-poor	14	86	82

Mother's Employment	Government	77	23	7
	Private	90	10	13
	Self-Employment	57	43	4
	Others	50	50	3
	Not Employed	03	97	73
Stunting		23	77	100

Source: Researcher's finding using sample survey data analysis, 2023

As shown in the Table 6, the highest percentage of suffering from stunting was recorded for the children who learning in type 2 schools (25%). It is evident that the lowest incidence of stunting (22%) is appearing among the children who learning in types 1AB schools. However, there was not a big difference in stunting between the children learning in type 1AB an 1C schools (22% and 23%).

Considering the poverty, the highest incidence of stunting (64%) was recorded for the children belonged to poor families compared to non-poor (14%). Supporting this result, a study conducted in Sri Lanka has concluded that malnourished children usually come from poor physical and economic resourced households [24]. A previous study carried out in India found that bivariate Moran's I statistics of Stunting with poverty 0.52 and suggested that the poverty of household was strong and significant predictors of Stunting [25]. Considering mother's employment, the highest stunting is seen among the children whose mothers are working in the private sector (90%). For all employment groups except for never employed mothers, the percentage suffering from stunting was larger (77%, 90%, 57%) than the percentage without stunting (23%, 10%, 43%). The lowest percentage (3%) of having stunting was recorded for the children of mothers who never employed. Agreeing with result of this study, a previous study has showed the maternal occupation has statistically significant association with nutritional status of children [26].

V. CONCLUSIONS

This study focused on identifying the prevalence of stunting among school children in the Nuwara-Eliya district, Sri Lanka using primary data collected through a structured questionnaire. Sample distribution has been presented using descriptive statistics. Sample distribution was cross analyzed with several characteristics such as gender, race, religion, living sector, type of school, income expenditure, poverty and mother's employment. It found that the male representation (55%) of the sample is higher than the female representation (45%). The highest, 72% of the sample consists with Sinhalese while the lowest with Muslims band Burgers (2%). Regarding the religion, the highest percentage (70%) of the sample was recorded form Buddhist religion group. The lowest percentage (2%) of the sample was represented by Islamic children. Considering the residential sector, the majority of the children (68%) in the sample have lived in the rural sector while the least percentage of children have come from the estate sector. The urban sector representation in the sample was 21% recording the second place. Type 1AB and type 1C schools have similar representation (37%) in the sample while least representation was by type 2 schools (26%). The percentage of children from poor families is 18 and non-poor families is 82. Mothers of the majority of the children (73%) are never employed. Mothers of only 20% of the children are involved in government or private sector jobs. Concerning the income and expenditure, the maximum income and expenditure of the children's families are 84500 rupees and 60000 rupees per month respectively. The minimum income and expenditure of the children's families are 2500 rupees and 3000 rupees per month respectively.

This study computed that the percentage of children suffering from stunting is 23% which was measured through HFA Z score. The percentage of suffering from stunting is higher for female (33%) than that for male (14%). The highest prevalence of stunting is seen among Muslim children (29%). The stunting is appeared the lowest among Burger children with a 0%. Further, a considerable percent of both Tamil (28%) and Sinhala (22%) children are suffering from stunting. The highest percentage of malnutrition appeared to be in the urban sector (29%) while the second place have obtained by the estate sector (28%). However, there was not a big difference in stunting between urban and estate sectors. The percentages of children suffering from stunting decrease with the increase of income. Considering the expenditure groups, the two groups that show the highest stunting are 40001-50000 (30%) and ≤20000 (28%). The highest percentage of suffering from stunting was recorded for the children who learning in type 2 schools (25%). It is evident that the lowest incidence of stunting (22%) is appearing among the children who learning in types 1AB schools. Considering the poverty, the highest incidence of stunting (64%) was recorded for the children belonged to poor families compared to non-poor (14%). Considering mother's employment, the highest stunting is seen among the children whose mothers are working in the private sector (90%). The lowest percentage (3%) of having stunting was recorded for the children of mothers who never employed.

This study supports to identify the prevalence of among school children in the Nuwara-Eliya district, Sri Lanka. It is concluded that the child stunting is related with gender, race, religion, living sector, type of school, income expenditure, poverty and mother's employment. Thus, the study suggests to be of concern with gender, living sector, type of school, income, poverty and mother's employment in targeting nutritional program to overcome the incidence of stunting.

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